

WIDECAST Sea Turtle Recovery Action Plan for St. Kitts and Nevis



WIDECAST

Wider Caribbean Sea Turtle Conservation Network

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Sea Turtle Recovery Action Plan for St. Kitts and Nevis

Karen L. Eckert ¹

Thomas D. Honebrink ²

¹ Executive Director, WIDECAST

**² Conservation Officer, Southeast Peninsula
Land Development and Conservation Board**

Karen L. Eckert, Editor

Prepared by:



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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 (SPA), *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 (SPA 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 SPA 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 fifth in a series of Sea Turtle Recovery Action Plans prepared by the Wider Caribbean Sea Turtle Recovery Team and Conservation Network (WIDECAST), an organization comprised of a regional team of sea turtle experts, local Country Co-ordinators, and an extensive network of interested citizens. The objective of the recovery action plan series is to assist Caribbean governments in the discharge of their obligations under the SPA 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 Resources Conservation for Sustainable Development in the Wider Caribbean (Santo Domingo, 26-29 August 1981) that a "Wider Caribbean Sea Turtle Recovery Action Plan should be prepared ... consistent with the Action Plan for the Caribbean Environment Programme." WIDECAST is an autonomous NGO, partially supported by the Caribbean Environment Programme.

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True to the spirit and structure of the WIDECAST project (which consists of an international Sea Turtle Recovery Team 1/ and resident Country Coordinators throughout the Wider Caribbean region), this Action Plan could not have been written without the enthusiasm and participation of many people over the last three years. First and foremost, the senior author owes a debt of gratitude to Thomas Honebrink, Peace Corps Volunteer, Conservation Officer for the Southeast Peninsula Land Development and Conservation Board, and Co-Founder of the Marine Division of the St. Christopher Heritage Society (SCHS), and to Joan Robinson, WIDECAST Country Coordinator-Nevis, Curator of the Museum of Nevis History, and Founding member of the Nevis Historical and Conservation Society (NHCS).

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LIST OF ACRONYMS

CCA	Caribbean Conservation Association
NCEPA	National Conservation and Environment Protection Act
NEEC	Nevis Environmental Education Committee
NGO	Non-government Organization
NHCS	Nevis Historical and Conservation Society
SCHS	St. Christopher Heritage Society
SEP	South-East Peninsula, St. Kitts
SEPLDCA	South-East Peninsula Land Development and Conservation Act
UNEP	United Nations Environment Programme
WIDECAST	Wider Caribbean Sea Turtle Recovery Team and Conservation Network

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ABSTRACT

Three species of sea turtle, all internationally classified as endangered species, nest on the beaches of St. Christopher (St. Kitts) and Nevis. These are the hawksbill (Eretmochelys imbricata), green (Chelonia mydas), and leatherback or river turtle (Dermochelys coriacea). In addition to seasonal nesting, hawksbills and green turtles of varying sizes can be seen throughout the year feeding in shallow waters. The leatherback is not resident; gravid females arrive each year for a summer nesting season. A fourth species, the loggerhead turtle (Caretta caretta), is occasionally observed offshore. The documented harvest of sea turtles in the federation dates back to 1603 when a work party dispatched to Nevis described a "Tortoyse so big that foure men could not get her into the Boate". The 18th century letters of William Smith declare green turtles to be "so common that they need no description." There is no doubt that the ubiquitous sea turtles were an important part of diet and commerce during the centuries of colonial occupation.

Today there are far fewer turtles than there were four or five decades ago. They have been both netted at sea and killed on the nesting beach. Turtle hunters and observers familiar with the fishery disagree on the exact number of turtles currently harvested per year, but it appears likely that 50-100+ turtles, mostly greens and hawksbills, are landed annually on each of the two islands. The number of nets set and the number of hunters who await gravid (egg-bearing) females on the nesting beaches is considerably lower than at any time in the past. The number of part-time turtle fishermen is estimated to be less than ten on each island. The number of spearfishermen landing sea turtles is growing, however, and this is viewed as a serious threat. The collection of eggs is unquantified but approaches 100% in some areas. There is no legislation governing the harvest of turtles or their eggs at the present time, but the draft Fisheries Regulations of 1992 call for a moratorium on the capture of turtles and the collection of eggs. Such a moratorium is fully supported by this Recovery Action Plan.

The most significant stress on local turtle populations has been a virtually unregulated harvest. The consequences of over-harvest are nowhere more evident than on the nesting beaches. There is a consensus that the beaches once supported many more nests than are seen today. Too many of the federation's breeding females have been killed and their eggs taken. It is self-evident that if eggs are not allowed to produce hatchlings, there will not be a next generation of turtles to lay their own eggs. The reason there are fewer turtles at sea is that the over-harvest has not been confined to St. Kitts and Nevis. All Caribbean nations have participated. Turtles born in St. Kitts and Nevis do not remain resident in our waters through the many years (usually 20-35) required to reach sexual maturity. Instead, they travel throughout the region during their adolescence and return to their natal beaches only when it is time to breed. Thus, the juveniles feeding offshore in coral reefs and sea grass meadows represent the young produced on nesting beaches throughout the Caribbean Sea, whereas the females on our nesting beaches were born here many years ago and migrate "home" every 2-3 years to lay their own eggs.

The objectives of this Recovery Action Plan are to explain the biology of sea turtles, to provide an overview of the status and distribution of sea turtles in St. Kitts and Nevis, and to recommend conservation actions designed to promote the recovery of depleted stocks. In addi-

tion to the protection of turtles and eggs, the preservation of important feeding and nesting habitats is necessary. A few nesting beaches have been lost in recent decades, mostly to harbour development, but coming decades will see an unprecedented commercialization of the coastline. Several large hotels on the Southeast Peninsula and elsewhere are in planning or construction stages. Offshore, an increase in yacht and cruise ship traffic will mean increased solid waste and pollution, anchoring, and recreational use of the often fragile seabed (e.g., coral reefs). Integrated coastal zone planning with an eye to safeguard the precious coastal zone for future generations is needed. Regulations should include adequate construction setbacks, protection for coastal vegetation, sewage and waste disposal, moorings and other measures described in this Recovery Action Plan. In addition to national coastal zone management, improved law enforcement is necessary. A Division of Environmental Enforcement is recommended.

A five-year national Sea Turtle Conservation Programme is herein proposed. The goals of the programme are (1) to obtain comprehensive and accurate data on the distribution of turtle nesting and foraging habitat and (2) to promote the conservation and recovery of remaining sea turtle stocks. Activities, including habitat and market surveys, management planning, training, and environmental education, are fully described in the text. In addition to national efforts to conserve sea turtles, it is essential that St. Kitts and Nevis support international initiatives to conserve these highly migratory reptiles. In this regard, the Government is encouraged to ratify CITES, MARPOL, and the UNEP Cartagena Convention (with SPAW Protocol). In summary, an integrated approach to the continuing decline of sea turtles is needed, including strong domestic and regional legislation, habitat protection, population monitoring, and enhanced public awareness.

In order to ensure that the necessary regulations to safeguard turtles and their habitats have grassroots community support, user groups (e.g., fishermen), conservationists, government personnel, restaurant owners, and concerned citizens actively participated in the development of this Recovery Action Plan. The process of involving the community is essential and we recommend that full advantage be taken of Town Meetings and the media to increase public awareness of the plight of the sea turtle and of the island environment in general. The support and active participation of all citizens is needed if the twenty-first century is to fulfill a promise of independence and prosperity for the people of St. Kitts and Nevis -- and the hope of survival to many endangered wildlife species, including sea turtles.

RESUMEN

Tres especies de tortugas de mar, todas ellas clasificadas internacionalmente como especies en peligro de extinción, anidan en las playas de St. Kitts y Nevis. Estas son, la tortuga carey (*Eretmochelys imbricata*), la tortuga verde del Atlántico (*Chelonia mydas*), y la tortuga tora o de río (*Dermochelys coriacea*). Además de en la temporada de anidación se pueden ver tortugas carey y verde de varios tamaños durante todo el año, alimentándose en aguas de poca profundidad. La tortuga tora no es residente; las hembras grávidas llegan cada año para la temporada de anidación de verano. Una cuarta especie, la tortuga de mar (*Caretta caretta*), se observa ocasionalmente frente a las costas. El aprovechamiento de las tortugas marinas en la federación, que se halla documentado, data de 1603 cuando una partida de trabajo enviada a Nevis describió una "Tortuga tan grande que ni cuatro hombres pudieron subirla al bote". Las cartas de William Smith del Siglo XVIII declaran que las tortugas verdes "son tan comunes que no necesitan describirse." No hay duda de que las omnipresentes tortugas constituían una parte importante de la dieta y el comercio durante los siglos de ocupación colonial.

Hoy existen mucho menos tortugas que hace cuarenta o cincuenta años. Las han cogido en redes y se han muerto en las playas donde anidan. Los cazadores y los observadores de tortugas que saben de la pesca, no se ponen de acuerdo sobre el número exacto de tortugas que actualmente se aprovechan por año, pero parece probable que de 50 a más de 100 tortugas, en su mayoría verdes y carey aparezcan anualmente en las playas de cada una de las islas. El número de redes lanzadas y el número de cazadores que aguardan las hembras grávidas (portadoras de huevos) en las playas donde anidan es considerablemente menor que en cualquier época pasada. La cantidad de pescadores de tortugas de medio tiempo, se estima en menos de diez en cada isla. Sin embargo, la cantidad de pescadores con harpón que desembarcan tortugas marinas está aumentando, y esto se ve como una seria amenaza. La recogida de huevos no se ha cuantificado, pero se aproxima al 100 por ciento en algunas áreas. En la actualidad no existe legislación que rija el aprovechamiento de las tortugas o de sus huevos, pero el borrador de las Reglas de Pesquerías de 1992, exige una moratoria en la captura de tortugas y la recogida de huevos. Tal moratoria se encuentra apoyada plenamente por este Plan de Acción para el Rescate de la Tortuga Marina.

La sobrecarga más significativa en las poblaciones de tortugas locales ha sido un aprovechamiento, virtualmente no regulado. Las consecuencias del aprovechamiento excesivo se hallan en ningún lugar más evidente que en las playas de anidación. Es de consenso general el que las playas acogieron, una vez, muchos más nidos que los que actualmente se ven. Se ha matado demasiadas hembras grávidas de la federación o se les ha quitado sus huevos. Es evidente que si no se permite que los huevos produzcan ejemplares jóvenes, no habrá una próxima generación de tortugas que ponga sus propios huevos. La razón por la que hay menos tortugas en el mar es que el aprovechamiento excesivo no se limita a St. Kitts y Nevis. Todas las naciones del Caribe han participado. Las tortugas que nacen en St. Kitts y Nevis no permanecen residentes en nuestras aguas a través de los muchos años necesarios (20-35) para alcanzar la madurez sexual. En cambio, durante su adolescencia viajan a todo lo largo de la región y regresan a sus playas natales solo cuando es tiempo para reproducirse. Por consiguiente, los juveniles que se alimentan en los arrecifes coralinos y los pastizales marinos representan tortugas

producidas en las playas de anidación a lo largo del Mar Caribe, mientras que las hembras en nuestras playas de anidación, nacieron aquí hace muchos años y migran "a casa" cada 2 o 3 años para poner sus propios huevos.

Los objetivos de este Plan de Acción son explicar la biología de las tortugas marinas, proporcionar una panorámica de la situación y la distribución de las tortugas marinas en St. Kitts y Nevis, y recomendar acciones para la conservación, diseñadas para fomentar la recuperación de reservas mermadas. Además de la protección de tortugas y huevos, se hace necesario la conservación de importantes habitats nidos y de alimentación. En décadas recientes se han perdido unas pocas playas de anidación, en su mayor parte por el desarrollo de los puertos, pero los decenios venideros verán una comercialización sin precedentes de la faja costera. Varios grandes hoteles de la Península Sudoriental y de otras partes, se encuentran en las etapas de planificación o construcción. En mar abierto, un aumento en el tráfico de barcos y yates significará un aumento en los desechos sólidos y la contaminación, el fondeo y el uso del lecho marino (ej. arrecifes coralinos), a menudo frágil. Es necesaria la planificación integrada de las zonas costeras con vistas a salvaguardar las preciosas costas para las generaciones futuras. Los reglamentos debieran incluir la construcción de edificaciones de blindaje apropiadas, protección de la vegetación costera, eliminación de desechos y de aguas residuales, amarraderos y otras medidas que se describen en este Plan de Acción para el Rescate de la Tortuga Marina. Además de la ordenación de la zona costera, es necesario una mejor ejecución de la ley. Se recomienda la creación de una División para la Observancia Forzosa de las Leyes Ambientales.

Se propone aquí un Programa de Conservación de la Tortuga Marina a nivel nacional, de cinco años de duración. Las metas del programa son (1) obtener información exhaustiva y precisa sobre la distribución de los habitats donde anidan y donde se alimentan y (2) fomentar la conservación y la recuperación de las reservas de tortugas restantes. Las actividades, que comprenden estudios de mercado y de habitat, planificación del manejo, capacitación, y educación ambiental, se hallan descritas completamente en el texto. Además de los esfuerzos nacionales para conservar las tortugas marinas, es esencial que St. Kitts y Nevis apoyen las iniciativas internacionales para conservar estos reptiles altamente migratorios. A este respecto, se anima al Gobierno a ratificar los acuerdos de CITES, el Convenio de Cartagena del PNUMA (con el Protocolo de SPAW), y MARPOL. En resumen, es necesario un enfoque integral del descenso continuo de las tortugas marinas, que comprenda una fuerte legislación nacional y regional, la protección de los habitats, el monitoreo de la población y un aumento en la concientización pública.

Para asegurar que las regulaciones necesarias para salvaguardar las tortugas y sus habitats tengan el apoyo popular de la comunidad, grupos de usuarios (ej: pescadores), conservacionistas, funcionarios del gobierno, propietarios de restaurantes y ciudadanos preocupados participaron en la elaboración de este Plan de Acción para el Rescate de la Tortuga Marina. El proceso por el que se involucra a la comunidad es esencial y recomendamos que se aproveche tanto las reuniones del ayuntamiento como los medios de comunicación para aumentar la concientización pública de la defensa de la tortuga marina y en general, del medio ambiente de la isla. Se necesita el apoyo y la participación activa de todos los ciudadanos si para el Siglo XXI se quiere cumplir la promesa de independencia y prosperidad para el pueblo de St. Kitts y Nevis -- y la esperanza de supervivencia para muchas especies silvestres en peligro, incluso las tortugas marinas.

RESUME

Trois espèces de tortues de mer, toutes classées comme des espèces menacées, pondent leurs oeufs sur les plages de St. Kitts et Nièves. Il s'agit de la tortue cahouanne (Eretmochelys imbricata), la tortue verte (Chelonia mydas) et la tortue cuir ou tortue de rivière (Dermochelys coriacea). Les tortues cahouannes et les tortues vertes de tailles différentes ne se remarquent pas uniquement pendant la saison de la ponte, mais également pendant l'année lorsqu'elles s'alimentent dans les eaux peu profondes. La tortue cuir n'est pas résidente; les femelles gravides arrivent chaque année pour faire leurs nids pendant l'été. Une quatrième espèce, la tortue à écailles, (Caretta caretta) se remarque de temps en temps au large. D'après la documentation la capture de tortues de mer dans la fédération remonte à 1603, date à laquelle un groupe de travail envoyé à Nevis a parlé d'une "tortue si grande que quatre hommes n'ont pas pu la mettre dans le bateau." William Smith, dans des lettres écrites au 18ème siècle a déclaré que "les tortues vertes [étaient] si grandes qu'elles dépassent toute description." Il n'y a aucun doute que les tortues de mer toujours présentes représentaient une partie importante du régime alimentaire et du commerce pendant les siècles d'occupation coloniale.

Aujourd'hui, il y a beaucoup moins de tortues qu'il y a quatre ou cinq décennies. Elles ont été capturées en mer aussi bien que sur les plages pendant leur ponte. Les chasseurs aussi bien que les observateurs au courant de ces captures ne sont pas du même avis quant au nombre exact de tortues qui sont capturées chaque année; il semble néanmoins qu'entre 50 et 100 tortues environ, vertes et cahouannes pour la plupart, sont prises chaque année sur chacune des deux îles. Le nombre de filets placés et le nombre de chasseurs qui attendent les femelles gravides sur les plages est beaucoup plus bas que dans le passé. Le nombre de personnes qui chassent des tortues à temps partiel est estimé à moins de 10 sur chaque île. Néanmoins, le nombre de pêcheurs2Dharponneurs capturant des tortues est en hausse et cette situation est considérée comme menaçante. La collecte d'oeufs ne peut pas être chiffrée, mais s'élève à 100% dans certaines zones. Il n'existe actuellement aucune législation interdisant la capture des tortues ou de leurs oeufs n'existe; néanmoins la Réglementation de 1992 en matière de pêche appelle à un moratoire sur la capture des tortues et la collecte de leurs oeufs. Le présent Plan d'action pour la sauvegarde des tortues de mer appuie pleinement ce moratoire.

La capture non réglementée constitue la plus forte pression exercée sur les populations locales de tortues. Les plages où pondent les tortues portent le plus grand nombre de traces de surexploitation. Il n'y a aucun doute que les plages accueillaient beaucoup plus de nids qu'aujourd'hui. Trop de femelles parmi les populations de tortues dans la fédération ont été tuées et leurs oeufs pris. Il est clair que si l'on empêche la reproduction des tortues par les oeufs, il n'y aura pas de nouvelle génération de tortues pour pondre à son tour. Il y a moins de tortues en mer car la surexploitation ne s'est pas limitée à St. Kitts et Nièves. Tous les pays des Caraïbes y ont participé. Les tortues nées à St. Kitts et Nièves ne restent pas dans nos eaux pendant toute la période nécessaire (20 à 35 ans) pour atteindre leur maturité sexuelle. Elles voyagent dans la région pendant leur adolescence et ne retournent à leurs plages natales que lorsqu'elles sont prêtes à se reproduire. Les jeunes qui se trouvent sur nos plages y sont nées il y a plusieurs années et reviennent "à la maison" tous les deux à trois ans pour pondre leurs propres oeufs.

Le présent Plan d'action pour la sauvegarde des tortues a pour objectifs d'expliquer la biologie des tortues de mer, de fournir une vue d'ensemble sur l'état et la distribution des tortues de mer à St. Kitts et Nièves, et de proposer des actions de préservation visant à rétablir les populations qui ont été diminuées. En plus de la protection des tortues et de leurs oeufs, il est nécessaire de préserver les importants habitats d'alimentation et de reproduction. Quelques plages utilisées pour la reproduction ont été perdues au cours des années récentes, dû en particulier au développement des ports et au cours des décennies à venir, l'on assistera à une commercialisation sans précédent de la zone côtière. Plusieurs grands hôtels sont en voie de planification ou de construction dans la Péninsule sud-est et ailleurs. Une augmentation de la circulation des yachts et des bateaux de croisière engendra une augmentation des déchets et de la pollution, de l'ancrage et de l'utilisation, à des fins de loisirs, des fonds de mer souvent fragiles (des récifs coralliens, par exemple). La planification intégrée de la zone côtière est indispensable pour sauvegarder l'importante zone côtière pour les générations futures. La réglementation devrait inclure des contrôles adéquats sur la construction, la protection de la végétation côtière, l'évacuation des eaux usées et des déchets, l'ancrage et d'autre mesures décrites dans le présent Plan d'action de sauvegarde. En plus de la gestion de la zone côtière nationale, il faudrait envisager une amélioration de l'application par voie judiciaire. Il est recommandé de créer une Section pour l'application de la loi de l'environnement.

Ce document propose un Programme quinquennal pour la préservation des tortues de mer. Il a pour objectifs 1) d'obtenir des données complètes et précises sur la distribution des habitats des tortues pour la reproduction et l'alimentation et 2) de promouvoir la protection et la sauvegarde des populations de tortues de mer restantes. Le texte fournit le détail des activités, y compris des études du marché et des habitats, la planification de la gestion, la formation et l'éducation environnementale. En plus des efforts pour préserver les tortues de mer, St. Kitts et Nièves devrait appuyer les initiatives internationales visant à protéger ces reptiles très migrateurs. A cet égard, il est vivement recommandé au Gouvernement de ratifier les Conventions de CITES, MARPOL et la Convention de Carthagène du PNUE (y compris son Protocole SPAW). En bref, une approche intégrée est nécessaire pour combattre le déclin des populations de tortues, y compris, une législation national et régionale solide, la protection des habitats, la surveillance des populations et une plus grande sensibilisation du public.

Afin de s'assurer de l'appui au niveau de la communauté pour la mise en place de la réglementation nécessaire pour sauvegarder les tortues et leurs habitats, les groupes d'utilisateurs (les pêcheurs, par exemple), les écologistes, les responsables gouvernementaux, les restaurateurs et des citoyens intéressés ont participé activement à l'élaboration du présent Plan d'action de sauvegarde. Il est indispensable de faire participer la communauté dans ces efforts et nous proposons que l'on profite au maximum des réunions municipales et des médias pour sensibiliser le public au problème particulier de la tortue de mer et à celui de l'écologie de l'île plus général. L'appui et la participation active de tous les citoyens est nécessaire pour relever le défi du 21ème siècle, un défi d'indépendance et de prospérité pour le peuple de St. Kitts et Nièves ainsi que d'espoir de survie pour les espèces sauvages menacées, dont les tortues de mer.

I. INTRODUCTION

St. Christopher and Nevis (hereafter, St. Kitts/Nevis) is a two island nation in the north-eastern Caribbean Sea comprised of St. Kitts (176 km²; 17°15'N, 62°45'W) and Nevis (93 km²; 17°10'N, 62°35'W) situated three km to the southeast (Figures 1 and 2). The written history of the islands begins in 1493 with the accounts of Christopher Columbus, who claimed the islands for Spain. Spain made no attempt to colonize them, however, and Carib dominion lasted until the early 17th century when resource-hungry northern Europeans descended on the Eastern Caribbean in force. The 1600's were characterised by the massacre and enslavement of the native Caribs by the English and French, and decades of intermittent colonial warfare for control of the fertile islands. The English were ultimately triumphant and enjoyed a century of prosperity based on sugar plantations and slavery. Fluctuating market conditions after 1820 and labour problems arising from slave emancipation in 1838 brought the era to a close, but sugar continued to dominate the local economy. The last Nevisian sugar mill shut down in 1958 and the last commercial crop was harvested in 1969 (Richardson, 1983). Sugar continues to contribute to the Kittitian economy, along with tourism, construction, light manufacturing, and local agriculture and fishing (CCA, 1991). The two islands became an independent nation in September 1983. The most recent national census reported 9,130 persons in Nevis (May 1991) and 41,870 persons in St. Kitts (mid-year 1990).

The social and economic history of the islands has had a profound effect on the environment, including sea turtles and their habitats. Vast areas of reef deteriorated over many decades as pieces of coral were collected for refinement into lime, timber was cut to prepare the land for agriculture (resulting in upland erosion, sediment-laden runoff, and siltation of the nearshore marine zone), and runoff laden with agricultural chemicals found its way to the sea. More recently, coral reefs have been destroyed by anchoring and beaches have been lost to or degraded by sand mining, coastal development, increasing visitation, and natural disasters. Sea turtles themselves have been harvested for two millennia or more. Preliminary excavations of 21 early settlements in Nevis reveal occasional sea turtle bones in sites dating from 200 BC to 1500 AD (Samuel Wilson, University of Texas, pers. comm., 1991). The first written account of a visit to Nevis described an abundance of turtles. According to Hubbard (1992), Captain Bartholemew Gilbert of Plymouth, England, sailed to Nevis with a work party of 20 men and boys for the purpose of cutting *Lignum vitae* wood. An entry penned on 19 June 1603 stated, "This day in the Evening some went with the Boate unto the shore, and brought on board a Tortoyse so big that foure men could not get her into the Boate but tied her fast by one legge unto the Boate, and so towed her to the ship, when they had her by the ship, it was no easie matter to get her on board. ...This day at night we opened our Tortoyse, which had in her about 500 Egges, excellent sweet meat, and so is the whole fish."

There were so many sea turtles in both Nevis and St. Kitts that Gilbert's crew complained that when they cast nets for fish, turtles were continually caught in them. The ubiquitous sea turtles caused the nets to burst and allowed the fish to escape (Hubbard, 1992). Smith (1745) wrote, "Green [sea turtles] . . . are so common that they need no description". Nearly a century later, a 1698 Act regulated the prices of fresh provisions, including fresh turtle, at 6½d per pound (Gordon, 1985). Today the harvest of both turtles and eggs continues, although by all accounts there are far fewer turtles than there used to be. Four species are found in local waters.

They are the green (Chelonia mydas), hawksbill (Eretmochelys imbricata), leatherback (Dermochelys coriacea) and, rarely, the loggerhead (Caretta caretta) (Figure 3). Long-time residents remember the British custom of the Town Crier announcing the catch of a turtle and its impending slaughter for market. Mr. Douglas Yearwood recalled this rhyme as he had heard it as a young boy growing up in St. Kitts:

Fine and fat, fine and fat --
Green-back turtle will be slaughtered in the public market
tomorrow morning, at J. W. Adam's stall.
Fine and fat, fine and fat --
Six pounds for one dollar,
Ready cash, *Noooo credit!*

The catch of a turtle was not an everyday occurrence, and the practice of announcing the kill served to alert the community that the delicacy would soon be available. Following the enactment of conservation legislation in 1948, the habit of publicly announcing the catch served the additional purpose of discouraging fishermen from bringing turtles in illegally during the closed season. Cecil Byron, now Chief Magistrate in Nevis, recalls clearly a similar chant recited in Nevis when sea turtles were to be offered in the public market. The meat was cheaper than beef and comparable in price to pork and fish. In the 1960's the public announcements were discarded as "colonial and old-fashioned" (Douglas Yearwood, pers. comm., 1992).

While the Town Crier was familiar in urban areas, such as Basseterre, the catch of a turtle was not publicly announced in more rural areas of St. Kitts or Nevis. A turtle was not considered unusual in the coastal villages; indeed, turtles were typically part of a fisherman's haul. Ralph Wilkins (Assistant Fisheries Officer), who grew up in rural Sandy Point (St. Kitts) in the 1950-60's, recalls that it was commonplace to store sea turtles communally beneath those houses in the village that were constructed on stilts. Turtles were butchered as buyers were available. The Sunday morning meal was traditionally one of turtle meat and eggs, the latter rolled in flour and spices and fried into fritters. Similarly, turtle fishermen and older residents in Nevis confirm that the practice of "stockpiling" turtles under elevated houses or other usable structures was the norm. The turtles were common and it was not atypical to bring in more than could be immediately consumed. They would survive many days on their backs if kept shaded. There appears to be a general consensus amongst knowledgeable residents that the 1970's brought a noticeable decline in stocks, both at sea and on the nesting beaches. Long-time divers agree that turtles at sea are today both fewer and smaller. The beaches of the Southeast Peninsula were described to the authors as "desolate" compared to the number of eggs laid there 20 years ago.

It is unfortunate that there are no historical records available regarding the number of fishermen involved in the turtle fishery or their annual catch. In a report prepared for the Second Western Turtle Symposium, Wilkins and Barrett (1987) concluded that relatively few fishermen had actively pursued sea turtles in recent years; of roughly 650 active fishermen, "only about 40" were engaged in the turtle industry at the time of their writing. Barrett (1987) reported the total catch in 1986-87 to be about 110 turtles (mainly greens and hawksbills) and the average weight of turtles landed to be about 65 lb (30 kg). The following year, during the 1987-88 open season, only "eight fishermen [in Nevis were] directly engaged in the [turtle] fishing, operating 10 nets

specifically for this purpose". The catch that year (47 turtles, mostly female hawksbills) was low (Barrett, 1988). There are no comparable data for St. Kitts. From interviews conducted during the development of this Recovery Action Plan, the authors estimate that the catch may approach 100 turtles per year in St. Kitts and that this has been the case for most of the 1980's. While there are relatively few "turtle fishermen", most likely less than 10, an increasing number of spear-fishermen are targeting turtles whenever the opportunity arises.

In the past, most turtles were captured in nets designed to ensnare them. The nets ranged from 50-75 feet in length and 7-10 feet deep, with a mesh size of 8-10 inches. Some turtles were taken during nesting. Some turtle fishermen claim that by watching the sky, such as for "pitching stars", they could predict when a turtle was likely to nest. Today the tradition of staying up all night waiting to capture egg-bearing turtles on the nesting beach continues in both St. Kitts and Nevis, especially in the "turtle villages" (e.g., Sandy Point, Cayon, Keys) of St. Kitts. Eggs are routinely collected on both islands. It is widely claimed that virtually every egg is harvested and either shared with friends or, more rarely, sold. Turtles are also taken from the sea. Large-mesh turtle nets are regularly set by Nevisian fishermen in Nevisian waters and in the bays of the Southeast Peninsula (Audra Barrett, Assistant Fisheries Officer, pers. comm., 1992). Turtle nets are rarely set by Kittitian fishermen. A significant number of fishermen and recreational divers take turtles opportunistically, in and out of season, by spearing. The opportunistic take is certain to be higher than the directed take at the present time. Many of those captured are under-sized (turtles less than 20 lb (9 kg) are protected; see section 4.21).

According to Kenneth Samuel, native Kittitian, former turtle hunter and long-time diver, the hawksbill turtle is becoming rare in St. Kitts, at least in Caribbean (south shore) waters. The few individuals once seen around the *Talata* wreck in Basseterre Harbour were lost about three years ago when a local fishermen set his nets on the wreck. Samuel knows of only one site (the *River Taw* wreck) where they have been regularly seen in recent years. Other divers and fishermen contend that there are several shallow reef sites where hawksbills are observed. No one, however, disputes a serious decline in numbers over the course of recent decades. Twenty years ago, hunters would let a female nest up to six times on South Friar's Beach before killing her "and the attending male" (K. Samuel, pers. comm., 1992). In contrast, not a single nest was reported on South Friar's Beach from 29 June-12 August 1992. When Samuel became involved in dive-tourism and realised the extent to which marine resources were deteriorating, he gave up turtle hunting. Similarly, Charles Solas recalls that in years past he had his choice of six or more leatherbacks per night on the Atlantic beaches of St. Kitts; now many nights go by during the nesting season before a female comes ashore. There are beaches on both islands where nesting occurred in the past, but no longer. Today turtle hunting is largely a past-time, a cultural tradition, for participating fishermen. There are no full-time turtle fishermen.

From 1948-1992, regulations were in force to regulate the harvest of sea turtles. The Turtle Ordinance of 1948 protected turtles less than 20 lb (9 kg) and prohibited the killing, sale or possession of any turtle product between 1 June and 30 September. During the open season the meat of both hawksbill and green turtles was sold mostly to hotel restaurants; the shells were often used for wall decorations or jewelry. Today most restaurants refuse to buy turtle meat, some in deference to the endangered status of local and regional populations. There is a limited market on St. Kitts for oil rendered from the leatherback, which is used for medicinal purposes.

Oil in the possession of Charles Solas was selling for EC\$ 11-12 per bottle in the summer of 1992. There is apparently no market for leatherback meat or oil in Nevis. Green and hawksbill meat is consumed locally or exported to neighbouring islands (section 3.3). In contrast to the situation prior to the 1970's when the turtle fishery was a major source of income for some fishermen, there are no fishermen at the present time that depend solely or principally on sea turtles or their eggs for their livelihood. Interview data suggest that monies derived from turtles comprise less than 10% of a fisherman's income.

It is clear that the days of abundance are over. Fishermen alive today remember a time when ocean resources of all kinds seemed infinite. This is no longer the case, not with fishes, not with lobsters, not with turtles. It will not be easy for micro-states like St. Kitts/Nevis to meet the challenges of the twenty first century, but one thing is certain -- if we do not actively pursue a vision of the future that includes native wildlife, then the islands we pass to our children will be impoverished of spirit and weakened of potential. The future of our now endanger-ed sea turtles currently rests in the hands of a few hunters who are exterminating them. If we do nothing as a government or as a community to improve the economic status of our fishermen and to educate ourselves not, for instance, to consume turtle eggs, then the turtles will surely be exterminated in our lifetimes. What will St. Kitts/Nevis look like in thirty years? It seems like a long time, but in fact it represents but a single generation for a sea turtle. Will there still be sandy beaches suitable for incubating eggs? Healthy coral reefs? Clean water? The time for decision -- and action -- is now.

This Sea Turtle Recovery Action Plan is dedicated to the next generation, to a future that includes both economic prosperity for people and the survival of sea turtles. Much of the general background narrative was drawn from the recently completed Country Environmental Profile for St. Kitts and Nevis (CCA, 1991) and from the remarkable volume of documentation compiled in 1989 for the Southeast Peninsula Land Development and Conservation Board. The Profile was prepared under the aegis of the Caribbean Conservation Association (CCA) with technical support from the Island Resources Foundation, the St. Christopher Heritage Society (SCHS), and the Nevis Historical and Conservation Society (NHCS). The Southeast Peninsula reports were prepared by a variety of experts and made possible by a grant from the U. S. Agency for International Development. Both the Profile and detailed information now available on the natural resources of the Southeast Peninsula constitute major contributions to the literature available to local policy-makers, who must make increasingly difficult decisions balancing the long-term requirements of ecology and economy.

Similarly, but with a much more focused agenda, this comprehensive Sea Turtle Recovery Action Plan is designed to provide policy-makers and non-government groups with detailed information requisite to make informed decisions. This document, tailored specifically to the circumstances of St. Kitts and Nevis, is one of a series of Recovery Action Plans developed by the WIDECast project. It was written in collaboration with the WIDECast network in St. Kitts/Nevis and with the support of a regional team of sea turtle experts. Joan Robinson (Curator, Museum of Nevis History) and Tom Honebrink (Conservation Officer, SEP Land Development and Conservation Board) are the WIDECast Country Coordinators [N.B. Honebrink, a Peace Corps Volunteer, will be replaced as project coordinator in St. Kitts at the end of his tour in mid-1993; a member of the SCHS will be selected to fill the position]. Our in-

tentions in developing this Action Plan are to (1) summarize the status and distribution of local sea turtle populations, (2) examine threats to their survival, and (3) recommend conservation actions to be taken on their behalf. The consensus is that sea turtles in St. Kitts/Nevis are fewer today than at any time during the twentieth century. In order to promote the survival of remaining stocks, a national Sea Turtle Conservation Programme is herein proposed (section 4.6).

Before proceeding with the main body of the text, the authors would like to give special recognition to the fifth and sixth grade students at Estridge Primary School in St. Kitts. Their environmental studies teacher, Peace Corps Volunteer Diana Honebrink, devoted class time in October 1992 to a discussion of sea turtle biology and the concept of a national recovery plan for endangered sea turtles. The students then wrote a Recovery Action Plan of their own. They worked together in small groups, each with a specific section of the plan as their responsibility. The following text, entitled *Estridge Primary School Recovery Action Plan for Sea Turtles in St. Kitts and Nevis*, reflects a remarkable grasp of the subject matter. It also eloquently reminds us that we do not inherit the earth from our parents, we only borrow it from our children.

INTRODUCTION: The sea turtles are dying out and soon they will be extinct. People are killing them for their meat and shells, and sometimes killing them for fun. People also take the female turtle's eggs. If people take the eggs all the time, soon all turtles will die out. People are killing the big leatherback turtles so they can make oil. We need to save the turtles so that their populations will increase.

BIOLOGY: Green turtles live in the sea. They eat sea grass, are coloured yellow and green, sleep in coral reefs, and do not have a pointed face like the hawksbill turtle does. Hawksbill turtles live in the sea. They have a very funny-shaped nose and a beak like a hawk. They eat all kinds of different sea things. Leatherbacks live in the sea. They have a soft back and eat jellyfish.

THREATS TO SEA TURTLES: The worst threats are (1) killing the turtles so that soon there will be no more of them, (2) taking the eggs so that no young will hatch, (3) destroying the sea turtle's habitat so that there will not be any place for them to live, (4) throwing garbage into the sea and then the sea turtles they might eat the garbage and become extinct, (5) poisoning the sea with oil, (6) troubling the young turtles after the eggs hatch.

SOLUTIONS TO THREATS FACING SEA TURTLES: (1) Protect the turtles -- please stop killing the turtles when they come to lay their eggs and protect all ages of sea turtles, including the eggs; don't trouble the eggs. (2) Protect important habitat -- stop polluting the water, stop driving your vehicle on the sand, stop taking away the sand from the beach, put signs on the beaches that say "Please stop digging up the sand", stop building hotels on the beaches, put signs near the sea that say "Don't pull up the sea grass", don't throw garbage in the sea because it can harm sea turtles, don't throw oil in the sea water because it can kill sea turtles, don't dig in the sand because there can be eggs in the sand and you can destroy the eggs.

IMPLEMENTING THE RECOVERY PLAN: We could tell one another like our friends, mother and father, families and neighbours. If you want to tell the whole world, you could call on a telephone, or write a letter or an article for a magazine or newspaper, or go to everyone's houses, or appear on television. The Honorable Roy Jones [Constituency Representative] and the policemen should come and talk to the people of St. Kitts and Nevis and tell them to help us with the sea turtles. Tell them -- "Don't trouble their eggs, don't cut off their flippers, and if you trouble their eggs all the time there will be less turtles. Also, don't take them home as pets." If we tell people the first time, they won't agree with us. But if they don't agree with us, we could go on telling them and explaining to them that we want the sea turtles to live always. Then maybe they will agree with us.

II. STATUS AND DISTRIBUTION OF SEA TURTLES IN ST. KITTS & NEVIS

2.1 Caretta caretta, Loggerhead Sea Turtle

There are no indigenous common names applied to this species; the preferred name is "loggerhead". The loggerhead turtle is recognized by its large head, thick, somewhat tapered carapace (=shell), brown and gold or reddish-brown colouration, and characteristically heavy encrustation of invertebrate epifauna (especially barnacles). The large head and strong jaws, for which the species was named, are necessary adaptations to a diet of mollusks and hard-shelled crabs; tunicates, fishes, and plants are also eaten (Dodd, 1988). Adults attain a straight carapace length of 120 cm and weigh up to 200 kg (440 lb) (Pritchard et al., 1983). There are typically five pairs of lateral scutes (large scales) on the shell (Figure 3).

The species has a wide oceanic distribution; in the Atlantic Ocean individuals have been sighted as far north as Newfoundland (Squires, 1954) and northern Europe (Brongersma, 1972) and as far south as Argentina (Frazier, 1984). Nesting grounds are often located in temperate latitudes, with the greatest numbers of nesting females recorded along the Atlantic coast of Florida (USA) and Masirah Island (Oman). Nesting is also reported from various islands of the Greater and Lesser Antilles (although firm records are not always available), the Caribbean coasts of Mexico and Central America, and the Atlantic coast of South America from Venezuela to Brazil, as summarized by Dodd (1988). The greatest threat to the large breeding colonies in the USA is drowning in shrimp trawls (U. S. National Research Council, 1990).

It is generally conceded that loggerheads do not nest in St. Kitts/Nevis, but "an occasional nesting loggerhead" on the Southeast Peninsula was reported by Campbell Evelyn in d'Arbeau (1989). Individuals are sometimes seen offshore, but are rarely captured. Meylan (1983) reported that "the few individuals that have been seen were immature." One was reported to have been caught inside the reef at Dieppe Bay, and another off Key Ghaut (St. Kitts). The fishermen of Nevis periodically report "strange turtles" which may be loggerheads (A. Barrett, pers. comm., 1992). The species is considerably rarer than either the green turtle or hawksbill.

The meat is presumably eaten when available. There are no population estimates.

2.2 Chelonia mydas, Green Sea Turtle

Local common names for the species include "green turtle" and "green-back". The green turtle is recognized by a round, blunt beak with serrated cutting edges, one pair of enlarged scales between the eyes, and four pairs of lateral carapace scutes that do not overlap as they do on the hawksbill (cf. section 2.4) (Figure 3). The shell colour is light to dark brown, sometimes shaded with olive, with radiating wavy or mottled markings of darker colour or with large blotches of dark brown. It is generally devoid of barnacles. The plastron (=belly plate) is whitish or light yellow (Carr, 1952). Adults can attain weights of 230 kg (500 lb) (Pritchard et al., 1983) and generally measure 95-120 cm in straight carapace length (nuchal notch to posterior tip); a mean size of 100.2 cm (n=2107) is reported from the Caribbean nesting beach at Tortuguero, Costa Rica (Bjorndal and Carr, 1989). Audra Barrett measured seven carapaces from young green turtles killed on Nevis in 1986; they averaged 68 cm total curved carapace length (range 57-75 cm) (Wilkins and Barrett, 1987). Individuals of varying sizes are present in the waters surrounding St. Kitts/Nevis throughout the year.

It is quite certain 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 years) 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.

Green turtles travel extensively during the first decades of their lives 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 (=feeding areas). Therefore, the movements of adult turtles are likely to be less extensive than those of juveniles, since adults move seasonally between relatively fixed feeding and breeding areas.

The nesting season has yet to be precisely defined in St. Kitts/Nevis, but Wilkins and Meylan (1984) suggest that the bulk of the nesting occurs between May and October. Towle et al. (1986) estimated that nesting peaks in August-September, but indicated that a low level of nesting may occur year around. Neither nest density nor nesting frequency are known for St. Kitts/Nevis. On the basis of information available from other areas, 2-6 clutches of eggs are probably laid per female every 2-3 years. At the well-studied Tortuguero, Costa Rica, rookery, gravid (=egg-bearing) females deposit clutches averaging 112 eggs (sd=24.2, range 3-219, n=2544) every two weeks (Bjorndal and Carr, 1989). Undisturbed eggs hatch after approximately two months of incubation, with incubation temperature determining the sex ratio of the hatchlings (Morreale et al., 1982). In St. Kitts/Nevis, most eggs are believed to be harvested soon after they are laid (A. Barrett, pers. comm., 1989), despite the fact that eggs are protected between 1 June and 30 September (section 4.21).

Meylan (1983) described nesting as "sporadic" on St. Kitts and noted that "the most frequently mentioned nesting sites are on the tip of the southeastern peninsula -- at Majors Bay, Banana Bay, Cockleshell Bay, Mosquito Bay, and Sand Bank Bay . . . both [green turtles and hawksbills] also nest incidentally at Conaree and Belle Tete" (Figures 4 and 5). She also mentioned that green turtles feed, occasionally in groups, on the north coast at Willett's Bay and around the Southeast Peninsula. Green turtles are occasionally seen at Nag's Head (Robert Young, Vanier College, pers. comm., 1992) and are regularly observed at Grape Tree Bottom on the Caribbean coast of the Southeast Peninsula (Thomas Honebrink, pers. obs.). One of the largest green turtles ever hauled ashore was at Trinity Bay in the 1950's; a donkey cart was used to transport it into the village (Oliver Spencer, pers. comm., 1992). Waters offshore Old Road, Sandy Point, and Dieppe Bay towns were all favoured netting locations.

In a report prepared for the Western Atlantic Turtle Symposium, Wilkins and Meylan (1984) indicated nesting on St. Kitts at Sandy Point, Newton Ground, Dieppe Bay, Sandy Bay, Conaree, North Friar's Bay, Sand Bank Bay, Mosquito Bay, Major's Bay, Cockleshell Bay, Garvey's, Challengers, and Ballast Bay. Some of these beaches, including most of the Caribbean shoreline from Lynch Bay southeast to Hart's Bay (Lynch, Challenger's, Trinity, Garvey's, Hart's), were lost to Hurricanes Klaus (1984) and Hugo (1989). The sand has never returned. d'Arbeau (1989) surveyed the beaches of the Southeast Peninsula and attributed 22% of the nests to green turtles (26 June-31 July 1989); South Friar's and Sand Bank bays appeared to be the most important for this species (Table 1). Unfortunately, vehicle traffic and beach-cleaning equipment now discourage nesting on South Friar's beach (section 4.134).

In Nevis, Meylan (1983) noted historical records of green turtles nesting at Pinneys Beach (Figure 6), but expressed doubt that much nesting occurs today because of the high level of activity on this beach. She stated that foraging occurs "widely" around the island and indicated that green turtles were captured by nets off the southeast and southwest coasts and Newcastle. Several have borne tags originally put on at the nesting beach on Isla Aves, suggesting that Nevis may be one of the resident feeding grounds for that population. Robert Young observes green turtles feeding on "virtually every hike along the cliffs at White Hall Bay" on the south coast; large green turtles are also "predictable" at Almond Gardens (pers. comm., 1992).

On Nevis, nesting has been reported at Pinneys Bay, Red Cliff, and Indian Castle (Wilkins and Meylan 1984) and occasionally on the north coast on beaches in the Newcastle area. Nesting is rare to nonexistent at Pinneys due to increased levels of human activity and the beach at Indian Castle has been "destroyed" by sand mining (A. Barrett, pers. comm., 1991). At the present time, the most important green turtle beaches in Nevis are believed to be the pocket beaches in the Newcastle area, and White and Landing bays on the southeast coast (A. Barrett, pers. comm., 1992). Both juvenile and adult green turtles are harvested, especially during the open season (1 October-31 May); see section 3.3.

2.3 Dermochelys coriacea, Leatherback Sea Turtle

Leatherbacks, referred to in St. Kitts as "river turtles", are the largest of the sea turtles. Females nesting in the Caribbean typically weigh 300-500 kg (650-1100 lb). The largest leatherback on record is a male that stranded on the coast of Wales in 1988 and weighed 916 kg (2015 lb) (Morgan, 1989). The species is easily distinguished from other sea turtles because it lacks a bony shell, having instead a slightly flexible skin-covered carapace. The smooth, black skin is spotted with pale yellow or white. The tapered carapace is raised into seven prominent ridges and measures 130-165 cm in straight-line length (Figure 3). 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. Kitts/Nevis, arriving in the early months of the year to lay their eggs. It is likely that they leave north-temperate foraging and residence areas to come to St. Kitts/Nevis and then return to these latitudes after egg-laying is complete (cf. Eckert and Eckert, 1988).

The nesting season is said to occur between March and May (Meylan, 1983) but it is likely, based on the season in neighbouring islands, that some nesting continues through mid July. Turtle hunters interviewed by primary school children indicated that the season in St. Kitts spans February to June (see Appendix I). Data collected at the well-studied nesting ground 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 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 (Basford et al., 1990); 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.

In St. Kitts, most nesting occurs on the Atlantic coast and principally from Cayon River to Key Ghaut (there is also some nesting south of Key Ghaut, despite the offshore reef), but also on beaches as far south as Sand Bank Bay. Residents of the village of Keys ("Turtle Town") reported to Meylan (1983) that 8-12 leatherbacks nested annually between Cayon River and Key Ghaut. Meylan found seven tracks of varying ages on this beach on 19 May 1983. The following year, Wilkins and Meylan (1984) reported nesting at Conaree, North Friar's Bay, Sand Bank Bay, and Sandy Point, the latter on the Caribbean coast (Figures 4 and 5). Caribbean coast nesting appears to be considerably less frequent than Atlantic coast nesting, though Sandy Point is recognized as an important area. An early report by Caldwell and Rathjen (1969) indicated that two leatherbacks were taken in June 1968, including one taken on the beach at Belle Tete,

the sandy promontory just north of Sandy Point Town. Five tracks were observed there by Anne Meylan during a field survey on 18 May 1983. Further south and several years later, two tracks were visible at South Friar's Bay on 2 April 1989 (Karen Eckert, pers. obs.).

In preparation for WATS II, Conaree Beach (Key Ghaut to Jack Tar Village) was monitored between 28 April-9 June 1987; 14 leatherback nests were recorded and most if not all eggs were poached. Two nesting females are known to have been killed during this time, one measured 51 inches (129.5 cm) curved carapace length (CCL) and the other 54 inches (137 cm) CCL; a third female was measured whilst nesting and measured 59 inches (150 cm) CCL (Wilkins and Barrett, 1987). Nesting on the channel beaches of Cockleshell and Mosquito has also been observed (Arendt, 1985 *in* Towle et al., 1986). d'Arbeau (1989) surveyed the beaches of the Southeast Peninsula and attributed 9% of the nests to leatherbacks (26 June-31 July 1989). She concluded that South Friar's Bay appeared to be the most important for this species (Table 1). In 1992, nesting was documented on North Friar's Bay (Kate Orchard, pers. comm.), Sand Bank Bay (Ricky Pereira, pers. comm.), and Cayon (Tom Honebrink, pers. obs.). On 3 May 1992, a nester wandered landward and became mired in Frigate Bay Salt Pond behind the Monkey Bar. She was dragged out by a rope tied to a truck (Rick Cordwell, pers. comm., 1992).

Nesting on Nevis is described as "infrequent" (Meylan 1983). In an early account by Arthur Anslyn (pers. comm. to Rathjen, 3 July 1966 *in* Caldwell and Rathjen, 1969), "two of the biggest turtles ever landed in Nevis were captured when they came up on the beach to lay their eggs. The first one was captured on the southeast coast and weighed an estimated 2000 pounds [N.B. this is likely to be an exaggeration]. The second, on the western coast, weighed 1036 pounds." These turtles are sure to have been leatherbacks. Wilkins and Meylan (1984) reported nesting at Red Cliff and Indian Castle beaches on the south shore and estimated that 3-5 nests per year were laid at Indian Castle (Figure 6). Today some nesting is reported from Cades Bay, Oualie Beach (Mosquito Bay) and Hurricane Hill, but the Indian Castle beach site has been "destroyed" by sand mining (A. Barrett, pers. comm., 1991).

A 25 April 1992 article in *The Democrat* reported that "a group of Nevis fishermen accidentally landed a huge leatherback turtle [at Oualie Beach], which had become entangled in their nets. As the leatherback is not considered good eating meat, it had no apparent commercial value to the fishermen, who left the turtle on its back on the beach whilst they went to sell their catch of fish, no doubt intending to return when they had more time to disentangle it from their valuable nets. The giant leatherback turtle, which is a heavily protected "endangered species" in almost every country of the world -- with the unfortunate exception of St. Kitts and Nevis -- was over six feet long. . . A small crowd of tourists and locals became alarmed at the turtle's distress and called the Fisheries Division and John Yearwood, President of the St. Kitts and Nevis Hotel Association, who acted immediately by offering to reimburse the Nevisian fishermen for any damage done to their nets in cutting the turtle free. . . After the net was fully cleared from its body without damage, the turtle swiftly set off for the water's edge and launched itself back into the sea to the admiring cheers of the crowd of well-wishers."

Little is known about the offshore behaviour of leatherback turtles in St. Kitts/Nevis, including whether or not they feed in local waters. Stomach contents of animals killed in other parts of the world indicate that the diet is mostly cnidarians (jellyfish, siphonophores) and tuni-

cates (salps, pyrosomas) (Brongersma, 1969; Den Hartog and Van Nierop, 1984; Davenport and Balazs, 1991). Based on offshore studies of diving by adult females nesting on St. Croix, Eckert et al. (1989) proposed that the observed inter-nesting dive behaviour reflected nocturnal feeding on vertically migrating zooplankton, chiefly siphonophore and salp colonies. There are no records of juveniles in St. Kitts or Nevis, although injured juveniles have been found recently in Barbados (Horrocks, 1987) and Puerto Rico (Johnson, 1989). The paths taken by hatchlings leaving their natal beaches are not known. There are no data on growth rate or age at sexual maturity for wild leatherbacks.

Oil derived from leatherbacks killed in St. Kitts has traditionally been used for medicinal purposes, including home cold remedies, and this continues to the present day (see also section 3.3). Leatherbacks have at times been killed in Nevis, but historically there has been virtually no market for the meat or the oil.

2.4 Eretmochelys imbricata, Hawksbill Sea Turtle

The hawksbill is distinguished by a narrow, pointed beak with which it pries sponges and other soft-bodied organisms from the reef. The carapace is often posteriorly serrated and the four pairs of carapace scutes overlap, like shingles on a roof (Figure 3). There are two pair of pre-frontal scales between the eyes. Adults rarely exceed 80 kg (175 lb) and a carapace length of about 90 cm (straight-line, nuchal notch to posterior tip) (Pritchard et al., 1983; Witzell, 1983). Bright mottled colouration (brown, orange, gold) 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 females often nest on isolated beaches (including those flanked by exposed coral and rock) that are difficult for biologists to reach 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 (cf. Corliss et al., 1989). Average clutch size ranges from 120-160 eggs in the Western Atlantic (summarized by Witzell, 1983). The female often lays her eggs deep in the shelter of beach vegetation, such as the sea grape (Coccoloba uvifera). Little evidence of the visit exists aside from 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). As is true for other sea turtles, females will predictably return to the same beach or area to renest on intervals of 2-3 years, again based on data collected in Antigua (Jim Richardson, University of Georgia, pers. comm., 1992). Sand temperature plays a large role in determining hatchling sex -- warmer temperatures produce females, whereas cooler temperatures produce males.

Nesting may occur during all months of the year, especially May to October (Wilkins and Meylan, 1984), in St. Kitts/Nevis. Meylan (1983) described nesting as "sporadic" on St. Kitts and noted that "the most frequently mentioned nesting sites are on the tip of the southeastern peninsula -- at Major's Bay, Banana Bay, Cockleshell Bay, Mosquito Bay, and Sand Bank Bay . .

. . both [green turtles and hawksbills] also nest incidentally at Conaree and Belle Tete" (Figures 4, 5). In a report prepared for the first Western Atlantic Turtle Symposium, Wilkins and Meylan (1984) indicated nesting on St. Kitts at Sandy Point, Newton Ground, Dieppe Bay, Sandy Bay, Conaree, North Friar's Bay, Sand Bank Bay, Mosquito Bay, Major's Bay, Cockleshell Bay, Garvey's, Challengers, and Ballast Bay. d'Arbeau (1989) surveyed the beaches of the Southeast Peninsula and attributed 68% of the nests to hawksbills; Major's Bay was clearly the most important site for this species, with South Friar's Bay in second place (Table 1). By 1992, severe erosion at Major's Bay had reduced the available nesting habitat there.

In Nevis, nesting was reported at Pinneys Bay, Red Cliff, and Indian Castle by Wilkins and Meylan (1984) (Figure 6), but is now rare to nonexistent at Pinneys due to increased levels of human activity and the beach at Indian Castle has been lost to sand mining. At the present time, the most important hawksbill beaches in Nevis are believed to be the pocket beaches in the Newcastle area, and White and Landing bays on the southeast coast (A. Barrett, pers. comm., 1992).

All size classes of hawksbills (23 cm straight-line carapace length and larger) are encountered in nearshore waters. Meylan (1983) reported sightings in shallow reefs around Dieppe Bay, Belle Tete, and Canada Estate in St. Kitts, and that in Nevis hawksbills were "captured in nets in the Black Bay [Red Cliff] area, although less frequently than green turtles." Wilkins and Meylan (1984) indicated that foraging had been observed at Sandy Point, Willett's/St. Paul's, Dieppe Bay, Keys/Conaree, South Frigate Bay, and Major's Bay; and off Pinneys Beach in Nevis. Les Windley (Sea Nevis Charter Boats, pers. comm., 1992) reports that juvenile hawksbills (less than 2-ft (0.6 m) shell length) are sometimes seen during charter trips and snorkeling at Shitten Bay on the south coast of St. Kitts, and at Cades Bay and the Prinderella area of western Nevis; the turtles have never been seen feeding, but appear to seek shelter in the shallow reefs. Residents report regular sightings at Whitehouse Bay and Nag's Head on the Southeast Peninsula.

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). In the absence of comprehensive dietary data for local populations, there is little recourse but to assume that the distribution of hawksbill foraging is more or less coincident with the distribution of coral reefs in St. Kitts/Nevis. Hawksbills also occasionally eat whelks, cracking the shell and consuming the soft mollusk (Kenneth Samuel, Kenneth's Dive Center, pers. comm., 1992). Both juveniles and adults are harvested in St. Kitts and Nevis, especially during the open season (1 October-31 May); see section 3.3.

2.5 Lepidochelys kempii, Kemp's Ridley Sea Turtle

There are no records of Kemp's ridleys in St. Kitts or Nevis. 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 (cf. hawksbill turtle, section 2.4). Adults weigh 27-41 kg (60-90 lb) (Ross et al., 1989). The species is carnivorous and eats mostly crabs, but also preys upon other crustaceans, shell-

fish, 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 having been held captive during its first year (Woody, 1991), Kemp's ridleys are confined to the Gulf of Mexico and temperate northern Atlantic. Unarguably the most endangered sea turtle in the world, the total adult population is thought to number no more than 900 females and an unknown number of males (Ross et al., 1989). Nesting occurs almost exclusively in the state of Tamaulipas, Mexico.

2.6 Lepidochelys olivacea, Olive Ridley Sea Turtle

There are no records of olive ridleys foraging or nesting in St. Kitts or Nevis, nor would the species 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 yellowish 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. In the western Atlantic, olive ridleys have been reported from Brazil northward to Venezuela (Pritchard, 1969) but significant levels of nesting appear to occur only 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 (Fretey, 1990). Incidental catch and drowning in shrimp trawls has been implicated in their demise. Diffuse nesting occurs in northwestern Guyana and in French Guiana (Reichart, 1989).

III. STRESSES ON SEA TURTLES IN ST. KITTS & NEVIS

3.1 Destruction or Modification of Habitat

The environmental resources of St. Kitts/Nevis are unique and irreplaceable. It is crucially important to pursue national economic development in an orderly manner to promote and maintain a competitive business climate *and* to conserve these environmental amenities for the enjoyment and economic utilization of future generations. St. Kitts/Nevis is a very small country. The reality of scale limits development options to some extent, and there is not the margin for error that larger countries enjoy. Holistic and thoughtful development is essential. There are already examples of habitat destruction and perhaps the most obvious, at least in terms of sea turtles, is beach degradation. Problems include the loss of some beaches to sand mining and the abuse of others by vehicle traffic, waste disposal, commercial development, and armouring (section 4.13). Residents cite once active nesting beaches, such as Pinneys on Nevis, that are now rarely visited by turtles because of human activity. Further, there is concern that large-scale development of the Southeast Peninsula of St. Kitts, encouraged by the recent completion of a paved road extending the length of the once wild peninsula, will ultimately destroy many of the nation's remaining sea turtle nesting beaches. Once the relatively few sandy beaches are over-commercialized, they cannot be recaptured for the quiet pleasure of residents, tourists, or wildlife. This is a central point, for without a commitment by Government to exercise

stewardship over the coastal zone, there can be little enthusiasm among turtle hunters to do their part in safeguarding the biodiversity of this beautiful nation.

It is equally important to recognize existing threats to the marine environment, since sea turtles utilise the coastal zone for feeding, resting, and migrating. Domestic pollution, especially around urban areas, poses a threat because not all the raw sewage generated is collected via a sewer system for subsequent treatment. Much of this waste disappears directly into the sea. In addition, waste products from a variety of industries in St. Kitts, including sugar cane and molasses production, distillery, abattoir, brewery and power plants, "all enter the coastal environment and contribute to stressful conditions experienced by marine ecosystems" (CCA, 1991). Local agriculture, increasingly dependent on agrochemicals, also contributes to contaminated runoff. Ships discharge sewage and other refuse at sea. Fisheries and marine tourism (SCUBA diving) may have negative effects on the marine environment, especially when considered cumulatively. In particular, coral reef destruction is an increasingly worrisome problem due to anchoring, lost or discarded fishing gear (lost fish pots, tangled fishing line, torn nets), garbage, and the activities of recreational divers, the latter involving the touching and trampling of corals. Sea grasses are also at risk from anchoring and sedimentation. It is generally conceded that sea grasses around Nevis, especially around Charlestown, are "slowly disappearing" (Robinson, 1991).

Probably the most prominent examples of habitat degradation around the two islands are the main harbours at Charlestown and Basseterre. Water quality is poor in these areas, largely due to general shipping-related pollution and run-off from the streets of the capital cities. In the Charlestown Harbour, the sea grasses are mostly dead and the corals are gone. Physical damage to coral reef habitat in the Basseterre Harbour and Brimstone Hill Shallows has been extensive, primarily due to anchoring. There are anchor scars 150-200 m across in Basseterre Harbour where huge coral formations once flourished (K. Samuel, pers. comm., 1992). Furthermore, the beach at Basseterre used to be some 50-70 m wide and host significant numbers of nesting turtles. Construction of the Deep Water Port and the pier there starved the Basseterre beach over a period of about ten years. Today the beach is only 1-2 m wide; indeed, the coastal road is often undercut by waves breaking near it. Big and Little Potato bays just south of the Deep Water Port also used to have sea turtles nesting, but the beaches have been reduced to rubble and the turtles are gone. Similarly, construction of the solid Charlestown pier has precipitated the loss of sandy beaches from the pier north to Pinneys Beach Hotel in Nevis. Fewer than ten years ago people could swim off sandy beaches between the pier and Pinneys Beach Hotel. This is no longer true because the sand is diverted out to sea or deposited in Gallows Bay. What was once sandy shore is now rocky.

Harbour areas are zoned for commercial activities, and as such their degradation is virtually assured. More troublesome is increasing activity in as yet unspoiled areas, such as the Southeast Peninsula and the Narrows. Sea grass is abundant around the Southeast Peninsula, particularly in the channel (Narrows) bays. For example, Mosquito Bay is a high use area because of water sports promoted there and there is evidence (e.g., aerial photographs) of a thinning in the bay's grass beds. Dredging at Cockleshell Bay has already damaged the seabed and further manipulation is planned (section 4.147). Simmonds (1991a) reported that of four sites examined for the Coastal Marine Ecosystem Monitoring Project (Sand Bank Bay, North

Frigate Bay, Old Road Bay, Sandy Point), varying degrees of overall reef health were observed. Sand Bank Bay and North Frigate Bay were described as "poor"; substantial amounts of broken and damaged corals (mostly elkhorn, *Acropora* sp.) were observed, as well as excessive algal growth. Old Road was found to be in "good" condition and Sandy Point in "fair" condition. The latter two sites had less algae and a greater diversity of invertebrates and fishes. It is widely held among local divers that St. Kitts' Atlantic reefs are dying. The mortality appears to be patchy and particularly severe offshore from Jack Tar Village and north toward Half Moon Bay; the cause is not known (Joseph Simmonds, Fisheries Officer, pers. comm., 1992).

3.2 Disease or Predation

The extent to which disease and predation negatively influence the survival prospects of sea turtles in St. Kitts/Nevis has not been quantified, but there is no reason to believe that either factor is out of balance or poses a serious threat. Green turtle fibropapilloma disease has been observed by SCUBA dive operator Kenneth Samuel, but only "a couple times and not recently". The disease is a herpesvirus-like infection which has been reported elsewhere in the region (see Jacobson, 1990) and is extensively documented in Florida (Ehrhart, 1991). Symptoms include external tumors of varying sizes. The tumors can result in blindness and debilitation; in several cases, internal tumors have been seen in the lungs, intestinal surface, and kidneys (Jacobson, 1990). The cause of this potentially fatal disease is not known. If turtles with visible tumors are captured they should be released. Under no circumstances should diseased turtles be eaten.

Major predators on sea turtle eggs and hatchlings include both indigenous (ants, crabs, birds) and exotic (dogs, mongooses, pigs) species. Wilkins and Meylan (1984) mentioned dogs and mongooses as predators of hatchlings. Wild pigs foraging at the dump near Conaree, St. Kitts, occasionally roam the beach and may disturb turtle eggs (pigs are significant egg predators elsewhere in the Wider Caribbean region). d'Arbeau (1989) estimated hatchling loss to crabs, birds, and mammals (and desiccation in one case) on seven Southeast Peninsula beaches from 23 June to 31 July 1989 to be 21.28% (Table 2). The exotic species have had a particularly devastating effect on the native fauna; ground birds are now scarce, sea turtles are endangered, and the mountain chicken, agouti, and iguana are all extinct (CCA, 1991). There is no evidence that monkeys (*Cercopithecus aethiops*) resident on the Southeast Peninsula pose any threat to sea turtles or their eggs and hatchlings (R. Young, pers. comm., 1989).

A wide variety of fishes consume hatchlings at sea. As the turtles grow, their vulnerability to predation is reduced. Only the larger sharks and killer whales (*Orca orcinus*) can successfully challenge a fully armoured turtle. In January 1992, a 3 m tiger shark was landed at Oualie Beach Resort, Nevis, and found to have ingested a juvenile hawksbill about 30 cm in carapace length (Young, 1992). d'Arbeau (1989) described a shark attack on an adult green turtle in shallow waters off the Southeast Peninsula in June 1989; "wave action brought the injured female close to shore where she was ... slaughtered by the road construction crew." Fishermen and divers occasionally see turtles with missing or partially missing flippers, a condition which is likely to be attributable to shark encounter. Some years ago, leatherback remains were found in the stomachs of three killer whales captured off St. Vincent (Caldwell and Caldwell, 1969).

3.3 Over-utilisation

Historical overview: Preliminary excavations of 21 early settlements in Nevis have revealed occasional sea turtle bones in sites dating from 200 BC to 1500 AD (Samuel Wilson, University of Texas, pers. comm., 1991), but there are no data to indicate the extent to which turtles were harvested during prehistoric eras. Similarly, very little information can be found relating to their catch or consumption during the centuries of European occupation. General anecdotal details were reported in the letters of William Smith: "There are seven or eight kinds of Turtle *alias* Tortoise, though but one of them eatable, which is called Green Turtle, because its fat is of a green colour, and that not of the sort, whose shell serves for Snuff-Boxes. They are so common that they need no description; and the manner of catching them at Nevis, is as follows. When a Person sees any of their Tracks in the Sea Sands, he next Night sits up to watch, and turn them upon their Backs, and then they are quite helpless. Their Blood is cold; and upon opening one of them, I have seen, at least, two hundred eggs that are exactly round, (like a School-boy's Marble) taken out of it, about forty of which, were enclosed in whitish tough Skins, with a water-coloured, or jellyish substance round the yolk, and were ready to be laid at one time." (Smith, 1745).

One thing is undeniable, and that is that sea turtles have been harvested for centuries in what is now the nation of St. Kitts and Nevis. It is difficult to know precisely when local turtle populations began their decline, but the trend is consistent with that reported elsewhere in the Caribbean. During an October 1992 interview, Charles Solas (about 65 years old) of Keys village recalled cutting cane as a young man and sometimes walking to Conaree Beach to sleep at night. There were as many as six (sometimes more) leatherbacks nesting per night on the beach in those days, although he and the other hunters rarely killed more than one (each) per night because that was all they could handle (transport, butcher, distribute). A turtle could be expected each time "a star pitched". He remembers killing a maximum of three in a single night. Since it was not possible to transport a turtle off the beach at night, he would either decapitate her or cut off her nose with his cutlass, believing that if she could not smell the water, she would not return to the sea. Hunters generally worked alone, sometimes with a dog. Family and friends were assembled at dawn to assist in transport and butchering. Meat and oil were the primary products. Eggs were very popular and "plenty people" used to gather them on the beaches during the nesting season. Eggs were located by probing with a steel rod.

According to Solas, who concedes that very few turtles come to the beaches anymore, the females have simply gone somewhere else, "gone by the current". Today a hunter will wait many nights before his effort is rewarded. The scenario is similar for green and hawksbill turtles. Another native Kittitian, diver Kenneth Samuel, remembers sea turtles brought in in abundance during the 1940's and 1950's. They were stockpiled at fishermen's residences, such as at the Ramsey house and others on the waterfront in Basseterre, where they were stowed under the building on their backs until butchering. Buyers came to the fishermen's houses and ordered the number of turtles desired. Turtles not sold after 7-10 days were close to death, having had no access to food or water, and were killed for distribution to friends and villagers who could not otherwise afford the luxury of meat at one shilling (25 cents) per pound, considerably more expensive than fish. A popular method of preparation was to soak the meat in a pork barrel with spices and the juice from imported pickles, then cure it in the hot sun. Large sea turtle shells

were used as toy boats for children. By the 1970's it was clear to anyone paying attention that turtles were smaller, and they were getting rare (K. Samuel, pers. comm., 1992).

The beaches of the Southeast Peninsula have always been particularly good nesting habitat. Campbell Evelyn (former Chairman, Conservation Commission) and Oliver Spencer (Old Road Fisherman's Cooperative) recall "lots" of nesting on these beaches, especially on the Caribbean and terminus (Narrows) shorelines. In 1968-1970, it was possible to walk in the sea grass along the shoreline of Cockleshell Bay and collect huge conchs in knee-deep water. There were turtle nests "everywhere". Mosquito Beach, too, was "famous for turtles", both hawksbill and green. Diving in Mosquito Bay in the 1970's, Spencer remembers multiple turtle nets set offshore. In addition to frequent nesting on the terminus beaches of Mosquito, Cockleshell, and Banana Bays (Figure 5), Evelyn estimates that there were commonly as many as 35 (and up to 75) green turtle nests on South Friar's Bay at any one time. This is particularly telling because green turtles are today the rarest of all the sea turtles that nest in St. Kitts and Nevis. Evelyn describes the Peninsula beaches today as "desolate". Since the peninsula lacked a road until very recently, the majority of sea turtles in recent decades were taken by netting. Nevertheless, it is also true that gravid females and eggs were taken from the nesting beaches by fishermen traveling to the peninsula by boat.

Contemporary data: Meylan (1983) reported that sea turtle populations in St. Kitts were considered by most residents to be declining. The following text is taken from her account. Net fishermen complained about a reduction in annual catch. Catch rates for fishermen at the time of her writing were on the order of 10-20 per year. One turtle fisherman at Dieppe Bay used to catch 50 turtles per year in the early 1960's; in 1979, he caught a total of four green turtles and hawksbills, and one leatherback. He implied that he had exerted equal effort during both periods, although this is a difficult point to establish. About ten people on the island were actively setting turtle nets at the time of Meylan's writing. None were exclusively dependent on this for their livelihood, but the meat and income were undoubtedly an important contribution to their subsistence. Most turtles caught were immature greens. The meat (all species, with leatherback least preferred) was sold in many villages and occasionally in the public market in Basseterre, as well as to hotels. The price in 1980 was US\$ 0.80/kg; it had increased to US\$ 1.60/kg by 1983 [N.B. US\$ 1.00 = EC\$ 2.70 in October 1992]. Turtle eggs were also eaten, but rarely sold. Leatherback oil was widely used medicinally.

Meylan (1983) reported that there was "limited information" on changes in population levels of marine turtles in Nevis. A tortoiseshell buyer in Charlestown reported a decrease in the amount of tortoiseshell he was able to purchase from fishermen on the island -- from 136 kg/yr in 1975 to 91 kg/yr in 1980. Inasmuch as hunting pressure increased during this period, a decline in the hawksbill population may have occurred. The status of green turtles around Nevis was reported as "unknown" by Meylan (1983). She indicated that at least a dozen people, most of whom lived in Hanley's Road, Bath Village, and Newcastle, fished for turtles with tangle nets in order to supplement their incomes and diets; none depended solely on turtle fishing for their livelihood. While there was considerable fluctuation from year to year, the average annual catch reported by Nevis fishermen was 5-15 turtles, mostly green turtles. When abundant, green turtles were shipped live on the ferry or the "lighters" to the public market at Basseterre, St. Kitts. As in St. Kitts, but apparently to a much lesser extent, oil derived from the leatherback was used in

Nevis as a home remedy for colds and congestion. On both islands, sea turtles were harvested without any knowledge on the part of the hunters as to the size of the populations at large, or the number of individuals that could be sustainably taken each year.

In the National Report for St. Kitts/Nevis prepared for the 1983 Western Atlantic Turtle Symposium (WATS I), Wilkins and Meylan (1984) described five landing sites for turtle products -- Basseterre (caught with "set nets from Nevis"), Sandy Point ("set nets, spear, nesting"), Indian Castle ("set nets, spear"), St. Paul's ("set nets, spear"), and Dieppe Bay ("set nets, spear"). Typical turtle nets are gill nets 50-75 feet long and 10 feet deep, with a mesh size of 8-10 inches (Barrett, 1987). In a later report, Wilkins and Barrett (1987) conceded that turtles were "relatively low in abundance" as compared to 1983 when the first survey had been conducted. Nests made on Conaree Beach in 1987 were found poached "within a day or two". Prior to and during the Conaree Beach survey, two leatherbacks were legally taken there. In all, more than 50 turtles (hawksbills, green turtles, loggerheads, leatherbacks) were caught in St. Kitts during the 1986-1987 open season. The meat was consumed locally. Hawksbill shells were either sold to a buyer from neighbouring islands, or sold to a local buyer who, in turn, sold them to an outside buyer. In Nevis, about 20 fishermen "fully engaged in turtle fishing" operated some 36 nets in inshore areas, along the peninsula of St. Kitts, and near beaches "known to be frequented by turtles". Total catch in Nevis for the October 1986-May 1987 open season was estimated to be 110 turtles, mainly hawksbill and green turtles (average: 65 lb). Hawksbills were caught most frequently; leatherbacks were occasionally caught and released because the meat was not favoured. Hawksbill and green turtle meat was sold mostly to hotels. The shells were used for decoration and jewelry; some fishermen "swinged" (charred and broke) them for use as fish trap bait.

By the 1987-1988 season, only eight fishermen were directly engaged in turtle fishing in Nevis and they operated 10 turtle nets; the catch of 47 turtles, the majority being female hawksbills, was considered relatively low (Barrett, 1988). Based largely on interviews with fishermen and Fisheries Officers, d'Arbeau (1989) reported that green turtles and hawksbills were caught by spearing on the coral reefs, particularly those offshore the Southeast Peninsula. Turtle nets were also set (mostly by Nevis fishermen) in the two mile channel separating St. Kitts and Nevis. According to Assistant Fisheries Officer Audra Barrett (pers. comm. *in d'Arbeau, 1989*), Nevis recorded an annual turtle catch of 110-120 greens and hawksbills in 1988 and an estimated 1989 catch of 60-70; most of the turtles were caught off the Southeast Peninsula. "Turtle watches" are also carried out by fishermen who await the return of a nesting female 13-15 days after laying. Once laying has been accomplished, the eggs are removed and the turtle turned and slaughtered. Eggs are either consumed locally (often rolled in flour and seasoning and deep-fried) or sold to certain hotels on the island at approximately EC\$ 6.00 per dozen (Kenyon Griffin, pers. comm. *in d'Arbeau, 1989*). Traditionally the leatherback has not been captured primarily for meat, but rather for oil. The eggs of all three species are considered a delicacy and also regarded as having aphrodisiac properties. Eggs are collected when a track reveals the presence of a nest, which is usually located by probing. Anslyn (1982) reported to the 1982 CCA Annual Meeting that "turtle eggs, considered a delicacy by some, are still being taken from nests during the closed season."

There are no turtle harvest data for 1989 or 1990 in Nevis. At least three green turtles were killed on Gallows Bay (probably in May 1990), as evidenced by the shells left behind. During the 1 October 1990-31 May 1991 open season, about 75 turtles (30 to 150-200 lb each) were landed in Nevis. These were generally net-caught and kept alive for 2-3 days to "advertise" their availability; when a sufficient number of buyers (residents, hotel owners) had been identified, the turtles were butchered for meat and, in males, the penis. Closed season landings included large green turtles slaughtered at Pinneys Beach on each of three successive Saturdays in July 1990 and a leatherback killed in the Cotton Ground area in June 1991. Net fishing is concentrated in shallow coastal waters, generally in areas of sea grass. One day in early October 1992, 12 nets were set between Oualie Beach and Dogwood Point. Some Newcastle fisher-men also set their nets in waters adjoining nesting beaches on the Southeast Peninsula, St. Kitts. One day in early 1992, six nets were set in Mosquito Bay (R. Pereira, pers. comm.). Turtles at sea have noticeably declined over the last 12 years, according to local divers. A "few" were sure to be seen on every dive until about four years ago; now sightings are irregular at best. Large sea turtles are almost never encountered (Ellis Chaderton, SCUBA Safaris, pers. comm., 1992).

In St. Kitts, Fisheries personnel estimate that fewer than 50 turtles are landed per annum, but there is some evidence to suggest that the number may exceed 100 turtles. There are probably fewer than five active turtle net-fishermen, but there is a rapidly growing number of spearfishermen. Most spearfishermen report taking 1-3 turtles each year. Charles Henry and his four friends spearfish daily from Cayon to Saddlers and estimate they each catch an average of one turtle per month, or about 60 turtles/yr between them. Both hawksbills and green turtles are shot, but mainly hawksbills. Meat sells for EC\$ 3 on the beach and a whole shell for EC\$ 50; total profit is about EC\$ 200 per turtle (C. Henry pers. comm. to Tim Sands, Fisheries Division, 1992). Netting is largely a thing of the past, except on the Southeast Peninsula. Traditional sites included Old Road, Sandy Point, and Dieppe Bay, but few nets have been seen drying in recent years. Most turtles are butchered as soon as they are landed, especially in the turtle villages where demand is still relatively high. In some cases, turtles may be kept 2-3 days while residents wait for hot water to become available. The plastron must be soaked in hot water to remove the horny outer layers before it can be cut into strips and stewed. Eggs are harvested year-around and, according to Fisheries Officers, probably in large numbers. Eggs are not available in public markets, but are consumed by the collector or distributed informally (or sold) amongst friends and neighbours.

The hunting of nesting leatherbacks (river turtles) continues in Keys, Cayon, and Sandy Point Town in St. Kitts. Hunters' fires were a common sight on Conaree/Canada beach during the summer nights of the early 1980's (C. Evelyn, pers. comm., 1992). Today there are fewer hunters and fewer turtles. In addition to Charles Solas in Keys, there are two men in Cayon who regularly seek leatherbacks; an estimated three females are killed each year (C. Solas, pers. comm., 1992). The number of hunters in the vicinity of Sandy Point Town is not known, but an elderly hunter, Mr. Richardson, reported seven leatherbacks killed there in 1992. Meat sells for about EC\$ 2/lb, as compared to EC\$ 4-5 for green turtle or hawksbill meat. In addition to meat, an estimated 20-30 bottles or two kerosene tins of oil are rendered per leatherback. Oil sells for EC\$ 11-12/bottle, compared to EC\$ 5-6/bottle "a few years ago" (C. Solas, pers. comm., 1992). Solas killed one leatherback on Conaree Beach in 1992, but, for the price of EC\$ 60 (a portion of the profit from the meat, sold at EC\$ 1.50/lb in Keys) and 12 bottles of oil, he gave it to a young-

er man to butcher and sell. The number of turtles nesting near the villages of Keys and Cayon in 1992 is not known, but, based on data from residents who informally counted fewer than 10 crawls on the beach, the number of turtles probably did not exceed three (each turtle nests an average of six times per season; see section 2.3).

In the areas of the Cayon River and Hermitage Bay, "no turtle makes it back to the water" (Telca Wallace, pers. comm., 1992). The meat is eaten stewed or salted and dried; oil is taken for congestion, general good health, and reputed aphrodisiac qualities; and eggs are relished. Early one morning in April 1992, two nesting crawls were seen at Cunningham Beach near Cayon. Both nests had been raided and one female had been decapitated the night before. The hunters were present on the beach, awaiting transportation to bring the turtle to the village where the animal would be boiled for oil (Thomas and Diana Honebrink, pers. obs.). The men indicated that they knew April was the season for egg-laying and they had been awaiting the turtle's arrival. They also knew that the season was open and that the activity was legal. The eggs were subsequently sold in Keys. In the next six weeks, the Honebrinks observed an additional 4-7 nests on this beach. Evidence of vehicle traffic on the beach and probing sticks in the vicinity of these nests suggested that hunters had sought (perhaps successfully) to collect the eggs. Eggs sell for EC\$ 6-8 per dozen.

Cuisine: Sea turtle meat has long been included at feasts and dinners. This is clearly indicated in Pares' (1950) comprehensive account of the history of the Pinney family's sugar plantation business in Nevis from 1685 to 1850. He wrote, "When John Pinney arrived in the West Indies at the end of 1764 people lived there very much as they had done in his great-great-uncle's time. [T]he picturesque embellishments of life which charmed ... transient visitors [included] the hedges of pomegranate and cape-jasmine, of lime and logwood [and] the round of feasts, with turtle on the table at every meal and thirty-two different kinds of fruit at dessert; ..." Pares (1950) noted that William Coker, born on Nevis and for a time manager of absentee-owner John Frederick Pinney's plantation, "was long quite unable to get a turtle to send home to John Frederick Pinney because they were all bought up by the resident planters." Much later, a guidebook to Nevis would confirm, "Turtle is made into soup or stewed; best of all is Turtle Parmesan" (Gordon, 1985). Turtle stew is also included in a recent compilation of Caribbean recipes by the St. Kitts Association of Home Economists (SKAHE, 1991).

In response to a letter from the NHCS (Lead Organization for WIDECast in Nevis; see section 4.41), all major restaurants in Nevis, including Golden Rock and Nisbett Plantation, have stopped selling sea turtle meat in deference to the species' endangered status. Similarly, turtle is no longer offered at Miss June's Cuisine because "so many people have asked that I discontinue it" (June Mastier, owner and chef, pers. comm., 1992). Until recently, Mastier had purchased turtle meat at EC\$ 4/lb; buffet meals including turtle started at EC\$ 40. Some owners of sea-side restaurants/bars interviewed during development of this Recovery Action Plan reported purchasing live sea turtles (in one case, two juvenile hawksbills for EC\$ 400) and releasing them; none could remember being offered eggs. A very large green turtle was offered to Ian Mintrim (pers. comm., 1992) early in 1992 for EC\$ 1500. One local eatery, Cla-Cha-Del, was still offering turtle in season at the time of writing (stew or steak: EC\$ 30 a la carte, \$50 full course). There are still a few restaurants in St. Kitts where turtle can be eaten, such as Chef's

where the price of a meal in 1992 was EC\$ 20. Other Kittitian restaurants (e.g., Balla-hoo, Fairview Inn) have discontinued their sea turtle meals.

Incidental catch: Incidental or accidental catch, where sea turtles are drowned in active or abandoned fishing gear deployed for other target species, does not seem to be a serious problem in St. Kitts and Nevis. Nonetheless, drownings and near drownings do occasionally occur. For example, an adult female green turtle (42 inches curved carapace length; 230 lb) was found dead in a net set for sharks in July 1987 at Helden-St. Paul's, St. Kitts (Wilkins and Barrett, 1987). This turtle had been tagged with number #P1803 and a return address of Gainesville, Florida; the tag number was forwarded to Gainesville by Fisheries personnel. In 1990, a large green turtle entangled in a "Japanese net" (heavy green fiber netting) was found struggling just north of Cades Bay, Nevis. The turtle was near death when retrieved and the fishermen butchered it for meat (A. Barrett, pers. comm., 1992). There is no trawling in domestic waters. Longlining is just beginning. The industry uses bottom-set hooks. The incidental catch of sea turtles has not been reported (see also section 4.27).

Tortoiseshell and trade: Meylan (1983) noted that in May 1983, hawksbill shell (tortoiseshell) sold for US\$ 24/kg in St. Kitts. At that time some of the shell was worked locally, but most was exported raw. There were few turtle products for sale as souvenirs, "presumably because of the low level of tourism." Similarly, there was "limited marketing" of tortoiseshell and polished turtle shells in local tourist shops in Nevis at the time of Meylan's (1983) writing. The ban on importation of sea turtle products into the U. S. is said to have "sharply curtailed this trade". The retail situation is similar today; that is, tortoiseshell jewelry is rarely offered for sale. In June 1992, an informal survey of boutiques in Basseterre revealed that selected small items were offered for sale in the Pelican Mall and four bracelets (US\$ 12 ea) and five pairs of earrings (US\$ 12 ea) were on sale at Gold Plus. Also in mid-June, a clerk at Objects of Art indicated that the store usually carries turtle shell but didn't have any in stock at that time. She confirmed that the turtles were locally caught and artisans sold the finished items directly to the shops. The Shoreline Plaza sells tortoiseshell earrings (EC\$ 35/pr). No tortoiseshell could be found for sale in Nevis in 1992.

Above and beyond domestic harvest is the ongoing international commerce in hawksbill shell plates (tortoiseshell, or 'bekko'), a phenomenon widely touted as the single most significant factor endangering hawksbill populations around the world. To meet the demands of at least four separate native industries, Japan has conducted the world's largest international trade in sea turtles and sea turtle products, focusing not only on the hawksbill, but on green turtles and olive ridleys as well (Milliken and Tokunaga, 1987). Japanese imports of raw tortoiseshell between 1970 and 1989 totalled 713,850 kg, representing more than 670,000 turtles; more than half the imports originated from the Caribbean and Latin America (Milliken and Tokunaga, 1987, updated by Greenpeace to 1989). Between 1970-1987, a total of 675,247 kg of stuffed hawksbills representing an additional 587,000-plus turtles was imported (Greenpeace, 1989). Milliken and Tokunaga (1987) note that in order to maintain these levels of importation, the annual slaughter of at least 28,000 hawksbills is required.

Between 1970 and June 1989, Japan imported 368,318 kg of tortoiseshell from the Wider Caribbean alone, the equivalent of more than a quarter million turtles; in 1988, Japan imported

from the Wider Caribbean the tortoiseshell from nearly 12,000 adult hawksbills (Canin, 1989). St. Kitts/Nevis has allegedly participated in this trade in recent years. Japanese import statistics show that 136 kg of tortoiseshell was received from St. Kitts/Nevis in 1990 (Canin, 1991). The average yield per hawkbill is 1.34 kg in the Caribbean (Milliken and Tokunaga, 1987); thus the export that year represented a minimum of 100 turtles. Fisheries Division personnel have no knowledge of any such trade and consider it impossible that these turtles were exported from St. Kitts/Nevis. Since it is highly unlikely that the local population of hawksbills could supply this amount of shell, the most plausible explanation is that St. Kitts/Nevis, a non-party to CITES [Convention on International Trade in Endangered Species of Wild Fauna and Flora], was named as the port of export even though the shell did not actually originate here. This practice is not uncommon among unscrupulous dealers trying to evade CITES restrictions (Canin, 1991).

Over the past decade, a modest level of export of turtle products has taken place between St. Kitts/Nevis and neighbouring islands. Meylan (1983) described an "active market" in Nevis. In 1980, a buyer in Charlestown was purchasing shell from fishermen around the island for US\$ 16/kg and reselling it to a dealer from St. Lucia. The price in 1983 ranged from US\$ 16-24. Other buyers from Puerto Rico, Dominica, and Guadeloupe periodically canvassed the fishermen at their homes for raw shell material. Wilkins and Barrett (1987) also noted the "occasional sale" of shells to buyers from neighbouring islands. Barrett (1988) reported, "Turtles are slaughtered and sold by fishermen themselves to the public, hoteliers, and restaurants on the island. A total of 1000 pounds [of meat was] exported to St. Barthelemew. The hawkbill shells are sold to local craftsmen for EC\$ 30 per pound. . . . Some of the shells were also exported to St. Barthelemew." In October 1991, several sources reported to the NHCS that 1400 lb (636 kg) of turtle meat had been exported to a buyer in St. Barthelemew. It was common knowledge amongst Nevis divers, fishermen, and Fisheries personnel interviewed for this report that turtle meat is routinely sold to neighbouring islands, especially St. Barthelemew, but also St. Martin and perhaps others. Meat sells in Nevis for EC\$ 3-5/lb, but a fishermen reportedly earn about US\$ 5/lb by selling it through a middleman in St. Barthelemew. Turtle meat sometimes leaves the country by air (labeled simply, "meat") and other times by boat.

3.4 Inadequate Regulatory Mechanisms

National fisheries legislation was in force between 1948 and 1992 that protected small sea turtles (under 20 lb, or 9 kg) and established a closed season between 1 June-30 September. For a variety of reasons, this legislation was inadequate to prevent a significant decline in local sea turtle populations. First, the closed season did not encompass peak nesting periods (1 April-30 November) and thus allowed the continued harvest of gravid females. In addition, by protecting only very young (small) turtles, the most valuable members of the population (i.e., the large juveniles and adults) could be legally taken eight months of the year. We now know that population stability depends on high rates of survival for large juvenile and adult turtles that have already endured the two decades or more needed to reach maturity (or near-maturity). Second, enforcement was nonexistent and fishermen often disregarded the regulations (CCA, 1991). d'Arbeau (1989) described the closed season as "generally ineffective" and reported green turtle meat for sale in St. Kitts during the closed season.

In light of the decline of nesting turtles on the beaches of St. Kitts and Nevis (section 3.3) and in recognition that turtles are declining throughout the Wider Caribbean region, it is a recommendation of this Recovery Action Plan that the Government of St. Kitts and Nevis implement the OECS harmonized legislation, which calls for a moratorium on the harvest of sea turtles and their eggs throughout the region. Sea turtles are a shared resource in the Caribbean basin, meaning that all countries must work together to achieve conservation goals. Further discussion of this recommendation, as well as a presentation of options and alternatives, is provided in section 4.23. In addition to inadequate fisheries legislation, there are no protected areas established for the benefit of sea turtles, conservation law enforcement could be greatly improved, and international treaties designed to protect endangered species in the Wider Caribbean, such as CITES and the Cartagena Convention (see section 4.3), have not been ratified.

With regard to regulatory mechanisms in general, the National Conservation and Environment Protection Act (NCEPA) of 1987 is relevant to nesting beach conservation and protected area designation. The Act provides for the establishment and administration of national parks, historic and archaeological sites, and other areas of natural or cultural interest. The Act allows for the establishment of a Conservation Commission to advise the Minister on the selection of protected areas, among other things, and declares that the "Conservation Commission shall promote conservation as part of long term national economic development". A variety of activities are regulated under this legislation, including sand mining and the removal of beach vegetation. Anchoring, polluting, collecting or harassing wildlife, and fishing can be restricted in protected areas. Animals (including wild birds and their eggs) listed in the Third Schedule of the Act are nationally protected; unfortunately, no sea turtles are listed. The Act also provides for the appointment of wildlife or park officers. The Act needs to be fully implemented and all species of sea turtle should be included in the Third Schedule.

The Southeast Peninsula Land Development and Conservation Act of 1986 describes the power and functions of the Southeast Peninsula Land Development and Conservation Board to include maintaining the environmental quality of the Southeast Peninsula. The Board is charged with making recommendations concerning zoning, pollution control, and the development and implementation of an environmental protection plan; carrying out planning studies; and monitoring development schemes. By the power vested in them by the Act, the Board has prepared both a Southeast Peninsula Land Use Management Plan and comprehensive Development Guidelines (Ministry of Development, 1989a,b). These include coast conservation measures. Further, the Act designates the Southeast Peninsula as a "conservation area", wherein a permit from the Minister is needed to willfully kill, wound or take any wild animal or wild bird. The reference to "any wild animal" would logically include any marine turtle nesting on a peninsula beach. Nevertheless, the Act has never been so applied. The Act needs to be fully implemented in all respects, including the protection of depleted species.

The following recommendations were made to Government at the Follow-up Conference to the Country Environmental Profile of St. Kitts and Nevis (SCHS, 1991) and are endorsed by this Recovery Action Plan.

(1) Coastal and Marine Resources Group –

- * Raise public awareness of and concern for the importance of marine life,

- * Ratify all pertinent treaties that would help to protect marine resources,
- * Adopt and enforce the Fisheries Act and revise and implement the Fisheries Regulations,
- * Consolidate planning agencies (Planning Unit, SEP Land Development and Conservation Board, Frigate Bay Development Board) and recruit marine resource experts to serve on a centralized planning board,
- * Further develop policies requiring Environmental Impact Assessments, including a short list of consultants qualified to do EIAs and to initiate a plan of surveillance (monitoring, enforcement) to ensure that development projects adhere to the conditions established by the EIA,
- * Even in the absence of complete data, proceed with management steps to eliminate the overfishing problem and at the same time seek to establish a system of data-gathering in support of management objectives.

(2) Land Use, Planning and Institutional Framework Group –

- * Establish a National Planning Task Force comprised of representatives from the Ministry of Finance, Ministry of Development, Conservation Commission, Legal Department, Chamber of Commerce, SCHS, and NHCS.
- * Establish a permanent (integrated) National Development Control Authority comprised of a policy-making body with enforcement powers which will replace existing Boards and/or Committees. This authority should include the Ministry of Development, Ministry of Finance, Legal Department, Skantel, and the Chamber of Commerce.
- * Review and update existing legislation related to land use and building development, and create new legislation where necessary.
- * Strengthen existing institutions.

Similarly, the Final Report on the Nevis Environment Planning Conference (28-29 January 1992) highlighted three major recommendations on the subject of regulatory mechanisms: (1) a committee of senior level people representing sectors of Nevis with an interest in the environment is needed to provide advice to the Government, (2) a qualified Environmental Officer is needed to oversee the proposed environmental developments in Nevis, and (3) the merging of the Town and Country Planning Board and the Building Board into a new Development Control Authority should proceed "as soon as possible." In the area of Coastal and Marine Resources, the Meeting discussed inadequate regulatory mechanisms and/or enforcement in the areas of coastal zone management and construction, and suggested that the Protected Area provisions of NCEPA be fully engaged toward the successful conservation of specific critical habitats (Nevis Island Administration and NHCS, 1992).

Finally, the enforcement of regulations would be greatly enhanced by the creation and staffing of a Division of Conservation Enforcement. This might be accomplished by making minor institutional adjustments to the existing Division of Conservation (Department of Agriculture). Alternatively, if the oft-repeated proposal to create a Department or Ministry of the Environment for the purpose of consolidating the environmental programmes and obligations of the Government were to be realised, then this Department (or Ministry) should logically have a

Division of Conservation Enforcement to enforce all aspects of environmental law, including the conservation and management of species (see section 4.24).

3.5 Other Natural or Man-made Factors

It is not uncommon for beaches to experience severe erosion after tropical storms, such as occurred at Pinneys Beach (Nevis) and Sandy Point Beach (St. Kitts) after Hurricane Klaus in 1984 (Wilkins and Barrett, 1987). Towle et al. (1986) document severe coastal erosion of Southeast Peninsula beaches, particularly the channel beaches, during Hurricanes Frederick and David in 1979 and Klaus in 1984. Residents often credit Hurricane Klaus with the loss of several nesting beaches on the Caribbean coast of St. Kitts, from Old Road Bay to Garvey's Bay. These are comprised of cobbles today and no longer support nesting. Cambers (1989a) reported significant damage done to potentially important nesting beaches by Hurricane Hugo. At Pinneys Beach, she documented 4-8 m erosion in the southern portion (and the loss of many palm trees) and >15 m erosion to the north near Golden Rock Beach Bar which was destroyed in the storm. Huge amounts of debris were left on nesting beaches at Cade's Bay and Mosquito Bay. Overall, Hurricane Hugo resulted in the average loss of 45% of the area of west coast beaches on Nevis (Cambers, 1989b).

Cambers (1989b) stated that the "serious nature of the erosion on the west and north coast beaches cannot be over-emphasised. Data exist for one site at Pinneys Beach which show that between 1983 and 1989 the high water mark retreated inland some 19 m, this represents an erosion rate of some 3 m (10 ft) per year." In a follow-up study, she reported that the average beach width in St. Kitts declined 2.5 m (8 ft) per year between August 1989 and December 1992, mostly as a result of the loss of the Dieppe Spit to Hurricane Hugo. Had the spit remained intact, however, the annual loss would still have averaged 0.8 m (2.6 ft). Even this lower rate represents a dramatic loss compared to other rates throughout the region (Cambers, 1992). d'Arbeau (1989) reported severe erosion at Major's Bay, a significant hawksbill nesting site on the Southeast Peninsula, which "created a formidable barrier to any turtle attempting to reach land" on the northern end of the sandy beach in mid-1989. She also noted the accumulation of garbage, especially on the windward (Atlantic) beaches of the peninsula, beach scarring by vehicle traffic, and the removal of vegetation which may limit nesting sites for hawksbills.

Vehicles driven on beaches is a problem, notably at Sand Bank Bay, St. Kitts. Signs requesting that vehicles not operate on the beach have not been effective. Specific public education is required in this regard. Riding horses on some beaches, such as Newcastle and Pinneys, may also have a negative effect on sea turtle nests by crushing eggs and hatchlings. Evening campfires, especially common at Banana and Cockleshell bays, may inhibit nesting. On both islands, small beach fires (such as smoke fires to repel insects) are occasionally seen. There is no evidence that these negatively impact sea turtles, but beach fires should be monitored to prevent large blazes that may destroy incubating eggs or disorient adult or hatchling turtles. An unquantified number of hatchlings are collected as pets for children each year (see Appendix I). This poses a direct threat to the survival of sea turtle populations.

Tar balls are very common on the Atlantic beaches of St. Kitts and less so on the channel beaches. Deforestation at Paradise in 1991 caused considerable erosion and siltation of the near-

shore marine zone (J. Robinson, pers. comm., 1992). Personal watercraft ("jet skis") are a relatively new phenomena and are in use at South Friar's Bay. Jet skis have the potential to kill sea turtles on impact; injury and mortality from this source should be monitored. Windsurfers sometimes strike turtles at sea (Monty Bassett, pers. comm., 1992). Boat strikes are also a potential problem.

IV. SOLUTIONS TO STRESSES ON SEA TURTLES IN ST. KITTS & NEVIS

4.1 Manage and Protect Habitat

It is intuitive that in order to conserve the marine resources of St. Kitts/Nevis, especially depleted species such as sea turtles, the habitats upon which these species depend must be protected. This can be accomplished in a variety of ways, including setting aside areas as National Parks or Wildlife Reserves. Where protected area status is not feasible, regulatory guidelines must be enforced to restrict potentially harmful activities. In the marine environment, harmful activities can be defined to include indiscriminate anchoring, chemical pollution, and other degradation 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 which areas are truly important (section 4.11). Once this has been accomplished, 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. Coral, sea grass and beaches, all ecosystems crucially important to sea turtles, are also essential for the long-term sustainability of the economy of St. Kitts/Nevis, including commercial and recreational fisheries, coastal development, and tourism.

In the sections that follow, the identification of habitat important to turtles is discussed, as are recommendations and mechanisms for the long term preservation of these habitats. Recommendations are underlined for ease of reference.

4.11 Identify essential habitat

With respect to sea turtles in St. Kitts/Nevis, two broad types of marine habitat are considered essential: sea grass and coral reefs. Green turtles depend almost exclusively on sea grasses for food (section 2.2) and loggerheads consume a wide variety of invertebrates (section 2.1), many of whom depend on sea grass for some part of their life cycle. Protection of sea grass is, therefore, vital for the survival and recovery of sea turtles. The great value of healthy sea grass beds should not be defined solely in terms of sea turtles, however. 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.

Meadows of broad leaved "turtle grass" (*Thalassia testudinum*) and more slender "manatee grass" (*Syringodium filiforme*) are particularly vital as a nursery areas for commercially important fishes and invertebrates (queen conch, spiny lobster) who depend on grassbed habitat for continued survival. Sea grasses, with their extensive root system, prevent the suspension of sediments, thus stabilising sand and other sediments. The leafy canopy slows water movement and filters the water column. Once the sea grass cover is removed, the many ecological contributions of the grasses are lost, turbidity increases, and it becomes nearly impossible for new grass to recolonize the area (Wilcox, 1989). Sea grass can be damaged or eliminated by many factors, most notably pollution, sedimentation, and anchoring. Sedimentation (smothering grasses with silt and dirt) commonly results from dredging or land-based run-off, the latter often associated with upland deforestation or other clearing of vegetation. The most important sea grass communities are situated around the Southeast Peninsula and Sandy Point area of St. Kitts, and off the north and west coasts of Nevis. Requests to physically uproot large areas of sea grasses (e.g., Casablanca Hotel recently asked permission to clear the sea grass in Cockleshell Bay to a depth of 1.5 m for aesthetic reasons) should be rejected.

Coral reef communities are also important. 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 (section 2.4), and for loggerhead turtles (section 2.1). Wilcox (1989), in her study of the marine resources of the Southeast Peninsula of St. Kitts, noted that in order to grow and flourish, coral reefs need clear, clean water and relatively high wave energy. In return, a healthy reef system, especially the barrier type of reef, continually acts to reduce incoming wave energy and provides a source of beach sand. Coral reefs are also critical habitat for the majority of bottom-dwelling or demersal fish living in nearshore areas of the Caribbean. As such, reefs are vital not only for sea turtles in St. Kitts/Nevis, but also for a wide variety of commercially important fishes. More than 300 fish species are found on Eastern Caribbean coral reefs, and approximately 180 of these are used for human consumption (Goodwin et al., 1986). The most important living coral communities in St. Kitts are found around the Southeast Peninsula and all along the Atlantic coast (Figure 4). There are well developed but smaller coral reefs offshore Sandy Point Town and Old Road Town. In Nevis, the most extensive reefs are found off the northern and southwestern coastlines (Figure 6).

In addition to essential marine habitat, many of the sandy beaches in St. Kitts/Nevis are used by sea turtles for nesting (section 4.112). The protection of sandy beaches is an important component of any effort to conserve and perpetuate populations of sea turtle that breed in St. Kitts and Nevis. Sea turtles return to the area where they were hatched when the time comes to lay their own eggs. Shoreline development, coastal armouring, sand mining, and general activity at or proximal to a nesting beach can reduce or eliminate the capacity of the beach to support sea turtle nesting and the successful incubation of eggs. Sound management of the beach resource is imperative. Orme (1989) provides guidelines for planning and development of the nine major beaches of the Southeast Peninsula, as well as within the coastal environment of the peninsula in general. The Southeast Peninsula Land Development and Conservation Board later developed detailed guidelines for development of the peninsula, as well as a strategy for managing land use (Ministry of Development, 1989a,b). Many of these guidelines and recommendations are cited elsewhere in this Recovery Action Plan (e.g., sections 4.122, 4.13).

4.111 Survey foraging areas

"Turtles are seen almost everywhere by divers and seine fishermen" (Wilkins and Barrett, 1987), but surveys designed to define specific foraging grounds (=feeding areas) have not been undertaken. Based on opportunistic sightings and other informal reports, the sites most visited by turtles include in St. Kitts: Dieppe Bay to Sandy Point, Old Road to Basseterre, the entire Southeast Peninsula (foraging grounds adjoining nesting beaches seem to be the most popular), and Conaree north to Cayon; in Nevis: Black Bay, Indian Castle, and Charlestown to Newcastle. During beach surveys conducted in preparation for Second Western Atlantic Turtle Symposium (WATS II), juvenile green and hawksbill turtles were observed in foraging areas off Sandy Point, St. Kitts (Wilkins and Barrett, 1987). The fishermen who operate around the reefs and shoals of the Landing Bay (Nevis) area "always see a number of small turtles, estimated weight 10-15 lbs" (Wilkins and Barrett, 1987). Green turtles have been frequently sighted feeding along the southern coast of Nevis and hawksbills are reported in west coast waters adjacent Cades Bay (Young et al., 1988 *in* CCA, 1991).

The channel between the two islands (referred to as The Narrows) is good habitat for turtles and the adjoining sea grass meadows and coral reefs surrounding the Southeast Peninsula provide some of the most important feeding habitat for green turtles and hawksbills in the country (Meylan, 1983; Wilkins and Barrett, 1998; Wilcox, 1989; Campbell Evelyn, pers. comm., 1989). Available data suggest that the south (Caribbean) coast of the Peninsula is most important for foraging; however, it is quite possible that coral reefs along the Atlantic coast also serve as important feeding and refuge habitats, especially for the hawksbill turtle. The most important feeding areas for green turtles in Peninsula waters appear to be Major's Bay and the Caribbean shore between Nag's Head and Whitehouse Bay (Eckert, 1989). Leatherback turtles may feed on jellyfish and related animals in deep offshore waters while in the Caribbean (Eckert et al., 1989), but no information about potential feeding areas around St. Kitts/Nevis is available.

It is a recommendation of this Recovery Action Plan that field surveys be designed and implemented to define the extent to which sea grass and coral reef communities are utilised as foraging grounds by resident and itinerant populations of sea turtles. With these data, relatively important foraging grounds can be identified and specific conservation measures developed. In the absence of such survey data, foraging grounds must be considered coincident with sea grass and coral reef communities, implying that protective measures (see section 4.122) should be developed to apply to all zones of healthy of sea grass and coral. Protecting sea grass and coral in general has the added benefit of safeguarding the nation's fisheries and tourism industries.

4.112 Survey nesting habitat

As part of a survey of marine turtles in the Leeward Islands, Meylan (1983) reported that "the best nesting habitat for turtles [in St. Kitts] is on the Atlantic coast, where an extensive beach stretches more or less continuously from the Cayon River to North Frigate Bay. There are also several small beaches around the tip of the southeastern peninsula." In a report prepared for WATS I, Wilkins and Meylan (1984) noted that Sandy Point, Conaree, Majors Bay, Cockleshell Bay, Sand Bank Bay, and North Friar's Bay were the "main nesting beaches in St. Kitts." They also indicated green turtle and/or hawksbill nesting at Newton Ground, Dieppe Bay, Sandy Bay,

Mosquito Bay, Garvey's, Challengers, and Ballast Bay. There are relatively few suitable beaches in Nevis: these are Pinneys on the west coast, a few small beaches on the south coast (Indian Castle Estate, White Bay, Landing Bay), and Cades Bay, Hurricane Hill, and Newcastle Bay on the north and northwest coasts. The hawksbill appears to be the most common nester on Nevis. Declines in the nesting population have been observed; for example, there is virtually no nesting at Pinneys Beach anymore (A. Barrett, pers. comm., 1991). Periodic nesting surveys were conducted on Nevis under the direction of Assistant Fisheries Officer Audra Barrett in 1987 and 1988.

Two beaches reported to be used by sea turtles in St. Kitts were selected for surveys in preparation for WATS II, Sandy Point on the Caribbean shore and Conaree (Key Ghaut to Jack Tar Village) on the Atlantic shore. Two observers were hired to monitor these beaches between 3 May and 30 September 1987. There was no nesting at Sandy Point; however, at least 18 nests (including at least 14 leatherback and one hawksbill) nested at Conaree between late April and mid-August. Selected beaches were also monitored on Nevis in preparation for WATS II, but only two leatherback crawls were reported and neither resulted in egg-laying (Wilkins and Barrett, 1987). The same study reported that Landing Bay on the south coast is the major nesting site on Nevis. It is "well isolated" and can only be reached by foot or boat, depending on the weather. According to Wilkins and Barrett (1987), the beaches "most used" at the present time by turtles are those of the Southeast Peninsula of St. Kitts. Wilcox (1989) surveyed the coastal marine habitats of the Southeast Peninsula and reported nine "main beaches" located at the heads of the bays, and smaller unnamed beaches interspersed along the shoreline. Until recently access to these beaches was mostly by boat, but a paved road extending to the tip of the peninsula now provides access to most of the shoreline.

In anticipation of large-scale coastal development on the peninsula following a paved access road completed in 1989, two studies were published which assessed the potential impact of such development on turtles. Both studies (d'Arbeau, 1989; Eckert, 1989) included recommendations for reducing expected negative consequences of commercial development. These recommendations are discussed elsewhere, mainly in section 4.122. d'Arbeau's five-week (June-July 1989) survey of 11 of 13 sandy beaches on the peninsula to record turtle nesting activity made some attempt to distinguish species by crawl characteristics. Leatherbacks leave a deep, symmetrical imprint 1.75+ m wide; green turtles a deep, symmetrical crawl 1 m wide; hawksbills a shallow, asymmetrical imprint <0.8 m wide and typically nest near or within vegetation. The results of the study are summarized in Table 1. A useful physical description of each beach was also provided by d'Arbeau. She pointed out that identifying crawls was often difficult (especially as tracks aged) due to livestock tracks on the beach, human activity and vehicle traffic, dense accumulations of sea grass, and the steady movement of sand caused by the wind.

In 1992, the SCHS solicited assistance from local residents to survey six known nesting beaches on the SEP (late June-early August) as part of a Biodiversity Project funded by the Island Resources Foundation and the World Wildlife Fund. Rick Caldwell surveyed Banana Bay (29 June-23 July, no nests); Ricky Pereira, Mosquito Bay (29 June-21 July, no nests); Herman Uddenberg, Major's Bay (29 June-8 August, no nests); and Kate Orchard, North and South Friar's bays (29 June-12 August). Neither nests nor hatchlings were observed at South Friar's Bay, although leatherback hatchlings and dried yolkless eggs were found at North Friar's on 6

July (K. Orchard, pers. obs.). Sand Bank Bay was patrolled by several volunteers at 1-8 day intervals between 6 June and 12 August; six leatherback nests were documented. Pereira also reported a leatherback nest on Sand Bank Bay in May.

The results of the 1992 survey stand in stark contrast to d'Arbeau's work (Table 1). Because only a fraction of the adult females in a population of sea turtles nests during any given year, the number of females (and thus the number of nests) per beach fluctuate from year to year. This is particularly true in small populations. Nevertheless, it is not reasonable to have 130 nests recorded between 26 June and 31 July 1989 at South Friar's Bay (d'Arbeau, 1989) and not a single nest observed between 29 June and 8 August 1992 (K. Orchard, pers. obs.). The discrepancies underscore the need for comprehensive surveys designed to quantify the level of nesting on the nation's beaches. In the interim, it should be assumed, based on published studies, that Major's Bay and North Friar's Bay beaches on the SEP are among the most significant nesting sites on St. Kitts, with Turtle/unnamed bay, Canoe, Sand Bank, and Mosquito bays also relatively important and, on the Atlantic coast, Conaree Beach and Sandy Point. On Nevis, the important areas are Cades Bay, Hurricane Hill, Newcastle, White Bay and Landing Bay.

In summary, with the exception of a few short-term and localised field surveys (Wilkins and Barrett, 1987; d'Arbeau, 1989; SCHS, unpubl. data), nesting data are fragmentary and largely anecdotal. Systematic nesting surveys are urgently needed. It is a recommendation of this Recovery Action Plan that at least twice-weekly surveys (April-November) of potential nesting habitat be undertaken. A Lead Organization on each island (perhaps SCHS and NHCS, in cooperation with the Fisheries Division) should orchestrate the effort. The data should be centrally compiled. Interested volunteers, preferably residents who live near sandy beaches, should be assigned a beach to walk early in the morning on a specific schedule (ideally daily, since wind, human, and animal activity will erase the crawls). A log should be kept of observed crawls. Counted crawls should be gently swept clear both to preclude their being counted twice and to lessen the probability that poachers will find the eggs. After a period of two years, the beaches with the most nesting (at least two beaches on each island) should be monitored thereafter (1 April-30 November, later if possible) as Index Beaches (see section 4.291). Field workers should receive preparatory instruction prior to their survey efforts (section 4.55).

The aerial surveying of nesting beaches would be comparatively expensive (US\$ 200/day), but also very useful. Aerial surveys are especially suitable for monitoring leatherback nesting because the tracks remain visible on the beach for several days. Money for three years of biweekly aerial surveying during peak leatherback nesting season (April-June) has been budgeted as part of the national Sea Turtle Conservation Project described in section 4.6. Every advantage should be taken of aerial surveys conducted for other purposes that may include opportunities to record sea turtle nesting activity. Assistance may be obtained from the U. S. Navy during stop-overs in St. Kitts, at which time the pilots apparently offer assistance to local agencies with aerial photography and other requests.

4.12 Develop area-specific management plans

Area-specific management plans are necessary in order to safeguard important sea turtle foraging and nesting areas. At the present time there are no specific management plans for im-

portant sea turtle habitat in either St. Kitts or Nevis. Therefore, it is a recommendation of this Recovery Action Plan that "Sea Turtle Refuges" (reserves established specifically for sea turtles) be declared under the authority of the NCEPA and that at least one Refuge be declared on each island. The Refuges should encompass the most important sea turtle nesting areas and serve as a focal point for conservation, management, and monitoring of sea turtle populations [N.B. the Refuges should include Index Beaches described in section 4.291]. The Atlantic beach from Cayon River to Key Ghaut (and perhaps south to Jack Tar Village), Sandy Point/Belle Tete (which supports three species of nesting sea turtles), and the SEP (which is already a "conservation area" under the SEPLDCA; see section 4.21) in St. Kitts are good candidates for such designation, although it would be wise to undertake an island-wide survey, as recommended in section 4.112, in order to identify with confidence which areas are most used by turtles and thus would benefit most from protection. In Nevis, Hurricane Hill Beach, privately owned, should be seriously considered for Refuge status.

Refuge status would not exclude residents from using the beach for recreation, fishing, etc. Only activities clearly detrimental to the beach and to the turtles and villagers who depend on it would be prohibited, such as sand mining, garbage disposal, and careless shoreline development. The harvest and harassment of sea turtles and their eggs would be illegal under all circumstances on the protected beaches. Since the support and involvement of residents would be central to the success of a Refuge, we recommend that local non-government groups (SCHS, NHCS, Jaycees, fishing cooperatives) and/or government agencies initiate a dialogue with coastal residents living near a proposed Refuge in order to solicit their input and encourage their support. In addition, it is clear that mere designation of a Sea Turtle Refuge would be hollow without the thoughtful development of a comprehensive management plan. Management Plans (reviewed every five years) are required for all protected areas designated under the NCEPA. Regulatory guidelines developed for the Refuges should include (but need not be limited to) the regulations described in section 4.122. Wardens should be hired to monitor compliance with Refuge regulations, reporting violations to the proper authorities.

The first steps toward comprehensive management plans for some important marine areas, including the northern coast of Nevis (Newcastle Bay to Long Haul Bay) and the Southeast Peninsula of St. Kitts, have already been taken. In an in-depth assessment of the marine resources of the Southeast Peninsula of St. Kitts, prepared for the Southeast Peninsula Land Development and Conservation Board, Wilcox (1989) recommended "a St. Kitts/Nevis National Marine Park/Reserve around the entire Peninsula, from high tide to the 30 m depth contour, to provide a focal point for marine management, provide an administrative means to attract and receive external funding, and establish an overall conservation and development approach to the Peninsula at large." She provided guidelines and rules for land developers, fishermen, and tourists. She also suggested that specific protected areas be established within the reserve, including protection of the Atlantic coast for sea turtle nesting. Low density use of the Atlantic beaches and dunes was encouraged, as were use regulations to protect sea turtles and their eggs and nesting beaches. The proposed Marine Parks and Recreation Plan for the Southeast Peninsula of St. Kitts should be adopted and the entire coastline of the peninsula should be established as a marine park. The support of the Southeast Peninsula Land Development and Conservation Board should be obtained, the proposal passed by Cabinet, and, with the Board's endorsement, a comprehensive park management plan implemented.

Similarly, the groundwork has been laid for a Marine Research and Recreation Area in Nevis. As part of a four-month survey of the marine habitats of Nevis, conducted in 1990 under the aegis of the NHCS, depth and substrate type were recorded every 10 m along transects perpendicular to the shore line and extending 50-200 m offshore. Baseline data were collected in this way for Pinneys Beach, Cades Bay, Hurricane Beach, Newcastle Beach, and Almond Gardens in Long Haul Bay. The short-term objectives of the Nevis marine survey were to (1) map fringing reefs, sea grass, sand deposits, and marine life communities, (2) assess the general health of the marine ecosystem of Nevis, and (3) identify potential marine reserve sites. The reserves would be established primarily for species conservation and replenishment, as opposed to for-profit tourism (D. Robinson, pers. comm., 1992). The long-term objectives were to (1) provide data to aid in formulating coastal management and fisheries management strategies and monitoring schemes and (2) enable the NHCS to make recommendations for comprehensive coastal zone management policies. With increasing boat traffic, the data will be particularly useful in identifying anchorages that will not damage coral or sea grass ecosystems. The reserve will include both inshore and offshore waters and the protection of sea turtles and their habitats will be a priority. The Final Report (Robinson, 1991) suggests that a comprehensive "Handbook for Development", such as was produced for the Southeast Peninsula Land Development and Conservation Board, be developed for use in Nevis.

It is a recommendation of this Recovery Action Plan that marine parks and/or reserves be established in both St. Kitts and Nevis to safeguard healthy marine ecosystems, provide the necessary living requirements for depleted species, such as sea turtles and some species of commercial fish, and to promote tourism.

4.121 Involve local coastal zone authorities

In order for management planning to be effective, the support of local coastal zone authorities will be needed. At the present time, three separate entities are responsible for development planning (including coastal zone development) in St. Kitts. The Southeast Peninsula Land Development and Conservation Board is responsible for the area south of Timothy Hill, Frigate Bay Development Corporation is responsible for the area north of Timothy Hill to the Conaree Hills area, and the Planning Unit of the Ministry of Agriculture, Lands, Housing and Development is responsible for greater St. Kitts, although there is some confusion over the authority of land belonging to the former sugar estates and St. Kitts Sugar Manufacturing Corporation. These various planning agencies are responsible for sustaining the environmental quality of St. Kitts and overseeing development of the island. In Nevis, the Planning Unit is responsible for development strategies, both economic and physical planning.

In addition, the National Conservation and Environment Protection Act (1987) gives the Minister of Development, in consultation with the Conservation Commission, authority to (a) prepare and implement coastal zone management plans to regulate development and activity in a coastal zone and to make necessary Regulations, (b) formulate and execute "schemes of work" for coast conservation within the coastal zone, and (c) conduct research and undertake environmental impact assessments for any development activity in collaboration with other departments, agencies, and institutions for the purpose of coast conservation. The Minister may delegate certain responsibilities to others, including NHCS, SCHS or the Brimstone Hill Fortress

National Park Society. The Conservation Commission acts as an advisory commission to the Minister with functions of managing and controlling activities concerning beaches, national parks and protected areas. Management plans are to be prepared for all protected areas by the Conservation Commission.

It is a recommendation of this Recovery Action Plan that all relevant coastal zone authorities -- Ministers, development and advisory boards, the Conservation Commission -- work together with residents and non-government groups in full support of declaring and administering protected areas for the benefit of endangered sea turtles. The legislation to declare protected areas exists in the NCEPA, it has only to be fully realised and implemented. In addition to the federal legislation, the Nevis Island Administration may be able to declare protected areas under the auspices of Nevis planning legislation; this option should be explored.

4.122 Develop regulatory guidelines

In order for management planning to be effective, a regulatory framework is needed. The Southeast Peninsula Land Development and Conservation Board has already developed detailed guidelines for development of the peninsula, as well as a strategy for managing land use (Ministry of Development, 1989a,b). Copies of these guidelines are provided to prospective developers and established protocols must be incorporated into all development and construction plans. Many of the guidelines, such as for construction setbacks, solid waste disposal and landscaping, are identical to those generally proposed to safeguard sea turtle nesting areas. It is a recommendation of this Recovery Action Plan that equivalent guidelines be adopted for all development in St. Kitts and Nevis; further, that the guidelines be adhered to by developers and that the Board not waver or deviate from what has been established.

Regulations most important to the conservation of turtles fall into two categories: those pertaining to sandy beaches (egg-laying) and those pertaining to coral reefs and sea grass (food and shelter). Guidelines currently under development for the Newcastle Marine Reserve in Nevis are a useful model for marine protected areas. In a Beach Management Plan submitted to the SEP Land Development and Conservation Board, Orme (1989) made several recommendations "to preserve the valuable beach resources of the Southeast Peninsula and to manage these so as to minimize the negative impacts of development." Eckert (1989) made similar recommendations to the Board in a Sea Turtle Management Plan designed to conserve the peninsula's sea turtles in view of impending development. The following points are based on Orme (1989) and Eckert (1989). Topics are discussed in further depth in the section(s) noted in parentheses.

1) *Sand mining*: No mining of beach sand should be permitted under any circumstances (section 4.131). Beach sand is a finite resource that reportedly is not being replenished at the present time at a rate commensurate with past deposition; thus, beach mining implies beach loss. In addition, the persistent removal of beach sand disrupts stabilising vegetation and exacerbates erosion. The resulting pits not only invite injury to both humans and livestock, but they accumulate water and serve as breeding areas for mosquitoes and other unwanted insects. Orme (1989) also recommends that no mining of sand be permitted in the offshore or nearshore zones as this material is important to beach maintenance. Orme (1989) and Cambers (1988) both indicate ghauts (ravines) and interior sites where mining would be acceptable.

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. 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. There are already cases of beaches lost, rather than secured, as a result of armouring in St. Kitts and Nevis (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. With regard to the possible development of a marina on the Southeast Peninsula or elsewhere, Orme (1989) notes that it can be engineered "without recourse to entrance jetties that significantly impact littoral drift and beach stability."

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 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.

5) *Access*: The use of motorized 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 minimize destruction of the beach, including backshore vegetation, by trampling. Whenever possible, access should be provided by the construction of simple, elevated wooden walkways built over the primary dunes and positioned to direct foot traffic.

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 residents and landowners, especially hoteliers. The waste is insulting aesthetically, both while on the beach and after washing into the sea. Sunbathing, beach walking, and snorkeling should not have to be done amid discarded household and construction waste. Further, glass and metal injure turtles and larger objects on the beach can prevent females from finding a nest site. Visitors should be required to pick up and 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 vegetation, such as beach bean or seaside bean (Canavalia maritima), seaside purselane (Sesuvium portulacastrum), and beach morning glory or goat's foot (Ipomoea pescaprae), stabilises the beach and offers protection against destructive erosion by wind and waves. Larger supralittoral vegetation, such as West Indian sea lavender (Mallotonia gnaphalodes), sea grape (Coccoloba uvifera), manchineel (Hippomane mancinella), and acacia (Acacia sp.), provides nesting habitat for the hawksbill sea 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. One environmental cost of accommodating increasing boat traffic in St. Kitts/Nevis is the dumping not only of garbage at sea, but of raw sewage. The latter practice adds nutrients to the water which results in eutrophication and algae overgrowth in shallow coastal areas. One way to encourage boats to install and use holding tanks is to admit

only yachts and sailboats with proper holding tanks to offshore moorings and/ or planned marinas. 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 Eastern 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 coral and sea grass (>30 m depth). In the absence of secure moorings, the demolition of coral reefs and the uprooting of sea grasses by anchors will be quick and can be permanent (Williams, 1987; Rogers, 1985; Rogers et al., 1988). At this time, there are few cost-effective systems for mooring larger vessels such as cruise ships. It is recommended that cruise ships (>200 feet in length) be restricted to the Deep Water Port. Halas (1985) has designed an inexpensive mooring system (US\$ 100-200/mooring) which is adequate for holding yachts and live-aboard dive boats <100 feet in length. A demonstration of this technology is available upon request to John Halas, Key Largo National Marine Sanctuary, P. O. Box 1083, Key Largo, Florida 33037; Tel: (305) 451-1644. See also section 4.147.

St. Kitts does not have a significant history of dredging, but dredging is expected to increase at the Southeast Peninsula in the near future. Dredging may be required for marina development and for opening channels to load and unload construction equipment by sea. It is also likely to be requested for the purpose of removing sea grass beds for aesthetic reasons. It is imperative that these activities be intensely monitored and permitted only after all other alternatives are found to be inadequate. Special attention needs to be given to controlling sedimentation of adjoining marine communities. Severe disruption of the seabed, 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*: 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). In the absence of the sheltering influence of offshore reefs, shorelines are often severely altered, resulting in great economic and environmental losses. The practices of using chemicals or dynamite (sections 4.141, 4.142) for the purpose of stunning fish for harvest are prohibited at all times and under all circumstances and should remain so. The destruction of coral reefs resulting from these practices can be irreversible in our lifetime.

4.123 Provide for enforcement of guidelines

Institutional and governmental support for enforcement cannot be over-emphasised. In order to effect compliance with rules and regulations concerning the protection of habitat, law enforcement will be necessary. It is a recommendation of this Recovery Action Plan that a team of Conservation Officers, Wardens, or other law enforcement personnel be responsible for monitoring compliance in protected areas. 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, in-

cluding a night survey with all the beach-front lights turned on. The purpose of this inspection would be to verify that beach illumination is minimized and is in accordance with regulations designed to protect nesting, and especially hatching, sea turtles. With regard to enhancing environmental enforcement in general, including protected species, pollution, and game and mining laws, the creation of a Division of Environmental Enforcement is suggested (section 4.24).

4.124 Develop educational materials

In order for area management planning to be effective, residents and visitors (and, when appropriate, developers and concessionaires) must be aware of regulations in place to safeguard the environment. Materials readily available to the public should include clear descriptions of what types of activities are permitted and what types of activities are not permitted in the management area. Permanent wooden sign boards at beach entrances are one way to educate users. For example, a sign board may explain that beach fires and littering are not permitted, pets must be leashed, and vehicles must be parked in designated areas. If the nesting beach area is closed to the public at night, this should be clearly indicated. Finally, a phone number to report violations should be provided. Other options include the distribution of informative pamphlets and repeated information provided by the media. The non-government conservation community, including the NHCS and the SCHS, can be very helpful in promoting a grassroots understanding and appreciation of protected areas.

4.13 Prevent or mitigate degradation of nesting beaches

4.131 Sand mining

On the beach, natural sand deposits are important for recreation by residents and tourists and serve as a barrier against storm waves, thus protecting coastal residences and commercial investment. Removed from the beach, sand is a vital component of the construction industry as a raw material for cement. Unfortunately, the chronic removal of sand for construction or other purposes often accelerates beach erosion and degrades or destroys coastal vegetation by uprooting it or flooding the ground with seawater. In severe cases, saline ponds are formed in unsightly pits left by mining operations, shoreline trees and other stabilising vegetation are lost to the sea, and entire beach habitats are eliminated. With their loss, the coast's potential to support recreation, tourism, commercial development, and wildlife such as sea turtles is reduced. For this reason, sand mining is prohibited by the National Conservation and Environment Protection Act of 1987, except by permit from the Government.

There are several sites for beach sand mining in St. Kitts and Nevis (Figures 6 and 7). In some areas the mining poses a serious threat to important sea turtle nesting habitat. For example, there was once nesting at Indian Castle, Nevis, but with the loss of the beach the nesting has ceased (A. Barrett, pers. comm., 1991). About 5000 cubic yards of sand has been extracted from Indian Castle and the source is "exhausted" (Kirkpatrick Consulting Engineers, 1992). Cambers (1989a) documented extensive mining at Cades Bay north of Mariner's and less activity at Hurricane Hill beach and Newcastle Jetty beach. Large-scale mining is ongoing at Cades Bay and Gallows Bay (Robinson, 1991). In St. Kitts, mining occurs at Sandy Point, Belle Tete Point, Conaree, Wash/Holland Ghaut, and the southeast end of North Frigate Bay. These represent

some of the largest beaches on the island and provide nesting grounds for three species of endangered sea turtles, primarily leatherbacks. The sand is removed by tractor and the operations involve large, heavy trucks. Despite the fact that in most cases the mining activity has remained confined to relatively small areas of the total beach habitat, compaction of turtle nests by traffic to and from the mining site is also a potential problem.

According to the Country Environmental Profile for St. Kitts and Nevis (CCA, 1991), the supply of construction sand has been a "nagging problem for a long time". To meet the demand, sand is routinely removed in large quantities from beaches and ghauts (ravines). However, the "linkage between continuous sand removal from both the ghauts and the beach-dune systems and a continuing and worsening problem of erosion in both locations has not escaped the attention of both policy makers and environmental scientists". In some cases, such as the area south of Belle Tete, data indicate that sand removal has resulted in shoreline losses to erosion of as much as 20 m between 1968-1983 (CCA, 1991). A recent report (Cambers, 1988) examined the problem of shoreline erosion and recommended that sand mining be restricted to a few designated ghaut sites (Figure 7), and that site supervision and a fee of EC\$ 20 per load be implemented. The problem is especially severe in Nevis. Cambers (1989b) concluded, "it is essential that alternative sources of fine aggregate be sought in order to conserve the remaining beaches in Nevis."

In 1989, a Cabinet-appointed Committee on Sand Mining and Construction Waste (Chaired by the Director of Planning) was established to examine serious concerns which had been raised about beach and ghaut sand mining and solid waste disposal. Part of the Committee's mandate was to make recommendations for sand mining through implementation of a permit system with fee schedules and monitoring procedures (CCA, 1991). In addition to regulating where and how much beach sand can be taken, alternatives to beach mining are available and include inland deposits (e.g., the quarry in the St. James Windward area of Nevis), offshore mining, and importing sand from neighbouring islands such as Barbuda. A complete study of all options, including offshore mining, was recently completed by a team of specialists from the UK (Kirkpatrick Consulting Engineers, 1992).

The NHCS and the Nevis Environmental Education Committee have been very active in educating the public about the long-term implications of beach sand mining. The issue has been highlighted in the Society's newsletters and members have written to government officials urging them to legislate stiffer laws and penalties for the removal of beach sand. The Society published a brief report in 1989 entitled, "Sand Removal on Nevis Reaches Critical Stage". According to this report, "business and private home construction, as well as sand for fill, is escalating at a rate that is doubling sand use every year." This is a recipe for disaster, especially for coastal vacation developments which depend on sandy beaches to attract and entertain tourists. To the extent that sand must be removed from beaches, the report recommends that sand (1) not be free for the taking, (2) be wisely used and conserved and not left in large waste piles after construction is complete, and (3) be considered a national valuable resource and guarded as one would protect gold or silver ore.

It is a recommendation of this Recovery Action Plan that specific sites, preferably inland deposits, be designated for sand mining, extraction fees be implemented, permit conditions be

enforced, beach mining be banned, and the UNESCO/OEC coastal monitoring programme ("Beach Stability and Coastal Zone Management in the Lesser Antilles") begun in 1988 be continued in order to document shoreline erosion effected, in part, by sand mining, coastal armouring, and beach-front construction. It is further a recommendation of this Recovery Action Plan that the Conservation Division (Ministry of Agriculture, Lands, Housing and Development) hire additional personnel in order to more effectively monitor and enforce sand mining regulations. At the present time, there is only one Conservation Officer who is responsible for a wide variety of environmental regulations and cannot possibly single-handedly accomplish the task.

4.132 Lights

Sea turtle hatchlings orient to the sea using the brightness of the open ocean horizon as their primary cue (e.g., Mrosovsky, 1972, 1978). When artificial lights, such as commercial, residential, security or recreational lights, shine on the nesting beach, hatchlings often orient landward toward these lights instead of toward the ocean horizon. The result is often that the little turtles are crushed by passing vehicles, eaten by dogs and other domestic pets, or die from exposure in the morning sun. Nesting females are also sometimes disoriented landward by artificial lighting. This is a problem in St. Kitts/Nevis. For example, at Oualie Beach (Mosquito Bay) on the northwest coast of Nevis there was once "a lot of nesting", but today a condominium development has introduced lights and activity and nesting is declining. In 1990, hawksbill hatchlings emerging from Oualie Beach oriented landward and had to be collected from the cottages (A. Barrett, pers. comm., 1991). Disorientation of both hatchling and adult hawksbills occurs at Mosquito Bay on the Southeast Peninsula (Ricky Pereira, Turtle Beach Bar and Grill, pers. comm., 1992). Based on information shared by the WIDECAST project, Pereira has expressed his commitment to turn out beach-facing lights during the nesting and hatching seasons.

Blair Witherington, examining the problem of artificial lighting on the beaches in Florida (USA) and Tortuguero (Costa Rica), found that the presence of mercury vapor lights all but eliminated nesting on affected beaches; nesting of green turtles and loggerheads on beaches so lit was 1/10 and 1/20 that observed on darkened beaches (Witherington, 1992). With this in mind, some beach-front owners in Florida have switched to low pressure sodium (LPS) vapor lighting which emits a yellow glow, shines primarily in the 590 nm range, and has little if any effect on nesting females. While low pressure sodium lights do not constitute a complete answer to this difficult problem because they appear to mildly attract green turtle hatchlings, they represent a significant improvement over mercury vapor lights which emit a full spectrum of light and strongly attract hatchlings of all species (B. Witherington, Univ. Florida, pers. comm., 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 (a) time restrictions during the hatching season (lights extinguished during evening hours when hatching is most likely to occur; e.g., 1900-2300 hrs), (b) area restrictions (restrict beach lighting to areas of the beach where little or no nesting occurs; the effectiveness of this is diminished, however, since sources of light several km away can disrupt hatchling orientation), (c) motion sensitive lighting (sensor-activated lighting comes on only when a moving object, such as a person, approaches the light; this might be effective in low traffic areas) [N.B. obviously the light should not be positioned so that it is triggered by turtles crawling on the

beach], (d) shielding and lowering light sources (low intensity lighting at low elevations can be both attractive and adequate for most purposes; the glow can be shielded from the beach by ornamental flowering hedges or other barriers), (e) alternative light sources (LPS lighting is known to be less attractive to hatchlings than full-spectrum white light).

It is important that developers and residents alike understand that nesting sea turtles and their hatchlings are attracted by light. Consequently, lights, even low pressure sodium vapor lights, should always be shielded from shining directly on the beach. An effective method for accomplishing this is to leave or to plant a vegetation buffer between the sea and shoreline developments. Alternatively, shields can be built into the lighting fixture and/or lights can be turned off from 1700-2300 hrs (all night if possible) during the nesting and hatching seasons (ideally 1 April-30 November, but peak breeding season will vary by location depending on the species nesting). To prevent interior lights from illuminating the beach, one or a combination of the following window treatments should be required on all windows of single and multi-story structures: blackout draperies, shade-screens, and/or window tint/film with a shading coefficient (the percent of incident radiation passing through a window) of 0.37 to 0.45.

It is a recommendation of this Recovery Action Plan that lighting restrictions be imposed as a condition for obtaining a coastal construction permit. As a result of awareness generated by the WIDECAS project, lighting restrictions are proposed by Young and Scully (1990) in an environmental assessment report of the Pinney's Estate Development Plan in Nevis. The report states, "With respect to lighting, special attention should be paid to endangered sea turtles. Lighted beaches, obstructions, and vehicles on the beaches are all detrimental to turtle populations. Although Nevis does not presently have legislation to protect sea turtles, other maritime nations have adopted such measures . . .". The SEP Development Guidelines state, "Lighting shall be modified or eliminated on beaches where sea turtles may nest."

It is further a recommendation of this Recovery Action Plan that an issue of NHCS's *The Environmentalist* and SCHS's *Heritage* be devoted specifically to solutions, as articulated in this Plan, to lighting and other sea turtle threats. These publications could then be provided directly to hotels and other beach-front businesses. Workshops and seminars to alert coastal residents to lighting alternatives are proposed as part of "Sea Turtle Awareness Week" (section 4.41). Significant coastal developments on each island, such as Frigate Bay Development Corporation and/or the Casablanca administration on St. Kitts and the Four Seasons Hotel on Nevis will be encouraged by local WIDECAS network participants to set an example for other developments by implementing appropriate lighting schemes, taking care not to drive beach-cleaning machinery above the high tide line, removing lawn furniture from the nesting beach at night, etc. Articles in the newspaper and air time on television and radio can serve to spread the message and provide positive advertising for the hotels.

In the U. S. Virgin Islands, an overview of the problems posed by beach-front lighting and potential solutions (Raymond, 1984) is issued to all developers seeking permits for projects which may have an effect on sea turtle orientation due to lighting. Most developers now include this information in their environmental impact assessments and are designing appropriate lighting systems (Ralf Boulon, USVI Div. Fish Wildl., pers. comm., 1990). In Barbados, Dr. Julia Horrocks (Lecturer, University of the West Indies; WIDECAS Team Member) sent a let-

ter to all hotels and restaurants built near the beach asking two things, (1) that security personnel report incidents of sea turtle nesting on the beach, and (2) that lights shining on the beach be redirected or shaded during the breeding season. If the latter is impossible, she asks if personnel would examine the grounds each morning and "rescue" hatchlings that had mistakenly crawled away from the sea. We encourage this kind of communication in St. Kitts and Nevis.

4.133 Beach stabilisation structures

Most beaches are naturally very dynamic. In order to protect commercial investments such as beach-front hotels, beach stabilisation typically involves the use of breakwaters, jetties, impermeable groynes and/or seawalls. These structures are expensive and rarely effective in the long-term. Furthermore, because they interfere with the natural longshore transport of sediment, the armouring of one beach segment can result in the "starvation" and eventual loss of other beach segments down-current. For example, groynes at the Nisbett Plantation have clearly resulted in the starvation of down-current beaches to the east (e.g., Cambers, 1989a). Studies have been contracted to evaluate and propose mitigating measures at this site. When a retaining wall and stone revetments were erected in Gallows Bay from the pier to Hamilton House, the beach disappeared within five years (Huggins, 1991). A solid groyne (a loading ramp) was installed in Cockleshell Bay in 1992 and beach alteration was evident within the first month; sand immediately began accumulating on the up-current side and the down-current beach is diminishing in size. At Mosquito Bay, St. Kitts, a low decorative stone wall was erected during construction of the Turtle Beach Bar and Grill. Waves rebounding from this wall transport sand back out to sea, potentially accelerating erosion. It is a recommendation of this Recovery Action Plan that hard engineering options to beach protection, such as breakwaters and groynes, be regarded only as a last resort and that solid structures, such as those erected at Nisbett Plantation and Cockleshell Bay, be disallowed in favour of permeable structures.

The better solution to beach maintenance is an enforced construction setback adequate to reduce or eliminate the risk of losing coastal buildings to routine erosion or violent storms. In Nevis there are no fixed coastal development setbacks; each case is evaluated individually. However some recent guidelines have been developed by the Town and Country Planning Board to control development on beaches with tourist potential (see Corker, 1988). These guidelines provide for a buffer zone of 120 ft (37 m) from the high water mark where no building will be permitted; major buildings such as hotels should be sited 300 ft (91 m) from high water mark, and a maximum building height of 30 ft (9 m) is also recommended. These guidelines have been adopted as part of the Nevis Zoning Ordinance and will provide the Government of Nevis with an invaluable tool to contain future coastal erosion without endangering the beach or development infrastructure. Because of the undeveloped nature of most of its coastline, Nevis still has the potential to utilise coastal development control as a low cost solution to coastal erosion. It is a recommendation of this Recovery Action Plan that the necessary regulations be passed in-law, that the high water mark be clearly defined, and that conservative setback regulations apply to all lowland coasts below the 10 ft (3 m) contour.

The following useful discussion of setbacks for the Southeast Peninsula, St. Kitts, has been taken from Orme (1989). "An optimal setback of 100 m is recommended for the Atlantic beaches [of the Southeast Peninsula] where storm surges may be superimposed on wave trains

driven by the prevailing easterly winds. The issue is most acute at the larger, more developable beaches at North Friar's Bay, Sand Bank Bay and Mosquito Bay, each of which has a very active foreshore, a backshore of variable width, and one or more transverse dune ridges which protect the low-lying interior [N.B. and all of which host nesting sea turtles which could be displaced by armoring]. For example, the north end of North Friar's Bay beach suffered 26 m of lateral erosion in summer 1988 and the foreshore throughout the beach retreated to within 10-15 m of the primary dune front. This occurred under normal conditions and such mobility in term of cut and full must be considered part of the natural system. Under hurricane storm surges, beach erosion and dune retreat would be significant. Thus in these localities, the setback should include the variable backshore, the foredunes and the first or primary main dune, with access to the beach provided by elevated walkways or narrow zig-zag paths over or through the dunes.

"The other Atlantic beaches [of the Southeast Peninsula], not backed by lagoons or low-lying terrain, do not pose a comparable problem and setbacks in these cases, for example at Canoe Bay, could be less than 100 m, depending on slope. On the channel beaches (Major's Bay, Banana Bay, Cockleshell Bay), the impact of storm surges is likely to be less dramatic but there is a window between Nag's Head and the Nevis west coast through which significant storm waves can approach, as happened during tropical storm Gilbert's development in September 1988. Furthermore, each beach is essentially a narrow barrier backed by lagoons or lower land which should not be interfered with. Thus the setbacks should really be established at the leading edge of rising ground farther inland. On the Caribbean beaches, normal wave action is less dramatic but hurricane surges can still cause significant erosion and over-wash of the barrier beaches at Ballast Bay and South Friar's Bay. Once again, the barriers should remain intact." Setbacks should be established in the context of erosion dynamics with the intent to protect coastal properties over the long-term. In some cases, setbacks may need to exceed Orme's recommendation of 100 m. Cambers (1989a), in an assessment of damage to Nevis beaches by Hurricane Hugo, photographed the new beach bar and pool complex at Nisbett Plantation and questioned whether, in view of erosion caused by the existing groyne and accelerated by the hurricane, the 120-ft (37 m) setback would be adequate to protect the structure.

4.134 Beach cleaning equipment and vehicular use of beaches

All beaches are littered to some extent by recreational users, by waste (e.g., household waste, automobile tyres) thrown into ghauts and washed to the coast, and/or by sea grasses that regularly wash ashore in some areas. In addition, the Atlantic beaches of St. Kitts and Nevis are especially vulnerable to the accumulation of ocean-borne debris, including oil, abandoned fishing gear, and cruise ship waste (see also sections 4.144 and 4.145). Many beaches in St. Kitts are routinely cleaned for removal of sea grass and litter. Mosquito Bay, South Friar's Bay, and both South and North Frigate Bay are cleaned daily. Although most of the cleaning is accomplished using hand rakes, transportation of the accumulated debris off the beach is usually done by tractor and trailer. The operation of this heavy machinery above the high tide line (where sea turtles may have laid their eggs) is potentially detrimental to the reproductive success of turtles. In Nevis, the Four Seasons Hotel cleans its beach using a light-weight three-wheel vehicle that removes debris without incising the beach much more than would a hand rake (Brad Dow, pers. comm., 1992).

It is a recommendation of this Recovery Action Plan that beach cleaning, when necessary, be done using hand tools such as shallow rakes and not heavy machinery or devices that deeply incise the sand. The uppermost eggs in a green or leatherback turtle nest commonly incubate 20 cm (8 inches) or more beneath the surface of the beach. In contrast, hawksbills construct shallow nests in which eggs are protected by less than 10 cm (4 inches) of overlying sand. Damage to incubating eggs (or hatchlings awaiting an evening emergence) is easily caused by compaction or puncture from mechanized beach cleaning techniques. If raking seaweeds by tractor or other heavy machinery is inevitable, this activity should be confined to beach zones below the mean high tide line in order to avoid the compaction of sand above incubating eggs. Repeated compaction will kill developing embryos and tyre ruts can trap hatchlings crawling across the beach to the sea. Some commercial establishments, such as the Turtle Beach Bar and Grill, periodically remove thick mats of beached sea grass using a tractor. Since the beach is used by hawksbill turtles, care is taken not to allow the tractor to operate above the high tide mark where nests are made (R. Pereira, pers. comm., 1991).

It is a recommendation of this Recovery Action Plan that driving cars and trucks on sandy beaches be forbidden in St. Kitts/Nevis because their weight crushes eggs and can kill developing or newly hatched turtles. In addition, tyre ruts are unsightly and create hazards for hatchlings trying to reach the sea. The tiny turtles fall into the ruts, which generally run parallel to the sea, and because they cannot get out they die in the morning sun or become an easy meal for a predator. Many of the beaches on St. Kitts are routinely driven on by vehicles of all kinds. Sand Bank Bay (an important nesting beach; see section 4.112) in particular has become a compact roadway with heavy use by residents and tourists. As many as 15-20 cars are seen parked or driving on this beach on weekends. Cars are rarely driven on the beaches of Nevis, but Windward Beach near Red Cliff is an exception ("it is often driven on by fishermen and even more frequently by tourists and residents seeking recreational access to the beach"; R. Young, pers. comm., 1992). A locally-owned vehicle was observed driving south along the length of Pinneys Beach to the Beachcomber restaurant in October 1992 (K. Eckert, pers. obs.).

A public information campaign has been initiated by the SEP staff to discourage people from driving on the beaches. Signs have been erected on many SEP beaches, announcements made on radio and television, notices printed in the newspapers, and fliers distributed to car rental agencies. Unfortunately, the driving continues. The last alternative may be to prevent access by blocking the terminus of beach access roads.

4.135 Beach rebuilding projects

Beaches are sometimes rebuilt, or replenished, with sand from adjacent areas when erosion of beach areas, particularly those fronting resorts, becomes economically threatening. It is a recommendation of this Recovery Action Plan that rebuilding, when unavoidable in sea turtle nesting areas, require that replacement sand be similar to the original material in organic content and grain size (thereby maintaining the suitability of the beach for the incubation of sea turtle eggs) and that rebuilding activities do not take place during the primary breeding season. If beaches are rebuilt during the green/hawksbill turtle nesting season (peak: June to November) or hatching season (peak: August to January), heavy equipment and activity can deter nesting and crush eggs. In addition, the new overburden can suffocate incubating eggs and prevent the

hatchlings from successfully digging out of the nest. If leatherbacks are known to nest on site, personnel should keep in mind that they begin nesting in April (sometimes March), peak in May, and finish in early July.

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 up-current solid jetty or pier that is literally "starving" the down-current 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 or when nearshore pollution retards the productivity of calcareous (coralline) algae and other sand sources. [N.B. The National Conservation and Environment Protection Act, 1987, prohibits removing or assisting in the removal of "any vegetation from a beach in Saint Christopher and Nevis except under the authority of a permit" granted by the Minister.] 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 and sometimes guaranteed. This is not in the long-term interest of the people or sea turtles of St. Kitts/Nevis.

Beach rebuilding has not occurred to any significant degree in St. Kitts/Nevis, but authorities should remain vigilant in this regard. Probably the most careless example of manipulation was the illegal removal of beach sand in January 1992 from the primary dune at Sand Bank Bay and the deposit of this sand at Cockleshell Bay. The imported sand was used to extend and expand the beach at the site of the Casablanca Hotel under construction at Cockleshell Bay. The Casablanca site had previously been denuded of vegetation and coconut palm trees planted. The palms are not an effective wind break, however, and the imported sand remained on site for only a matter of days before it was blown away. Such "face-lifting" for short-term aesthetic purposes disrupts coastal ecology, sometimes severely so. The incident was particularly unfortunate because the sand was stolen from a known sea turtle nesting area. Banana Bay beach was also leveled and reshaped during the 1992 turtle nesting season by landmovers and dump trucks.

4.14 Prevent or mitigate degradation of marine habitat

4.141 Dynamiting reefs

The fishermen of St. Kitts and Nevis do not use dynamite or other explosives to assist in the catching of fish. The Fisheries Act of 1984 explicitly forbids the use of "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". Even the possession or control of any explosive or other noxious substance in circumstances indicating that same may be used in the act of catching fish constitutes an offence against the Act. The maximum fine upon summary conviction is EC\$ 1000. It is a recommendation of this Recovery Action Plan that the Act be fully enforced with regard to explosives.

The use of dynamite to catch or stun fishes or to remove coral reef structure (e.g., to provide boat access) results in severe and possibly permanent damage to the fragile coral. The

slow-growing and virtually irreplaceable coral reefs serve as nurseries, refugia, and foraging grounds for many species of commercial fishes. They are crucial to the sustained health of the fishing industry. They also absorb the impact of storm waves and ocean swells, thus protecting and sheltering the shoreline including commercial and residential investments. With an increasing number of SCUBA-oriented tourists, healthy coral reefs are an important component of the tourism industry. Finally, and most relevant to this Recovery Action Plan, coral reefs provide food and shelter to sea turtles. Hawksbills feed almost exclusively on reef-associated sponges in the Caribbean (section 2.4) and hawksbill and green turtles both seek shelter and rest in the structure of the reef.

4.142 Chemical fishing

Modern chemical fishing is not known to occur in St. Kitts/Nevis, although there are records of chemical-assisted fishing during the Colonial era. Smith (1745) wrote: "The Poison [extracted from the Dog-wood Tree] kills millions of the small Fry; and indeed I can assign no reason why they should not likewise destroy the Shell-fishes who lie at the bottom, and of course are less qualified to escape its effects by passing into the adjacent purer Water." As in the case of explosives, the use of chemicals such as chlorine and other "noxious substances" to catch or stun fishes constitutes an offence against the Fisheries Act of 1984 (section 4.141). Chemical-assisted fishing is short-sighted and destructive. It is a recommendation of this Recovery Action Plan that the Fisheries Act be fully enforced with regard to poisons.

4.143 Industrial discharges

The NCEPA (1987) states, "No person shall . . . foul or pollute any part of the coastal zone whether by depositing thereon offal, garbage or other waste or in any other manner." Legislation notwithstanding, it is inevitable on a small island that waste generated, especially in liquid or semi-liquid form, will soon find its way to the sea. Archer (1984) estimated that 90% of the waste water released from industry in St. Kitts flows to the sea through pipes and drains. Sugar cane and molasses production, soft drinks, dairy products, margarine, distillery, abattoir, brewery and power plants all produce waste products that enter the coastal environment and contribute to stressful conditions experienced by marine ecosystems in the coastal waters. For example, high biological oxygen demand (BOD) waste from sugar production is a major contributor to the pollution of Basseterre Bay and the loss of coral reef structures in the vicinity of the harbour. Recently, samples of coastal water that may have chromates from textile dyeing ventures were sent off-island for analysis because fish kills were observed nearshore (K. Archibald, Director of Agriculture, pers. comm. in CCA, 1991). In Limekiln Bay, discharges are heavy enough to discolour the inshore waters of the bay; caustic solutions from soft drink factories, waste water and effluent from the sewage package plant at the hospital, and high BOD wastes from the brewery are implicated in the heavy pollution of this area (CCA, 1991).

The streets of Charlestown, particularly near Gallows Bay, and other towns serve as conduits carrying debris (oil, litter, household waste) to the sea. Ghauts are similarly used, despite the declaration in the NCEPA that "all ghauts [are] an area of special concern to be managed in the public interest" and that any person polluting or littering a ghaut will be liable, upon summary conviction, to a fine not exceeding EC\$ 500 and in addition "shall be responsible

for the clean up of the litter deposited or pollution caused". There is no system for the collection and proper disposal of waste oil in either St. Kitts or Nevis. Much of the reported pollution at the electricity plant in St. Kitts is from waste lubricating oils resulting in oil-saturated soil and ditches. Oil entering drainage ditches combines with pollutants from other sources and is ultimately discharged into Basseterre Bay. In addition, waste oil and grease from garages are dumped into storm drains and on the ground. This material combines with oil from street surface runoff and is washed into drains, ghauts, and coastal waters during heavy rains. Similarly, waste oil from garages and electricity generating plants in Nevis is disposed of in storm drains or poured directly on the ground where it eventually washes into ghauts and coastal marine waters (CCA, 1991). Uncounted small businesses also contribute to the problem. For example, Warner's dry cleaning and deli facility (Charlestown) which routes detergent waste water and dry cleaning solvent into the street, where it flows ultimately to the sea.

A recent marine habitat survey of Nevis noted deterioration of the reef structure around the Charlestown Harbour at Fort Charles. Robinson (1991) speculated that this may have been caused by oil seeping into Gallows Bay after having been discharged from a nearby power plant into Bath Bog, by heightened shipping activity and run-off from Charlestown streets which is causing considerable amounts of pollution in the bay, and/or by the activity of Hurricane Hugo. The report also noted, "The pollutants are much more varied than previously known due to newly introduced building materials, cement, oil and gasoline spillage, and soap drain-off from a local laundromat." It is not clear at the present time exactly what the cumulative effect of land-based industrial pollution has been on sea turtles in St. Kitts/Nevis. However, it is possible that damage done to coral reefs and other foraging zones, not to mention debilitating or even lethal chemical input, will only accelerate the decline of the already depleted sea turtle fauna.

It is a recommendation of this Recovery Action Plan that investment in infrastructure to treat and properly dispose of industrial wastes be a priority for both Government and industry. Routine monitoring for compliance with environmental standards should be implemented.

4.144 At-sea dumping of garbage

The dumping of garbage at sea is recognized as a growing problem throughout the world. Death to marine organisms as a result of ingestion or entanglement is widespread (e.g., O'Hara et al., 1986; Laist, 1987; CEE, 1987). Balazs (1985) summarized worldwide records of ingestion of oceanic debris by marine turtles and listed a wide variety of items consumed, including banana bags ingested by green turtles in Costa Rica. Several years ago, Mrosovsky (1981) summarized data showing that 44% of adult non-breeding leatherbacks had plastic in their stomachs. Leatherbacks consume plastic bags, mistaking them for jellyfish. Some sea turtles have been found on the SEP entangled in discarded netting and other fishing gear. The Atlantic beaches are particularly vulnerable to the accumulation of debris, including cruise ship waste and oil. Sea turtles and their eggs can easily be harmed by encounters with tar, glass, and netting on the nesting beaches.

In St. Kitts/Nevis, as elsewhere, at-sea dumping is difficult to monitor. Addressing the problem requires a concentrated effort at public education, coupled with stiff penalties for offenders. It is a recommendation of this Recovery Action Plan that an awareness effort be initi-

ated under the aegis of Government, NGOs, and the media to alert fishermen and recreational boaters of the need to properly dispose of garbage. Great advances in public awareness have been made as a result of the NHCS-sponsored Beach Clean-up campaign in 1992. Residents, including many school children, participated in the clean-up which was part of the international coastal clean-up campaign of the Center for Marine Conservation (Washington D.C.). Participants learned how to categorize waste and how to develop a database to organize the information. They also gained an enhanced awareness of how much ocean-borne waste litters the shores of Nevis. The NHCS has recommended that a coordinated national waste disposal system be designed and implemented, and that advance notice be given to boaters that such facilities exist.

It is noteworthy that at an April meeting in the Bahamas, Caribbean government representatives proposed that "uniform standards on pollution and dumping . . . be imposed by CTO on all cruise lines." Furthermore, Caribbean governments want all cruise ships plying trade in the region's waters to be fitted with incinerators. They also want them to clean up garbage "already identified in the Caribbean as coming from cruise ships." Eventually, if Caribbean governments have their way, a Caribbean-wide "no-dumping" policy will be instituted (Anon., 1992). By ratifying MARPOL (see section 4.32), St. Kitts/Nevis can support the international community in taking a stand against the enormous volume of persistent debris dumped into the Caribbean Sea (and throughout the world) each year.

4.145 Oil exploration, production, refining, transport

St. Kitts/Nevis participated in the development of a Subregional Oil Pollution Contingency Plan at a Meeting of Experts held in St. Lucia in 1984 and the Government recently circulated a draft National Oil Spill Contingency Plan (Blake, 1992). The draft Plan notes that marine traffic, especially oil tankers, using local ports or in transit through coastal waters presents the risk of marine oil pollution from collisions, groundings, sinkings, oil cargo and bunker transfer, and other marine incidents. Such pollution can threaten recreation areas, sea birds, marine life, coastal installations, and fisheries. Response to accidental spillage of oil requires careful advance planning to ensure that the impact of the oil spill is minimized. The stated purpose of the Plan, therefore, is to "delineate responsibilities for the operational response to marine emergencies which could result in the spillage of oil and other hazardous pollutants into the marine environment." Several objectives were listed, including identifying high risk areas and priority coastal areas for protection and clean-up, providing adequate oil spill response equipment, training personnel, providing a framework for coordination and communication, enacting necessary legislation, etc. One shortfall in the present draft is the lack of an explanation of liability and prosecution if Government is the culprit. In addition, more emphasis should be given to cooperation between corporations and Government in the prevention and clean-up of spills and accidents (David Robinson, Chief Curator, NHCS, pers. comm., 1992).

In addition to attending the Meeting of Experts held in St. Lucia in 1984, St. Kitts/Nevis was also represented at a recent Caribbean Sub-Regional Seminar on Environmental Sensitivity Index Mapping for Oil Spill Response convened in Kingston, Jamaica. As a result, civil servants have received training in oil spill response strategies and an inventory of the St. Kitts coastline with regard to environmental sensitivity has been initiated. The inventory will ensure better preparation in the event of an oil spill because details of shoreline type and condition will be known

and the appropriate cleanup requirements can be met. Continued regional involvement and training is encouraged by the WIDECAST project. In order to take full advantage of regional technology and support in the event of a serious spill, it is a recommendation of this Recovery Action Plan that St. Kitts/Nevis accede to the Cartagena Convention (see section 4.32) without further delay. Article 3 of the Protocol concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region states, "Contracting Parties shall, within their capabilities:

- (a) 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) 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."

While the greatest threat of a spill or other accident comes from small coastal tank ships and the bunker fuel of cargo and cruise ships operating in local waters, it is perhaps only a matter of time before the country falls victim to "catastrophic pollution" from transiting marine traffic in regional waters (CCA, 1991). It has been recommended (Spitzer, 1984) that the Government formally recognize the Subregional Oil Pollution Contingency Plan (mentioned above) to provide a means for working and communicating with other nations in the region during major pollution incidents. We concur with Spitzer (1984) and recommend further that the Government implement the draft Marine Pollution Prevention Bill of 1988 which would provide a "reasonable legislative foundation for addressing the prevention, reduction and control of incidents in coastal waters involving oil and other marine pollutants".

According to CCA (1991), oil and other petroleum products are brought to St. Kitts by tanker to the Shell depot or the new Texaco depot just south of Basseterre. The Shell facility is supplied by relatively small tankers that are moored offshore and run floating hoses to the manifolds. Shell provides safety and clean-up equipment on tankers that carry persistent oils only. There is no equipment in St. Kitts to handle the clean-up of an oil spill or accident; assistance would have to be sought from Antigua or Barbados. Shell does, however, have a contingency plan that indicates personnel contacts and procedures for getting equipment to St. Kitts to initiate clean-up in the event of a spill (D. Phillips, pers. comm. in CCA, 1991). Oil and other petroleum products are brought to Nevis by tankers and off-loaded at buoys in Charlestown Harbour and Low Ground. Shell and Delta are distributors on the island, and both of these companies import and store diesel fuel and gasoline. Nevis does not have an oil spill contingency plan. Oil tankers coming into St. Kitts have capacities which range from 8,700 to 37,000 barrels; those coming into Nevis have an average capacity of 2,000 tons (CCA, 1991).

On 6 March 1991, 13 nm north of Nevis (17°18'N, 62°18'W), the Trinidad-registered barge *Vestabella*, loaded with about 560,000 gallons of #6 fuel oil, sank in 600 m of water after a

towing cable snapped. The following discussion is taken from Simmonds (1991b). The initial oil slick was more than 30 miles long. A response committee met on 10 March and decided that priority actions were to conduct an aerial survey, determine whether or not to use chemical dispersants, and closely monitor the spill. Later that day, a French Naval patrol boat applied the dispersant Finasol OSR7. The decision was made to proceed with the application of the dispersant, with the condition that the effects of the chemical were to "be monitored to validate toxicity on local organisms". By 13 March, oil, tar balls, and tar balls mixed with seaweed washed ashore on sea turtle nesting beaches on the north shore of St. Kitts, including Conaree. Many of St. Kitts' Atlantic beaches were "severely impacted by tar balls", including Dieppe Bay, Sand Bank Bay, and Frigate Bay. Most of the high energy, rocky beaches (e.g., Black Rock) were also oiled but the effects appeared transitory.

On 14 March 1991, marine surveys were conducted to assess *Vestabella*-related damage and samples collected were sent to Dr. D. D. Ibebele, Environmental Toxicologist (CERMES, UWI), to be analyzed for damage done to fish larvae and plankton living in the water column near affected coral reefs. On 22 March fish kills in the Banana Bay area were reported to the Coast Guard. On 26 March fishermen in the Dieppe Bay area reported their observations that tar could be found on "some of their surface gear", such as buoys and rope (Simmonds, 1991b). In Nevis, homeowners in the Almond Beach area reported oil in weeds offshore and a "slick" about 10 yd long on the beach at Long Haul Bay. On 28 March, prisoners cleaned oil-soaked weeds from the beach at Newcastle airport (John Titley, pers. comm. to Robert Young). On the same day, "large numbers" of tar balls about 1.5 inches in diameter could be seen at the tide lines, mostly mixed with sea grass. By 4 April, there was "extensive oil cover on nearshore sea grass beds and on the beach for a mile in each direction from the Almond Garden site west to Nisbet Plantation" (R. Young, pers. comm., 1992). Robert Young swam out to Rocky Point from Oualie Beach (Mosquito Bay) and photographed tar washing ashore in floating mats of sea grass. Wildlife casualties will never be fully known, but there were two confirmed reports of fatally oiled pelicans at Tamarind Bay; no oiled turtles were reported.

Several St. Kitts businesses, including the Turtle Beach Bar and Grill at Mosquito Bay and Mrs. Katzen's beach cottages (Coral Reef and Vientomarsol) at Conaree, lost profits to the spill. People went elsewhere rather than venture out into areas where the oil was clearly visible and risk returning with tar on their snorkeling gear and clothing. Cleaning solvent was made available at the Turtle Beach Bar and Grill for several months following the accident so that beach-goers could clean themselves. Sun 'n Sand Hotel on North Frigate Bay had to provide large quantities of cleaner to customers and guests (Kate Orchard, pers. comm., 1992). As late as January 1992, visitors to the north shore of St. Kitts (e.g., Dieppe Bay) reported oiled beach areas and soiled shoes and feet (J. Simmonds, pers. comm., 1992). As of October 1992, there were still "big lumps" of tar on the beaches at North Frigate Bay, North Friar's Bay, and Conaree (K. Orchard, pers. comm.).

The *Vestabella* spill was not an isolated incident. The recent reality of repeated oil spills in the northeastern Caribbean indicate the very serious nature of this threat. In September 1989, following Hurricane Hugo, a 42,000 gallon spill of #6 fuel oil (heavy crude oil) at the Water and Power Authority facility in Christiansted, St. Croix, left south coast beaches on that island heavily oiled. Pelican Cove, a hawksbill nesting beach on St. Croix, was buried under 0.3 m of

crude oil. On 15 March 1992, a pipe ruptured during ship-to-shore pumping of #6 fuel oil to a transfer station at St. Eustatius Terminal on the west coast of St. Eustatius, Netherlands Antilles. One hundred barrels of crude oil were released to the sea in a slick that headed northwest out across the rich fishing grounds of the Saba Bank. Heavy seas broke up the slick before it entered U. S. waters, but tar balls eventually fouled the coast of Puerto Rico (Zandy Hillis, U. S. National Park Service, pers. comm., 1992) and Saba (Sybesma, 1992).

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. He noted that the Gulf Stream at times carries oil from both European sources and the Gulf of Mexico into Florida waters. More recently, following the *Vestabella* barge spill, a hawksbill soaked in oil was found dead near Guayama on the south coast of Puerto Rico (Benito Pinto, Puerto Rico DNR, pers. comm., 1992).

4.146 Agricultural run-off and sewage

There are no data to indicate the direct effects of agrochemicals and sewage on sea turtles, but the cumulative effect of these poisons and high BOD wastes on the marine environment certainly weakens the capacity of coral reefs and other affected benthic systems to support life, including sea turtles. Agricultural chemicals are widely used in St. Kitts/Nevis, but there is no monitoring of their ultimate fate, either in the environment or in agricultural products. Most surely enter the sea at some point. The twin challenges are to regulate the use of agrochemicals in established industries in order to minimize negative impacts, and also to make careful choices about future agricultural investments. Nevis, for instance, is considering revitalizing its cotton industry and also introducing a cut flower industry, both heavy users of chemicals (CCA, 1991). Should either of these options be fully implemented, the use of agrochemicals may increase dramatically. The use of fertilizers and biocides is not limited to agricultural crops. Their use is increasing on hotel grounds, ornamental plantations, and golf courses.

Fortunately some progress has been made in the country's ability to monitor and control the use of fertilizers and poisons. In addition to training governmental personnel in coastal monitoring techniques, the Caribbean Environmental Health Institute in St. Lucia has recently provided approximately US\$ 10,000 worth of laboratory equipment (N. Singh, CEHI, pers. comm. in CCA, 1991). Recommendations have been made to renovate an old sugar cane lab into a central environmental lab for the country, which would include the CEHI equipment. The Government has enacted legislation for pesticide regulation (Pesticides Act, No. 20 of 1973). The Act provides a framework for drafting regulations, the organization and role of a Pesticides

Board, the assignment of inspectors, and a delineation of offences and penalties. The only regulations in place at the present time are the Pesticides (Labelling and Storage of Containers) Regulations (SRO No. 18 of 1975). The Pesticide Board, which has not been functional for a number of years, should be revitalized.

In St. Kitts, sewage is disposed of in one of three ways: septic and absorption pits, pit latrines, and treatment plants. More than half the homes in Basseterre, which is located at the edge of the sea, use pit latrines with essentially no treatment of human wastes (T. Mills, Chief Public Health Inspector, pers. comm. in CCA, 1991). In some residential areas disposal is accomplished by the use of holding tanks which overflow to soak-away pits. Effluent of varying quality routinely finds its way to the sea in many areas. For example, the reef at North Frigate Bay is overgrown with algae; sewage contamination has been implicated. A central sewage plant for the Frigate Bay area is presently at the engineering design stage; after approval, the project is expected to be completed within three years (W. Liburd, Frigate Bay Development Corp., pers. comm. in CCA, 1991). It is certainly unfortunate in light of the magnitude of coastal development expected on the Southeast Peninsula that there is no infrastructure on the peninsula to accommodate central sewage collection or treatment; responsibility for this is left to each landowner. In Nevis, most (66%) residents use pit toilets, the rest use connected or unconnected water closets or have no toilet at all. Statutory regulations for domestic sewage disposal and septic tank design have not been written. The first facility to construct and operate a package sewage treatment plant is the Four Seasons Hotel. Large-scale tourist development at Pinneys Beach could contaminate adjacent coastal and lagoonal areas if sewage is not carefully managed (CCA, 1991).

Draft legislation which would establish a Sewage and Water Authority for the country is pending. It is a recommendation of this Recovery Action Plan that legislation establish a strong regulatory framework for the use of agricultural chemicals, a system to monitor the fate of these poisons in the environment, and provisions for enforcement.

4.147 Anchoring and dredging

Anchor damage is a leading cause of destruction to sea grass meadows and coral reefs in the Eastern Caribbean and St. Kitts/Nevis is no exception. According to Robinson (1991), "the proliferation of tourism and added numbers of ships of every type is creating congestion in the Charlestown Harbour and along the Leeward coast [of Nevis]. There is considerable concern over anchorage and the dragging of anchors over reefs, sea grass beds, and other sea life. There are no accurate maps available to locate [important features of the sea bed], thus Nevis customs people cannot guide ships to safe moorings." Audra Barrett, Assistant Fisheries Officer, recently notified the Nevis Customs Department by letter that damage to coral reefs from yacht anchors was a very serious problem. Customs Officers responded with a campaign to alert yachters to the problem; compliance around Nevis appears to be improving (A. Barrett, pers. comm., 1991). The challenge now is to educate boaters to avoid sea grass communities, as well, for these are also ruined by repetitive anchoring.

In St. Kitts there is already clear evidence of coral/sponge damage in Basseterre Harbour (section 3.3), at frequently used dive sites, and in bays where yachts often anchor. For example,

South Friar's Bay is frequented by several large sailing/cruise ships (Club Med I, Windstar, Windspirit, Polynesia) that anchor near to shore and damage the seabed. There is also considerable damage throughout the country attributable to the cumulative effect of countless fishermen's anchors. Unfortunately, there has been active resistance from the fishermen to the installment of moorings, especially mooring sites for local fishing vessels. The fishermen guard their freedom of movement and contend that fixed moorings interfere with the setting of nets. It is a recommendation of this Recovery Action Plan that the concerns of fishermen be taken into account and that a compromise solution be identified to provide for the installation of a national system of moorings. The SCHS Marine Division is working toward such a solution. Anchors not only destroy habitat, but may actually kill sea turtles. Kenneth Samuel reported that a Taiwanese freighter dropped anchor in Basseterre Harbour a few years ago; the anchor landed directly on a sea turtle, killing the animal and pinning it against the bottom.

According to local SCUBA dive professionals, live-aboard dive boats visiting St. Kitts/Nevis, such as the Caribbean Explorer, are "pretty good" about anchor placement, but the cruise ships that come in with their own dive boats do considerable damage to the seabed. There is supposed to be a local observer onboard the dive boats whilst they are in domestic waters, but often this is not done. The Coast Guard is ultimately responsible for enforcing maritime regulations, including those governing anchor placement, but there is some reluctance to enforce the regulations for fear that the cruise ships will not continue to visit St. Kitts/Nevis. Anchor damage effected by the Windjammer fleet is also a growing problem, since they advertise their ability to enter (and drop anchor in) shallow, more secluded and pristine bays than the larger cruise ships. In the view of this Recovery Action Plan, it is crucial that the diving and cruise ship industries be required to adhere to anchoring etiquette. It is a privilege and not a right to enter the waters of St. Kitts/Nevis, and the privilege should be revoked on behalf of the people of St. Kitts/Nevis when it has been abused.

To date, moorings have been established in Nevis at Charleston and Pinneys; additional moorings are needed. In St. Kitts, there are moorings at selected dive sites. It is essential that yachts and vessels of all sizes be required to either anchor in designated sand bottom areas, or tie in at approved moorings in coral reef areas. Halas (1985) described a simple and cost-effective mooring system (US\$ 100-200 per mooring) which has proven adequate for holding yachts and live-aboard dive boats <100 feet in length both in Florida and in the Caribbean. Small cruise ships (including 'mini-cruisers') also require adequate mooring facilities. Until these are in place, these vessels should be required to remain offshore beyond the zone of coral and sea grass (>30 m depth). At this time, there are few cost-effective systems for mooring larger vessels such as cruise ships. Consequently, large cruise ships (>200 feet in length) should be required to dock at the Deep Water Port. Greater economic and environmental benefits will be realised by transporting tourists by water or ground transfer to their destinations.

The demand for overnight anchorage in St. Kitts/Nevis will only increase with the increasing emphasis on tourism, especially on the Southeast Peninsula of St. Kitts. In the absence of secure moorings, the demolition of coral reefs and the uprooting of sea grasses by anchors will continue and in many cases will result in long-term damage (see Williams, 1987; Rogers, 1985; Rogers et al., 1988). In addition to providing important foraging habitat for sea turtles, the nearshore zone and especially along the south coast of the Southeast Peninsula (in-

cluding Major's Bay) is essential habitat for juvenile fishes, conch and lobster. Water sports, particularly SCUBA, will be also be adversely affected if coral reef environments are degraded. It is a recommendation of this Recovery Action Plan that a comprehensive plan be developed to designate specific anchoring sites and install a comprehensive system of moorings. Input should be solicited from marine users (e.g., fishermen, yachters, divers), relevant government agencies (e.g., Coast Guard, Fisheries Division), and local conservation societies. For information and experience in installing moorings and designing mooring legislation, contact the Conservation and Fisheries Department (Government of the BVI, P. O. Box 860, Road Town, Tortola, BVI) and/or Dr. Tom Van't Hof (The Bottom, Saba, Netherlands Antilles).

With regard to dredging, the most recent episode was at Cockleshell Bay on the SEP. The on-site crane used for the construction of the Casablanca Hotel was used to remove as much sea grass as the boom could reach. The dredge spoil was left on the beach for several weeks and eventually evenly distributed over the beach sand. The developer has requested permission to remove sea grass to the 5-foot water depth. It is a recommendation of this Recovery Action Plan that any such request be denied. Damaging or removing sea grass beds for the stated or perceived needs of waders and sea bathers should be prohibited. Waders and sea bathers should be educated about the importance and functions of sea grass beds to their surroundings and to the communities that benefit from them. Creating channels for navigational purposes can also cause acute damage and stress to sea grass beds, especially if they are poorly located and excavated. When roots and rhizomes are removed, formerly clear waters are muddied and the problems of siltation also affect surrounding sea grasses (see Walters, 1992). Ultimately, the dredging of sea grass is likely to accelerate erosion of the adjacent sandy beach.

4.2 Manage and Protect All Life Stages

4.21 Review existing local laws and regulations

The Turtle Ordinance, Cap 99, of 1 January 1948 established a closed season from 1 June-30 September, inclusive, during which time it was prohibited to catch, take, buy, sell, and/or possess any turtles or their eggs or meat. The taking of turtles under 20 lb (9 kg) was prohibited at all times. Any person found guilty of an offence against this Ordinance was liable, upon summary conviction, "to a fine not exceeding twenty-four dollars." Turtles (or any portion thereof) or their eggs found in the possession of any person during the closed season could be seized, and "any net, instrument or thing" used in connection with an offence was subject to forfeiture. No persons were ever charged or convicted under this Ordinance.

The Turtle Ordinance was repealed by the Fisheries Act of 1992, which also gave the Minister the authority to prescribe "measures for the protection of turtles, lobsters, and conchs." Fisheries Regulations of 1992, made by the Minister of Agriculture, Lands, Housing and Development under Section 40 of the new Fisheries Act, are presently in draft form. The draft Regulations are modeled after the OECS Harmonized Fisheries Legislation and therefore provide for a moratorium on the capture of turtles and the harvest of their eggs. Part VI (Fishery Conservation Measures) reads: "TURTLES. 20. No person shall (a) fish for, take, sell, purchase or have in his possession any turtle or part thereof; (b) disturb, take, sell, purchase or have in his possession any turtle eggs; or (c) interfere with any turtle nest." The maximum fine upon sum-

mary conviction is proposed at EC\$ 5000. It is a recommendation of this Recovery Action Plan that the Regulations as they pertain to turtles be adopted and implemented as soon as possible. If it is clear that adoption will be delayed, then the Minister should consider a special ruling either unconditionally protecting all sea turtles or enacting interim measures allowing a strictly controlled harvest (see section 4.23) pending passage of the moratorium.

Also relevant is the National Conservation and Environment Protection Act (NCEPA), 1987, which aims to "provide for the better management and development of the natural and historic resources of Saint Christopher and Nevis for purposes of conservation". The Act provides for the establishment and administration of national parks, historic and archaeological sites, and other areas of natural or cultural interest. The Act allows for the establishment of a Conservation Commission to advise the Minister on the selection of protected areas, among other things, and declares that the "Conservation Commission shall promote conservation as part of long term national economic development". A variety of activities are regulated under this legislation, including sand mining and the removal of beach vegetation; anchoring, polluting, collecting or harassing wildlife, and fishing can be restricted in protected areas. The Act also provides for the appointment of wildlife or park officers. Animals (including wild birds and their eggs) listed in the Third Schedule of the Act are nationally protected. The Act also provides for the appointment of wildlife or park officers. It is a recommendation of this Recovery Action Plan that the Act be fully implemented and that all species of sea turtle be included in the Third Schedule.

The Southeast Peninsula Land Development and Conservation Act (SEPLDCA), 1986, describes the power and functions of the SEP Land Development and Conservation Board to include maintaining the environmental quality of the Southeast Peninsula. The Board is charged with making recommendations concerning zoning, pollution control, and the development and implementation of an environmental protection plan; carrying out planning studies; and monitoring development schemes. The Act also designates the Southeast Peninsula as a "conservation area", wherein a permit from the Minister is needed to willfully kill, wound or take any wild animal or wild bird. It is a recommendation of this Recovery Action Plan that the reference to "any wild animal" be interpreted to include any sea turtle nesting on a peninsula beach.

4.22 Evaluate the effectiveness of law enforcement

There is no enforced penalty for persons violating sea turtle conservation legislation. No arrests have ever been made, and no fines or other penalties have ever been levied. Annual Reports submitted to the Department of Agriculture by the Fisheries Officers alert the Minister to the penalty clause, but there has been no feedback or support for enforcement from the administration (A. Barrett, pers. comm., 1991). It is vital that support be visible from the top levels of Government. Since the Fisheries Officers live in the community and work closely with the fishermen, it is not possible for them to unilaterally enforce the law. To do so would be to risk losing support within the fishing community and to compromise their ability to perform their duties. There appears to be general support for sea turtle conservation legislation within the fishing community, but what is lacking is certainty within the minds of the few unscrupulous fishermen that they will be penalised to the full extent of the law for contravening sea turtle regulations.

It is a recommendation of this Recovery Action Plan that Government approach the challenge of enforcement with a unified attitude. Fisheries Officers cannot shoulder the burden alone -- even if they had the power to arrest, which they do not. Administrative, judicial, and police cooperation are essential.

4.23 Propose new regulations where needed

In keeping with the long-standing OECS position that the harvest of endangered sea turtles and the collection of their eggs should be phased out in OECS member States (and throughout the Caribbean region), the draft Fisheries Regulations of 1992 prohibit persons from fishing for, taking, selling, purchasing or possessing any turtle or part thereof; disturbing, taking, selling, purchasing or possessing any turtle eggs; or interfering with any turtle nest (see section 4.21). It is a recommendation of this Recovery Action Plan that the Government adopt and implement these regulations and that the ban remain in effect until such time as credible scientific studies show that a regulated take will not adversely effect sea turtle populations. The persistent decline of sea turtles in St. Kitts/Nevis and throughout the region is a reflection of more than a century of harvest -- especially of eggs and egg-bearing females -- with no regard for natural population sizes or rates of recruitment. In light of the depleted status of remaining sea turtle stocks, there is no credible alternative to a moratorium if the long-term objective is to retain sea turtles as a vibrant component of the local fauna. It is noteworthy that recovery will be slow, even if a moratorium was enforced immediately. Sexual maturity in Caribbean sea turtles is often not attained before 20-35 years of age. Thus, the fruit of the conservation agenda we adopt today will not be fully seen until our smallest children are grown.

4.231 Eggs

Female turtles produce hundreds and often thousands of eggs over the course of their reproductive years. Each turtle lays several clutches of eggs during the years in which she is reproductively active. Furthermore, it is common for females tagged on the nesting beach to be seen nesting regularly (generally every 2-3 years) for a decade or more, laying literally thousands of eggs. Only a fraction of these eggs will hatch and very few hatchlings will survive the decades preceding sexual maturity. High productivity on the part of the females serves to balance high natural rates of young juvenile mortality. It is vital that eggs laid on the beaches of St. Kitts and Nevis be allowed to incubate undisturbed so that as many hatchlings as possible are produced. Even under the best of circumstances, the measurable recovery of depleted sea turtle stocks will come slowly. Without sufficient recruitment into local nesting populations, these populations will diminish until they are completely gone. It is an unambiguous biological fact that the continued over-harvest of eggs will guarantee the extinction of local nesting populations, regardless of any other conservation measures. Therefore, it must be a recommendation of this Recovery Action Plan that the draft Fisheries Regulations of 1992, which include full protection for sea turtle eggs, be adopted and implemented without delay.

4.232 Immature turtles

Any continued harvest of the already depleted sea turtle resource is viewed as counter-productive to the objective of sustained recovery of local sea turtle populations. An in-

definite moratorium on the harvest of sea turtles (all species) of all sizes is urged at the earliest practicable time. It is a recommendation of this Recovery Action Plan that the draft Fisheries Regulations of 1992, which in keeping with the OECS Harmonized Legislation include full protection for sea turtles, be adopted and implemented without delay. It is noteworthy that relevant international treaties, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (section 4.31) and the United Nations Environment Programme's Cartagena Convention (section 4.32), classify and protect all six Caribbean species of sea turtle as Endangered. The nations of the Wider Caribbean are moving quickly toward full protection of these species, and St. Kitts and Nevis is encouraged to participate in this regional effort.

In the event that an immediate and indefinite moratorium on the harvest of sea turtles and their eggs is politically impossible, then interim legislation (described below) should be enacted for a period not to exceed one year. During this period, Fisheries personnel should be preparing the fishing community for a full moratorium. Whilst these interim regulations represent a significant advancement over the present regulatory framework (since presently there is no legislation whatsoever governing the harvest of sea turtles or their eggs), they are in no way capable of realizing the objective of a sustained recovery of depleted sea turtle stocks. They are intended only to serve as a credible intermediate step toward full protection.

Any interim regulations should restrict harvest to juvenile green and loggerhead turtles, and further confine it to turtles with a curved carapace length *less than* 24 inches (60 cm). Small juvenile turtles are completing a period of rapid growth. If turtles must be harvested, this size class is more capable of being replaced than adults. We recommend that the harvest of olive ridley, hawksbill, and leatherback turtles *of any size* be forbidden. Olive ridley and hawksbill turtles 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. With this in mind, the following text is suggested:

21.(1) The close season for turtle until otherwise declared shall commence from the 1st day of March and end on the 30th day of November of every year.

(2) No person shall:

- (a) catch or take, or attempt to catch or take, or cause to be caught or taken any Green turtle (Chelonia mydas) or Loggerhead turtle (Caretta caretta) during the close season; or
- (b) notwithstanding the provisions of subsection (a), at anytime catch or take, or attempt to catch or take, or cause to be caught or taken any Green or Loggerhead turtle which is greater than 24 inches (60 cm) in carapace (shell) length; or
- (c) catch or take any Green or Loggerhead turtle using a Spear Gun (Fish Gun); or
- (d) buy, sell, offer or expose for sale, or have in his possession the whole or any part thereof of any Green or Loggerhead turtle during the close season; or
- (e) notwithstanding subsection (a) take, capture or disturb or attempt to take, capture or disturb any Green or Loggerhead tur-

- tle or the eggs of same found on the shore or within one hundred yards thereof; or
- (f) buy, sell, offer or expose for sale, or have in his possession eggs of any Green or Loggerhead turtle.
- (3) No person shall:
- (a) catch or take, or attempt to catch or take, or cause to be caught or taken at anytime or in any place any Hawksbill turtle (Eretmochelys imbricata), Olive Ridley turtle (Lepidochelys olivacea), or Leatherback turtle (Dermochelys coriacea) or the eggs of such turtles; or
- (b) buy, sell, offer or expose for sale, or have in his possession the whole or any portion of Hawksbill, Olive Ridley, or Leatherback turtles, including the meat, oil, shell or eggs of such turtles.
- (4) Any person contravening any of the provisions of these Regulations is guilty of an offence and shall be liable upon summary conviction to a fine of \$5,000 or to imprisonment of 12 months; and, in addition thereto, any turtle parts, products or eggs and any boat, vehicle and/or equipment used in connection with the commission of an offence specified in Regulation 2 or 3 shall be forfeited to the Crown save and except that no such forfeiture shall take place in the event of the owner thereof satisfying the Court that he did not know of the use thereof in the commission of such offence.

Turtles must be landed alive in order that oversized turtles and protected species can be released unharmed. Thus, the provision that turtles not be speared is an important one. In addition, nets should be checked regularly to ensure that ensnared turtles do not drown or become vulnerable to depredation. It is a recommendation of this Recovery Action Plan that spearguns be licensed for use in the territorial waters of St. Kitts/Nevis. The draft Fisheries Regulations of 1992 prohibit the use of spearguns by persons who do not first obtain written permission from the Chief Fisheries Officer. A hawksbill turtle washed up dead on the SEP in 1991 with a spear hole through its neck (R. Pereira, pers. comm., 1992). In April 1992, Ross University students speared a turtle in Whitehouse Bay (David Howlett, Kenneth's Dive Ctr, pers. comm., 1992). Turtles landed legally should be killed as humanely as possible prior to butchering.

4.233 Nesting females

Sea turtles are long-lived and females lay eggs for many years. Adult sea turtles represent decades of selective survival (sexual maturity is reached for most species in the Western Atlantic at 20-35 years), they are the most difficult life stage for a population to replace, and they are (along with subadults just entering their breeding years) the most important life stage for the survival of a sea turtle population (Crouse et al., 1987; Frazer, 1983, 1989). It is crucial to remember that, regardless of the expense and care taken to protect sea turtle habitat, eggs and juvenile life stages, it is inevitable that we will lose the turtle populations that nest in St. Kitts/ Nevis if we continue to eliminate our breeding animals. It is an urgent recommenda-

tion of this Recovery Action Plan that adult turtles be protected at all times and under all circumstances.

4.234 Unprotected species

All species are unprotected at this time. It is important that any future conservation regulations explicitly ban the capture, possession and sale of all sea turtle species and their eggs. "Possession" should be defined so as to preclude prosecution of persons owning sea turtle shells and other decorative items legally obtained prior to the moratorium.

4.24 Augment existing law enforcement efforts

Recognizing that environmental law is becoming increasingly important and increasingly technical in St. Kitts/Nevis, as is the case throughout the Eastern Caribbean, it is a recommendation of this Recovery Action Plan that the Division of Conservation (presently comprised of a single officer) within the Ministry of Agriculture, Lands, Housing and Development be retitled the Division of Environmental Enforcement. A minimum of three officers (two in St. Kitts, one in Nevis) should be hired to oversee compliance with environmental legislation. These officers should be 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. A Workshop should be convened jointly by the Ministry, the Police, Customs/ Immigration, and the Coast Guard to better inform all officers of conservation regulations and the urgent need to consistently enforce domestic and international laws protecting turtles, lobsters, conchs, etc. A Manual of existing environmental legislation should be developed for public distribution.

Clear and public support from senior Government officials is a prerequisite for effective conservation enforcement. This would foster a greater sense of confidence among arresting officers that offenders would be prosecuted. The media and the non-government conservation community (e.g., SCHS, NHCS, NEEC) have an important role to play in encouraging a national consensus that conservation laws are important. Public participation in law enforcement is crucial. Violations should be reported. Complaints should be aired by the national media when reports of violations are ignored. Divers and fishermen are in unique positions to monitor offshore damage to habitat, report out-of-season catches, and exert peer pressure to prevent violations. The owners of residential and commercial beach-front property should be enlisted to report turtles caught or eggs collected out of season, and to monitor nesting beaches for poaching and other disturbances. To date, very few arrests have been made for the violation of conservation laws and fines and other penalties have not been levied. A precedent is needed. Once an example has been made, news of a "new attitude" toward offenders will spread quickly. That new attitude should permeate all sectors of society, and ensure that convicted violators will not be allowed to plunder the environment that all residents depend on for a secure future.

4.25 Make fines commensurate with product value

The Fisheries Act of 1992 provides no explicit protection for sea turtles, but does allow the Minister to promulgate regulations regarding the protection of sea turtles. The Act further

provides for a fine "not exceeding five hundred dollars" for a convicted offence against such regulations as are made by the Minister. A fine of EC\$ 500 is clearly insufficient to act as a reasonable deterrent against the illegal harvest of sea turtles. The draft Fisheries Regulations of 1992 include a year-around ban on the harvest of sea turtles and indicate that "any person contravening any of the provisions of these Regulations shall be guilty of an offence and shall be liable on summary conviction to a fine not exceeding five thousand dollars." A fine of EC\$ 5,000 exceeds product value in the case of sea turtles and should be adopted. In addition, it is important to provide for the confiscation of equipment used in connection with an offence and the forfeiture of any turtles, eggs, or parts thereof in the possession of the offender.

4.26 Investigate alternative livelihoods for turtle fishermen

Local fishermen participate in a multi-species fishery. No one depends on sea turtles for their livelihood at the present time, though in some cases the income derived may be seasonally important. There appear to be 10-20, perhaps fewer, part-time turtle fishermen based in Nevis; the annual reported catch in the last five years has sometimes exceeded 100 turtles (Wilkins and Barrett, 1987; Barrett, 1988). There are no comparable statistics for St. Kitts. Interviews conducted for this Recovery Action Plan revealed widely divergent estimates of the number of Kittitians involved in the fishery. The number of turtles landed in St. Kitts each year probably exceeds 100, all species combined (see section 3.3). In addition to the more-or-less "traditional" turtle and egg hunters (beach watchers, net fishermen), a growing number of spearfishermen are landing turtles opportunistically whenever they are encountered. Since reef fisheries in general are declining, alternatives to turtling must involve enhancing the productivity of local fish stocks (and thus fishermen's incomes) by, for example, manufacturing and deploying fish attracting devices (FADs) and establishing marine reserves. Spearfishermen should become more involved in fishing co-operatives, in discussions of fisheries enhancement, and in conservation initiatives.

In order to collect baseline data, it is a recommendation of this Recovery Action Plan that the Fisheries Division conduct a Sea Turtle Fishery Frame Survey. To the extent possible, bearing in mind that formal records have not been kept, the following should be determined: (1) number of men active in the turtle fishery, (2) number of turtles caught per year, (3) species and size classes caught, (4) capture methods, (5) capture/landing sites, (6) catch per unit effort, (vii) gear in possession, (8) gear used and frequency of use, (9) cost of gear, (10) market price for turtle meat and products, (11) income and proportion of total income derived from turtles. The exercise will also provide an opportunity for Fisheries and/or co-operative personnel to talk with fishermen about the endangered status of sea turtles, emphasize the importance of a region-wide moratorium on these migratory species, and solicit comments and other input. Historical trends in catch per unit effort are also important to determine whenever possible. Do hunters have to travel further today than they did 20 years ago to obtain turtles? Set their nets (or wait on the nesting beach) for longer periods of time? With Frame Survey data in hand, credible scenarios for enhancing alternative sources of income can be developed and implemented.

The following points should be made when talking to fishermen about endangered turtles and the necessity for protecting them:

1. Sea turtles are long-lived, reaching sexual maturity in 20-35 years.

2. Mortality is high in young juvenile stages, but extremely 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 in order that populations remain stable.
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. Harvesting large turtles, especially gravid females, is the surest 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. Kitts/Nevis, 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 -- these 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. Adult females return to St. Kitts/Nevis at regular intervals to lay their eggs and then leave at the end of the nesting season to return to feeding areas most likely located in distant countries.
12. All nations must work together if this shared resource is to survive.

In addition to efforts in-country, Ralph Wilkins and Audra Barrett (Fisheries Division) both feel strongly that an international (at least Eastern Caribbean) general fisheries workshop for fishermen and government fisheries personnel should be convened. In this forum, the fishermen themselves could become more involved in the issues, exchange ideas, evaluate alternative livelihoods, explore gear modifications, and participate in regional decision-making. In the past, only government personnel have been invited to attend such workshops; consequently, the gatherings sometimes degenerate into merely bureaucratic affairs.

4.27 Determine incidental catch and promote the use of TEDs

There is no local or foreign shrimp trawling in St. Kitts or Nevis. Commercial trawling does not, therefore, pose a threat to sea turtles locally and there is no reason to promote the use of the turtle excluder device (TED), a device designed to release turtles from shrimp trawls before they drown, in the waters of St. Kitts/Nevis.

Turtles are occasionally caught in beach seines or gill nets set for fish. An expanding longline industry may create an incidental catch problem. The industry currently uses bottom-set hooks which are unlikely to pull in sea turtles; however, sea turtle catches are reported in areas where hooks are suspended in the water column. The capture of leatherbacks by longlines has

been documented in the northeastern Caribbean (Camber and Lima, 1990; Tobias, 1991), the southeastern U. S. (Witzell, 1984), and the Gulf of Mexico (Hildebrand, 1987). Leatherbacks and loggerheads are captured in Antigua (Fuller et al., 1992). Fisheries personnel should be aware that the longlining industry has the potential to accidentally catch and kill sea turtles during normal operations. 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. Mitigating measures should be imposed should incidental capture be reported.

4.28 Supplement reduced populations using management techniques

Up to the present day, commercial development of important nesting beaches in St. Kitts and Nevis has not been extensive. The obvious explanation for reduced populations of sea turtles is the virtually unregulated harvest which has continued for many generations (section 3.3). Therefore, the recommendations of this Recovery Action Plan are as follows. Highest national priority should be the implementation of a moratorium on the capture, collection, and sale of sea turtles and their eggs (section 4.23). Second, important nesting and feeding grounds must be protected from degradation. Once important habitat has been identified (section 4.11), regulations designed to offer long-term habitat protection should be enacted (sections 4.13, 4.14). The protection of habitat should include the designation of Sea Turtle Refuges that include major nesting grounds (section 4.12). Should the adoption of more elaborate strategies, such as turtle tagging, predator control, or the construction and maintenance of an egg hatchery be desirable, methodology should follow that described in the Manual of Sea Turtle Research and Conservation Techniques (Pritchard et al., 1983). Advice and training is available from the WIDECAS project.

An individual sea turtle has the capacity to lay thousands of eggs in her lifetime, yet the probability that a given egg will lead to the production of a mature female is less than one percent. Many hundreds of hatchlings must enter the sea for each female that survives to adult-hood. For all sea turtle nests not harvested but allowed to develop, it is a recommendation of this Recovery Action Plan that it be a conservation management goal to see that at least 50% of these hatch successfully. Recognizing that there will continue to be productivity losses to predators, erosion, natural levels of infertility, etc., it is important that Government take quick steps to protect eggs from human consumption. Where necessary to protect eggs from poachers or predators, fenced hatcheries may have to be considered. But hatcheries should be used only if absolutely necessary. The artificial incubation of eggs and the improper handling of eggs and hatchlings can be disastrous. Incubation temperature is largely responsible for determining hatchling sex, so any attempt to artificially incubate eggs may skew normal sex ratios.

The occasional erosion-prone nest should be relocated to a safe place on the natural beach. The decision to do so should be made at the time of egg-laying. If eggs are moved after the first 24 hours of incubation, 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 so that the temperature of incubation is not altered. Hatchlings should always be allowed to emerge from the nest naturally and traverse the beach unaided as soon as they emerge. Hatchlings should never be retained as pets. Each hatchling is very important and contributes to the probability that enough turtles will mature to perpetuate the population. These hatchlings, when mature in about 20-30 years, will return to the beaches of St. Kitts/Nevis to lay the eggs of the next generation.

4.29 Monitor stocks

It is a recommendation of this Recovery Action Plan that sea turtle populations, at least breeding populations, be closely monitored for long-term fluctuations in numbers that will reveal the success or failure of conservation efforts. Index Beaches on each island should be selected for intensive monitoring. Volunteers should be solicited to participate in monitoring programmes; training workshops should be convened as needed (section 4.55). Research to provide statistical estimates of stocks should be encouraged and a long-term stock assessment programme to identify trends over a period of decades should be developed [N.B. population monitoring should continue for at least one sea turtle generation; that is, about 25 years]. A government office or conservation organization on each island should be designated to function as a repository for statistical data. The following subsections articulate acceptable methodology regarding 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

Leatherbacks, green turtles, and hawksbills lay their eggs in St. Kitts/Nevis (section II). Leatherback nesting is likely to commence in March or April, followed by green turtles in June, and hawksbills in July. Elsewhere in the Caribbean, leatherbacks generally terminate nesting by mid-July, but the other species will continue to nest into the winter season, with hawksbills active through December or later. 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.

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. There has never been an attempt to monitor nesting activity for an entire breeding season, nor has there 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, buried

glass, water; the sand may be too dry to hold a nest cavity), and injuries such as a missing flipper. If funds become available, personnel should be hired to conduct nocturnal censuses of important nesting beaches in order to document the actual deposition of eggs. A nest:false crawl ratio determined from the night patrols will permit an estimate of nest density from crawl tallies obtained during day census efforts. In the interim, 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.

It is usually difficult to confirm eggs during day surveys, but sometimes 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 the 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 her flippers. In the second case, the pattern alternates like a zipper, a result of the turtle moving her front flippers in an alternating rhythm. Leatherbacks leave a deep, symmetrical crawl about two meters in width. Green turtles also leave a symmetrical crawl, but it is only about one meter in width and the nest site is often characterised by a deep, solitary pit a meter or more in depth and breadth. Hawksbills and loggerheads leave an asymmetrical crawl, the hawksbill about 0.7 m in width and the loggerhead about 1.2 meter in width. The hawksbill crawl is often very faint, however, 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). In addition, hawksbills will often make their nests deep within the shelter of Coccoloba or other beach vegetation.

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. Thirty hawksbill tracks on a beach may represent only 20 actual nests, which in turn represent only *four* 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 patrol must be undertaken by trained personnel and the tagging of nesting females initiated. 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. However, valuable insight on the international movements of local sea turtles can be obtained from even short-term tagging.

Since it is neither practical nor necessary to monitor all the sandy beaches in St. Kitts/Nevis, it is a recommendation of this Recovery Action Plan that Index Beaches be selected for comprehensive study. An island-wide survey, as recommended in section 4.112, should be conducted to identify with confidence which areas are most used by turtles. At least two beaches with the most nesting activity on each island should be carefully protected from activity that will compromise the suitability of the habitat to support sea turtle nesting. Data collected from these will enable the Fisheries Division 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).

In section 4.12, we suggested that the Index Beaches be declared "Sea Turtle Refuges" under the authority of the NCEPA. Since these beaches represent the most important nesting areas for endangered sea turtles in St. Kitts/Nevis, it is vital to preserve them as focal points for conservation, management, and monitoring. The Atlantic beach from Cayon River to Key Ghaut (and perhaps south to Jack Tar Village), Sandy Point/Belle Tete (which supports three species of nesting sea turtles), and Sand Bank Bay in St. Kitts are good candidates for Index Beach (and Refuge) designation. In Nevis, Hurricane Hill Beach, privately owned, should be similarly considered.

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. 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 at hatching two months later. Photographs taken in three directions while standing over the nest are a useful reference.

Hatchlings can be expected after 55-75 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 oviposition 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.

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. Kitts/Nevis. 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 recognizable parts or derivatives thereof. Appendix I lists endangered species (including all species of sea turtle), trade in which is tightly controlled; Appendix II lists species that may become endangered unless trade is regulated; Appendix III lists species that any Party wishes to regulate and requires international cooperation to control trade; Appendix IV contains model permits. Permits are required for species listed in appendices I and II stating that export/import will not be detrimental to the survival of the species. CITES is one of the most widely supported wildlife treaties of all time. With the recent accession of Barbados, the Convention has 118 Parties (USFWS, 1992). CITES does not regulate or control any aspect of the domestic harvest and usage of species, including sea turtles; such regulations must promulgated by the national government.

Japan entered a "reservation" on hawksbill sea turtles when it joined CITES, and so has continued to trade in hawksbill products. There is no question that this trade has placed considerable strain on Caribbean populations. Between 1970 and June 1989, Japan imported 368,318 kg of tortoiseshell (the colourful plates that cover the hawksbill's shell) from the Wider

Caribbean region. Because each Caribbean hawksbill yields, on average, 1.34 kg of tortoiseshell, it is clear that this trade has consumed more than one-quarter *million* turtles. It appears that St. Kitts/Nevis has participated in this trade in recent years. For example, Japanese import statistics show that 136 kg of tortoiseshell was received from St. Kitts/Nevis in 1990, the equivalent of about 100 turtles. The trade is legal since St. Kitts/Nevis has not yet joined CITES. However, Fisheries personnel have no knowledge of any export permits granted for this purpose and seriously doubt that 100 hawksbills were taken from national waters for export in 1990. Alternatively, shell could have been stockpiled for a number of years and exported all at once in 1990, or unscrupulous dealers exporting shell illegally from CITES parties may have simply indicated that the shipment originated in St. Kitts/Nevis in order to evade CITES restrictions.

It is a recommendation of this Recovery Action Plan that St. Kitts/Nevis join CITES as soon as possible. If Japanese Customs data are correct and tortoiseshell is being exported from St. Kitts/Nevis, ratification of the treaty will halt this destructive practice. If St. Kitts/Nevis is simply being used by traders moving endangered species products through the region illegally, then ratification of the treaty will protect the reputation and sovereignty of St. Kitts/Nevis from this kind of abuse. The fact that Japan, in response to years of harsh and unyielding international criticism, agreed to halt all imports of sea turtle products as of 31 December 1992 (Donnelly, 1991) does not lessen the importance of ratifying the CITES treaty. There is also a significant annual export of meat (1400 lb in one shipment in October 1991, see section 3.3), especially from Nevis, to neighbouring islands, as well as "export" via tourists purchasing turtle jewelry and other trinkets. It is encouraging that Delroy A. Joseph (Senior Customs Officer) attended a 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 familiarize Eastern Caribbean governments, especially non-CITES parties, with the Convention.

4.32 Regional treaties

In 1940, the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere was negotiated under the auspices of the Pan American Union. Twelve of the Parties to the Western Hemisphere Convention are in the wider Caribbean region. However, the Convention contains no mechanism for reaching decisions binding upon the parties, but leaves each Party to implement the treaty's provisions as it find "appropriate". The Bonn Convention for the Conservation of Migratory Wild Animals, if ratified by enough nations in the wider Caribbean, could be an effective tool in the conservation of migratory species, such as sea turtles. It was developed to deal with all threats to migratory species, including habitat destruction and taking for domestic consumption. Unfortunately, only France, the Netherlands and the United Kingdom, among nations with claims in the Caribbean Sea, have signed this Convention.

The 1973 International Convention for the Prevention of Pollution from Ships (MARPOL) is a landmark treaty that should be ratified by St. Kitts/Nevis. MARPOL 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 minimise operational discharges. The five Annexes are for oil, chemicals in bulk, packaged chemicals, liquid sewage, and garbage. Annex

V (pollution by garbage) was amended in 1991, making the Caribbean a "Special Area". Stricter requirements are applied to special areas than elsewhere, in order to provide greater protection for the environment.

The most important treaty for St. Kitts/Nevis to ratify with regard to the protection of sea turtles and the habitats upon which they depend is the United Nations Environment Programme's (UNEP) Regional Seas Convention in the Caribbean, known as the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (or, "Cartagena Convention"). The Convention is coupled with an Action Plan, known as the Action Plan for the Caribbean Environment Programme (APCEP). The First Intergovernmental Meeting on APCEP was convened by UNEP in cooperation with the Economic Commission for Latin America (ECLA) in Montego Bay, Jamaica, 6-8 April 1981. The representatives of Governments from 22 States in the region (St. Kitts/Nevis was not represented) adopted APCEP at this meeting and established the Caribbean Trust Fund to support common costs and activities associated with the implementation of the Action Plan.

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

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

On 11 June 1991, Plenipotentiaries again met in Kingston, Jamaica, to formally adopt the Annexes. The Conference voted unanimously to include all six species of sea turtle inhabiting the Wider Caribbean (i.e., Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Dermochelys coriacea, Lepidochelys 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. Although the Government of St. Kitts/Nevis has periodically contributed to the Caribbean Environment Programme Trust Fund, as of 31 July 1992 it had not yet ratified the Cartagena Convention (UNEP, 1992). It is a recommendation of this Recovery Action Plan that the Cartagena Convention and its Protocols be ratified and implemented by St. Kitts/Nevis as soon as possible.

4.33 Subregional sea turtle management

It is well documented that sea turtles are among the most migratory of Caribbean fauna. There have been hundreds of cases of turtles tagged in one area and captured in another. Leatherbacks tagged in locales as distant as Chesapeake Bay (USA) and Tortuguero (Costa Rica) have been killed after swimming into Cuban waters (Carr and Meylan, 1984; Barnard et al., 1989). One leatherback tagged while nesting on St. Croix (USVI) later stranded in New Jersey, US (Boulon et al., 1988); another was captured in Campeche, Mexico (Boulon, 1989). A leatherback tagged while nesting in French Guiana in May 1970 was caught one year later in Ghana, west Africa, some 6000 km away (Pritchard, 1973). Juvenile hawksbills tagged in the USVI have been recovered in Puerto Rico, St. Lucia, St. Martin, Ginger Island (BVI) (Boulon, 1989) and the Dominican Republic (Ralf Boulon, USVI Div. Fish and Wildlife, pers. comm., 1991). A young hawksbill tagged in Brazil was killed 3700 km away by a fisherman in Dakar, Senegal, six months later (Marcovaldi and Filippini, 1991). An adult hawksbill tagged on Long Island (Antigua) whilst nesting was later captured by a fisherman in Dominica (Fuller et al., 1992).

Adult green turtles tagged while nesting in Costa Rica have been recovered from the Greater Antilles (Cuba, Jamaica, Puerto Rico), the USA, Mexico, throughout Central America, and from Colombia and Venezuela (Carr et al., 1978; Meylan, 1982). Juvenile green turtles tagged in the USVI have been recaptured in the Grenadines, the Dominican Republic, and the Bahamas (Boulon, 1989). Green turtles nesting in Suriname are routinely recaptured in Brazil (Pritchard, 1976). Meylan (1983) reported that "several" green turtles captured by nets off the southeast and southwest coasts of Nevis, as well as in the vicinity of Newcastle, have borne tags originally put on at the nesting beach on Isla Aves, some 200 km to the southwest. Indirect evidence of the migratory nature of sea turtles is also available in St. Kitts/Nevis -- all turtle fishermen are familiar with the seasonal arrival of gravid (=egg-bearing) turtles prior to the annual nesting season. Tagging efforts in St. Kitts/Nevis would be useful in further clarifying the international movements of Caribbean sea turtles. Mr. Augustine Merchant (Director, Department of Agriculture, Nevis) has approached WIDECAST asking that interested Nevis fishermen be taught how to tag and then release turtles caught incidental to other fishing activities.

It is intuitive that any action taken to protect sea turtles must be shared among nations that hold these species in common. This is why the WIDECAST project is active in all countries of the Wider Caribbean (the West Indies and Latin America), developing recovery plans and setting priorities for national and international action on behalf of remaining sea turtle stocks (section 4.53). In the case of St. Kitts/Nevis, it is virtually certain that foraging populations are shared with other nations and territories in the northeastern Caribbean. Juvenile turtles travel widely during the decades prior to sexual maturity. In addition, nesting females may travel hundreds or, in the case of leatherback turtles, thousands of kilometers in order to lay their eggs on the beaches of St. Kitts/Nevis. Fisheries staff are encouraged to alert fishermen to the impor-

tance of turtle tags, and to request that tags be submitted to the Fisheries Division so that the scientist who tagged the turtle can be notified [N.B. a tag should *never be removed from a live turtle*; if the turtle is alive, record the number and the address engraved on the tag and release the turtle]. Quentin Henderson (VSO), bee-keeper, has kindly offered to give complimentary jars of honey to Nevis fishermen who turn tags in to the Fisheries Division.

There are several ways in which St. Kitts/Nevis can participate in the regional and subregional conservation of sea turtles. The ratification of international wildlife treaties and agreements that protect marine and coastal environments are particularly useful. Some of the more important treaties have already been discussed in this document (e.g., CITES, Cartagena Convention). In addition, the Organization of Eastern Caribbean States (OECS) has considered subregional conservation measures that deserve the support of St. Kitts/Nevis, including an OECS-wide moratorium on the harvest of sea turtles. Wilkins and Barrett (1987) concluded that "turtle stocks in this part of the region [are] on the decline. . . . The OECS countries should be encouraged to implement the harmonized regulations giving effect to the moratorium on sea turtle fishing. Steps should be taken to encourage this to [all] wider Caribbean countries." St. Kitts/ Nevis is encouraged to participate fully in all relevant international programmes. Only in this way will national conservation efforts be successful in the long-term.

4.4 Develop Public Education

4.41 Residents

"In general, the populace of St. Kitts/Nevis, as elsewhere in the region, do not appear to be fully sensitised about the values or benefits of conservation and the role that careful management of the environment plays in national development. Neither is the corollary of this appreciated. Negative impacts upon national development, biodiversity, human health and the quality of life which result from mismanagement of the environment are not part of the consciousness of the average citizen." (James, 1992). Making the environment part of the consciousness of the average citizen is crucial to the sustained survival of both the human residents and the wildlife, especially the endangered wildlife, of the Caribbean basin. Fortunately, grass-roots advocacy groups throughout the region are becoming more involved with teaching their fellow citizens the value of wildlife, wildlands, a clean environment, and monitoring compliance with wildlife regulations. This is certainly true in St. Kitts/Nevis, where there is growing cooperation between conservation groups (e.g., NHCS, SCHS) and community service groups, educators, church groups, Fisheries and other government officials, marine resource user groups (fishermen, yachters, SCUBA divers), and media representatives.

Sea turtles are particularly good candidates for public education campaigns. They are easily cast as symbols of the health of the coastal zone, both marine (coral reefs and sea grass) and terrestrial (sandy beaches). Many residents have seen turtles in one setting or another, and the connection between protecting sea turtles and protecting large segments of the economic base of St. Kitts/Nevis (e.g., fisheries, tourism) can be clearly articulated. There have been several examples in recent years of public awareness efforts on behalf of sea turtles, including informative articles in local newspapers and NGO newsletters. WIDECAST has provided slides to NHCS and SCHS for educational use and is working with both groups to design a colourful

sea turtle brochure. Since 1991, Karen Eckert (Executive Director, WIDECAST) has given more than two dozen slide shows to audiences in St. Kitts and Nevis, typically sponsored by the NHCS or SCHS. Adults and school children have been targeted, and both groups have responded with long sessions of animated questions. Radio and television interviews have also aired.

The message has found its way into local business and community service programmes. For example, the Turtle Beach Bar and Grill on the Southeast Peninsula requested assistance from WIDECAST in designing an informative sea turtle exhibit (poster, photos, log book for sightings) now displayed at the restaurant and popular with guests. The Librarian of the Nevis Public Library has asked WIDECAST to provide a variety of educational materials and games in order that the topic of the 1992 annual Summer Library Programme can be "Endangered Sea Turtles of St. Kitts and Nevis". The three-week summer programme will serve several hundred community children of all age groups.

Churches have also become involved in the essential work of community environmental awareness. For example, in 1990 during Environmental Awareness Week and again on World Environment Day in June 1992, the Responsive Prayers read at Gingerland Methodist Church included the following lines:

Leader:	You gave us sandy beaches and we were greedy and raped them. Lord forgive us....
All:	And show us a new way.
Leader:	You gave us fish and turtles for food and we exploited them and cared not whether they replenish. Lord forgive us....
All:	And show us a new way.

As early as December of 1981, the NHCS published a notice in the local press in an attempt to discourage the harvesting of juvenile and egg-bearing lobsters and turtles. "This announcement appeared weekly for a period of about three months and was the first attempt by any local organization to nationally address the problem of conservation of marine resources" (Skerritt, 1982). As the Lead Organization for WIDECAST in Nevis, the NHCS remains very active on behalf of turtles. *EcoNews* and *The Environmentalist*, both published by the NHCS, feature regular articles on the endangered status of sea turtles and how the community can become more involved in their conservation. The NHCS has plans to construct a permanent airport display which will include sea turtle information, as well as a "traveling display" to rotate among interested local businesses (such as banks and medical offices) that will focus on natural resource conservation. The Society will continue its history of writing issue-letters to merchants, restaurants and hotels, sponsoring radio announcements on contemporary marine issues, and hosting public seminars. Through WIDECAST, NHCS has requested several hundred copies of the Center for Marine Conservation's "Sea Turtle Colouring Book" for distribution to primary schools.

In January 1989, the NHCS sent a letter to Nevis restaurant owners highlighting several matters of concern, including the endangered status of sea turtles. The letter read, in part: "The offering of turtle on the menus of local hotels is a serious concern. Sea turtle species are endangered throughout the world and Nevis is no exception. Concerned groups throughout the

region are suggesting a ten-year moratorium on sea turtles ... Even without the harvesting of sea turtles and sea turtle eggs, the species will have a hard time surviving. Encroaching civilization -- populated beaches, lighted beaches, the loss of sea grass and mangrove swamps as a result of clearing, garbage dumping, and siltation from land clearing -- makes it hard for sea turtles to survive ... Fishermen only harvest what they can sell, and when everyone refuses to buy sea turtles, the fishermen will quit taking them. Repeated refusals from prospective buyers will get the message across." As a direct consequence of this campaign, several local restaurants have agreed to remove sea turtle meals from their menus.

Similarly, the SCHS Marine Division focuses on issues directly affecting sea turtles and other marine resources. *Heritage* regularly features informative articles on the status and conservation of the coastal zone, including sea grasses, coral reefs and sandy beaches so important to the survival of sea turtles. The Marine Division has been an active participant in the development of this Sea Turtle Recovery Action Plan, soliciting input from a broad cross-section of the community, including persons representing fishermen, SCUBA divers, restaurant owners and hoteliers, coastal developers, Fisheries personnel and educators, and hosting "Town Meetings" to discuss the document. The SCHS has offered to distribute sea turtle awareness materials, plans to develop a sea turtle display at the SCHS office, initiated a survey of nesting activity on several known nesting beaches during the summer of 1992, and has an active campaign to discourage people from driving on nesting beaches (see section 4.134). An informative video en-titled "Underwater St. Kitts and Nevis" has been produced as part of the SCHS Marine Environment Education Programme. A variety of other educational materials are in the planning stages and some are being developed in cooperation with WIDECAS.

There is widespread support for a "Sea Turtle Awareness Week" in St. Kitts/Nevis. A coordinated, national effort would ensure that all residents were exposed to the message of sea turtle (and coastal) conservation. In 1991, the NHCS and WIDECAS submitted a proposal to the local office of Shell Antilles and Guianas, Ltd., for a small grant to facilitate the effort. The objectives were (1) to promote an awareness within the general public of the plight of sea turtles, nationally and regionally, (2) to provide the community with the latest scientific information on the biology of sea turtles and how to conserve them, (3) to encourage media involvement in the issues, (4) to sponsor hands-on workshops on sea turtle population monitoring and conservation, (5) to enhance local ability to make informed decisions regarding such issues as coastal development, sea turtle conservation, and law enforcement, and (6) to strengthen the effectiveness of local initiatives, such as the Ecosystem of Nevis Project and various projects of the SCHS Marine Division. Shell subsequently turned down the proposal, but an Awareness Week (including seminars, media events, workshops, and the distribution of educational materials) is a priority for the NGO community and support will be sought elsewhere.

It is a recommendation of this Recovery Action Plan that the WIDECAS project, in continuing cooperation with local conservation groups and government agencies, develop a variety of educational materials suitable for wide public distribution. These should include colourful, scientifically accurate, conservation-oriented materials that can be integrated into primary and secondary school curricula, adult education classes, fisheries extension programmes, coastal development seminars, general environmental education campaigns, print and electronic media programmes, and public displays (e.g., airports).

4.42 Fishermen

It is intuitively obvious that enforcement is impractical, if not impossible, in the absence of public knowledge of and support for the law(s) being enforced. This is particularly true for user groups such as fishermen. Fishermen, especially older individuals who have seen stocks decline noticeably during their lifetimes, are keenly aware of the depleted status of sea turtles. For this reason, there was fairly broad support from within the fishing community for legislation proposed in 1986 (and again in 1992) to ban the catch of sea turtles (see section 4.23). Prior to the 1992 Fisheries Act (which repealed the closed season), Fisheries personnel announced the closed turtle season on the radio and through Department of Agriculture publications; hotels were also reminded. Despite widespread knowledge of the law, varying levels of harvest occurred year-around since there has never been any credible likelihood of prosecution. A chance encounter with a sea turtle was (and is) difficult to pass by when the catch had otherwise been slight. Turtle meat sells for EC\$ 2-5/lb.

It is imperative to reach out to those who hunt and most frequently have contact with sea turtles. Targeting other groups, such as school children, planning boards and tourists, without the cooperation of direct users of the marine environment would be counter-productive. Fishermen should be involved in decisions regarding open and closed seasons, size limits, etc. Their participation in seminars and slide shows should be (and has been) sought so that they are aware of the status of sea turtles, their complicated life history in the Caribbean, and what is required to promote their recovery. Educational efforts should be directed both to individual fishermen and to fishing Co-operatives, and should be facilitated by Fisheries personnel and Co-operative officers. Workshops and/or special sessions in regular meetings of fisherman's Co-operatives would be helpful. Ongoing exchanges of information should be promoted by making displays, leaflets, and other items available at Co-operative buildings and/or landing sites. It is significant that fishermen, Co-operative officers, and Fisheries personnel were active participants in the development of this Recovery Action Plan.

The Department of Agriculture sponsors, or has sponsored in the past, several venues that allow Fisheries personnel to share information with fishermen and the general public. Radio DJs are given "Fisheries Facts" to work into their air time each day. "Agriscope", developed by the Communications Unit of the Department of Agriculture, airs twice weekly on the radio and focuses on topics of current fisheries interest, such as turtles, oil spills, gear, etc. It has been suggested by some members of the fishing community that a 15 minute radio programme each day, which discusses sea turtles and urges residents not to kill them or take their eggs, would be successful in St. Kitts/Nevis. This type of natural resource programming would logically include a broad spectrum of general interest topics, such as waste disposal and pollution, the biology of native birds and mammals, the importance of fragile habitats (such as the rain forest and coastal wetlands), and issues of interest to the fishing community.

It is a recommendation of this Recovery Action Plan that media programmes focusing on the marine environment, including endangered species such as sea turtles, be continued and expanded. It is also recommended that the participation and support of fishing Co-operatives be actively solicited during the development and implementation of conservation legislation. User groups should be given a chance to comment and provided with clear explanations about why

restrictions, such as on the harvest of sea turtles, are mandatory for the future of the resource. Finally, international workshops attended by representatives of the fishing community, rather than just government personnel, would allow fishermen to see that each local industry is important to larger fisheries conservation concerns in the region. At a sea turtle workshop, for instance, fishermen could be introduced to the latest information regarding survivorship, growth to maturity, fecundity, and the ability of sea turtle populations to recover from sustained exploitation. Alternative livelihoods should also be explored. Appropriate workshops might be sponsored by WECAF, or the Fisheries Unit of the OECS.

It is a recommendation of this Recovery Action Plan that Co-operative members and Fisheries extension officials be fully versed in the recommendations of this Recovery Action Plan. To best realize this goal, multiple copies of the Plan should be provided to Co-operatives (for sharing with members) and to the Fisheries Division. Copies should also be made available to the Director of the Fisheries Complex in Nevis and to similar marketing facilities, if relevant, in St. Kitts. Fishermen should be encouraged to participate in recovery actions, such as beach patrols and perhaps tagging. Mr. Augustine Merchant (Director, Department of Agriculture, Nevis) has already approached WIDECAST asking that interested Nevis fishermen be taught how to tag and then release the turtles they catch incidental to other fishing activities. If successful, a similar programme should be initiated in St. Kitts. Finally, a determined effort needs to be put forth to communicate the importance of sea turtle conservation to the spear-fishermen who, for the most part, do not belong to or participate in the fishing Co-operatives. The spearing of turtles is a serious and increasing threat to sea turtle survival.

4.43 Tourists

Tourism is increasing in St. Kitts/Nevis. The 1989 figure of 72,100 stay-over arrivals in the country is double the 1981 figure of 35,500 (CCA, 1991). If tourists are not to become an increasing part of the problem in terms of the environmental degradation of St. Kitts and Nevis, then visitor education will have to be a priority. The NHCS has engaged in a successful campaign to encourage restaurant owners in Nevis not to offer turtle meat on their menus (section 4.41). In concert with such efforts, it is important that persons to refuse to patronize restaurants and stores that offer turtle products. Since a few Basseterre stores still sell tortoiseshell items, tourists should also be made aware that if they are returning to any of nearly 120 CITES countries (section 4.31), sea turtle products will be confiscated upon their return home. If visitors refuse to buy sea turtle products, demand for them will decline and fishermen may not be inclined to harvest as many turtles. This information should be communicated through *Traveler* magazine and other literature widely read by visitors. WIDECAST and the NHCS are collaborating to design and distribute plaques or certificates to present to restaurants and merchants that do not serve or sell sea turtle products.

Other problems which affect sea turtles and are related to an increasing number of visitors include coral reef degradation, indiscriminate anchoring, waste disposal, and beach-front construction that brings lights and activity to nesting beaches. A colourful, permanent display at each airport that describes beach and marine etiquette (laws governing litter, anchoring, etc.) and the endangered status of some local wildlife (including sea turtles) should be a priority for local conservation groups. In addition, a leaflet should be provided to each tourist by Customs officials

requesting that visitors *not* buy turtle products, collect starfish, disturb coral reefs (trampling, anchoring, touching, collection), use spear-guns, drive vehicles on the beach, litter, etc. It would be helpful to reach cruise ship passengers and yachters, as well. The number of cruise and yacht passengers doubled between 1982 and 1983 and had tripled by 1989 (CCA, 1991). NHCS and SCHS should design appropriate brochures and other educational materials for tourists. Funding should be sought from local industries and private foundations.

Following the April 1992 capture and release of a large leatherback turtle from Oualie Beach, Nevis, John Yearwood, President of the St. Kitts and Nevis Hotel Association, spoke eloquently to the point that sea turtles have value not only to residents, but to visitors as well. He said, "Many visitors are attracted to our shores, in the knowledge that they have a good chance of seeing leatherbacks and other rare sea turtle species whilst snorkeling or SCUBA-diving in our crystal clear waters. A leatherback turtle of this great size and age is potentially exceptionally more valuable to our tourism industry, alive and free rather than dying painfully on a beach, totally out of its natural element. Our Government should give serious and urgent consideration to reviewing existing legislation to protect all endangered species in our Federation -- and to working with local fishermen and SCUBA-diving operators to identify coral reefs to be set aside as Protected Marine Parks, without endangering the livelihood of our hard-working local fishermen." (*The Democrat*, 25 April 1992).

4.44 Non-consumptive uses of sea turtles to generate revenue

"Good ecology is good economics". Several authors have extolled the beauty, diversity, and promise of the Southeast Peninsula of St. Kitts with regard to ecotourism, often with particular reference to the presence of sea turtles. Ecotourism, or the idea that tourists will visit St. Kitts/Nevis in order to partake of unspoiled natural and cultural attractions, has the potential to generate considerable income. Indeed, this has been the basis for an ongoing WWF-funded eco-tourism training programme by the NHCS. In St. Kitts, several reports submitted to the Southeast Peninsula Land Development and Conservation Board prior to the construction of the peninsular road emphasised the long-term value to the tourist industry of maintaining the ecological integrity of the peninsula's coastal zone. According to Williams (1992), "The future of our tourism development will depend on the extent to which the public and private sectors, and our people understand the relationship between tourism and the environment and take the necessary steps to ensure protection and enhancement of the natural and built environment. It is our *environment*, or rather the experience and enjoyment of it, that we promote and sell."

Sea turtles could play a supporting role in the generation of tourist income. Hotels with the foresight to plan for adequate setbacks, lighting restrictions, and pollution control; keep recreational equipment such as lounge chairs and sailboats from cluttering the beach at night; and resist armouring and other erosion control measures will find that sea turtles are likely to continue nesting on their beaches. Those choosing to capitalize on this fact may want to offer Sea Turtle Watches guided by trained naturalists, making it possible for guests to witness egg-laying and hatching on the hotel beach. This kind of programme can be designed by WIDECASST personnel, modeled after a successful programme in Antigua. A fee could be charged and ear-marked for conservation activities designed to maintain the sea turtle's nesting grounds. In addition to terrestrial attractions, local SCUBA dive professionals know that dive-

tourists are eager to see sea turtles and may be prone to return to those Caribbean sites where the elusive reptiles can be seen.

To quote Williams (1992) again, "Our survival and the quality of our lives today and in the future largely depends on the natural environment. With ecotourism, as with any activity intended to produce economic benefits, the inputs must be protected from becoming degraded." It is a recommendation of this Recovery Action Plan that the government and people of St. Kitts/Nevis work diligently for a balance between developing the material wealth of the nation and conserving the integrity of the supporting land and sea, the "principal" from which all income is (and forever will be) derived. An intact environment, including flourishing populations of sea turtles, is a sound ecological and economic investment. Short-term income can be derived from the sale and consumption of turtles and their eggs, but once the principal has been spent it cannot be replaced.

4.5 Increase Information Exchange

4.51 Marine Turtle Newsletter

The Marine Turtle Newsletter (MTN) is received by Fisheries Offices (Department of Agriculture) in St. Kitts and Nevis. In addition, the newsletter is received and archived at the Museum of Nevis History (formerly the Alexander Hamilton House Museum), the Nevis Public Library, the St. Christopher Heritage Society, and the St. Kitts Public Library. The MTN is distributed to readers in more than 100 countries and is an excellent way to stay informed about sea turtle biology and conservation around the world. The newsletter is available free of charge, is published quarterly in English and Spanish, and can be requested from: Editors, Marine Turtle Newsletter, Hubbs-Sea World Research Institute, 1700 South Shores Road, San Diego, California 92109 USA. Development authorities (e.g., Frigate Bay Development Board, Southeast Peninsula Land Development and Conservation Board) and other relevant groups, such as the Hotel Association and Fisheries Extension Office, should be encouraged to read the Newsletter.

4.52 Western Atlantic Turtle Symposium (WATS)

St. Kitts/Nevis participated in both Western Atlantic Turtle Symposia (WATS I, Costa Rica, 1983; WATS II, Puerto Rico, 1987) and plans to continue to participate in this important regional data base. The country was represented by Ralph Wilkins (Fisheries Division) and Anne Meylan (University of Florida) at WATS I, and by Ralph Wilkins and Audra Barrett (Fisheries Division) at WATS II. The WATS Manual of Sea Turtle Research and Conservation Techniques (Pritchard et al., 1983) is available for perusal at the Fisheries Office.

4.53 WIDECAST

The Wider Caribbean Sea Turtle Recovery Team and Conservation Network (WIDECAST) consists of a regional team of sea turtle experts which works closely with local Country Coordinators, who in turn enlist the support and participation of citizens in and out of government who have an interest in sea turtle conservation. The primary project outputs are Sea Turtle Recovery Action Plans (STRAPs) for each of 39 government regions, including St. Kitts

and Nevis, 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 (SPA) in the Wider Caribbean Region (see section 4.32). The longer-term objectives are to promote a regional capability to implement scientifically sound sea turtle conservation programmes by developing and supporting a technical understanding of sea turtle biology and management among local individuals and organizations. These objectives are accomplished by:

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

Beyond supporting the local and national efforts of governments and non-governmental organizations, WIDECAST works to integrate these efforts into a collective regional response to a common problem, the disappearance of sea turtles. WIDECAST is partially supported by the UNEP Caribbean Environment Programme, as well as by a wide variety of government and non-government agencies and groups. Non-government organization members, government personnel, divers, fishermen, teachers, restaurant owners, hoteliers, and a variety of concerned citizens are already actively involved in the WIDECAST project in St. Kitts/Nevis. The NHCS and the SCHS Marine Division are the Lead Organizations for the international WIDECAST project in St. Kitts and Nevis.

4.54 IUCN/SSC Marine Turtle Specialist Group

The Marine Turtle Specialist Group (Dr. Karen Bjorndal, 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 advice on conservation projects. For further information, contact Dr. Karen Bjorndal, Archie Carr Center for Sea Turtle Research, University of Florida, Gainesville, Florida 32611.

4.55 Workshops on research and management

Prior to the implementation of field surveys or other conservation projects, participants must be trained in basic sea turtle biology, including species identification (whether the evidence available is a turtle, egg, or beach crawl). Additional detail, provided as needed, should include proper methods to conduct beach patrols, transplant eggs, tag turtles, survey by air, etc. Informal local workshops can be arranged by WIDECAST upon request. The Lead Organizations for WIDECAST in St. Kitts and Nevis are the NHCS and the SCHS Marine Society; requests for assistance from the international WIDECAST technical team should be directed to these local groups. A short training course on sea turtle biology is available in Tortuguero, Costa Rica, from the Caribbean Conservation Corporation (P. O. Box 2866, Gainesville, Florida 32602).

For the most part, the training necessary to carry out many of the actions recommended in this Recovery Action Plan will need to be provided locally. With technical support from WIDECAST, it is recommended that NHCS, SCHS, and/or the Fisheries Division provide the necessary background to biologists, SCUBA divers, coastal developers, and residents who are interested in monitoring the status of sea turtles. A Manual of Sea Turtle Research and Conservation Techniques, produced by the Western Atlantic Turtle Symposium (Pritchard et al., 1983), provides instruction and background for many sea turtle research and management techniques. Programme managers are encouraged to follow this manual to the fullest extent when research and conservation projects are designed and implemented.

4.56 Exchange of information among local groups

If the non-government conservation community is to act as a fully functional ally of the fragile environment of St. Kitts/Nevis, then the full and constant exchange of ideas, resources, and published material is essential. The exchange of information is growing internally within each island, thanks to the tireless efforts of dedicated members of the NHCS and the SCHS, but a full exchange of information between the two islands is lacking. In Nevis, *EcoNews* and *The Environmentalist* are sent to all NHCS members, as well as to government Ministers, Police officers, teachers, and religious leaders. Extra copies are stacked at lawyers' offices, banks, and medical facilities to invite a wider audience. In St. Kitts, issues of the SCHS newsletter *Heritage* are available for sale to members and the general public. It would be very useful if grant monies could be secured for the free distribution of *Heritage* in order to encourage a wider readership among teachers, non-members, and others. A regular exchange of multiple copies of all relevant newsletters should occur between the two islands. Sea turtle conservation is one area of conservation that will depend on thoroughly integrated NGO efforts across the nation. It is also important that other relevant groups, such as teachers, media representatives, library staff, coastal residents, fishermen, boaters and SCUBA divers, be included in the routine exchange of information.

In Nevis, the Nevis Environmental Education Committee has successfully brought together a broad cross-section of the community to focus on environmental matters. These include representatives of Youth and Community Affairs, Adult Education, the Womens' Desk, Department of Education, Public Library, Nevis Historical and Conservation Society, Government Information Service, Representatives of the business sector, Public Health Department, Hotel Association, Fisheries Office, and Tourism officials. The Committee plans to provide bundles of leaflets ("fact sheets") on various topics, including sea turtles, at NEEC meetings so that participants can later distribute them within their own organizations.

4.6 Implement National Sea Turtle Conservation Programme

4.61 Rationale

It is clear from the information provided in this Recovery Action Plan that three species of sea turtle, all classified as "endangered" by the World Conservation Union (Groombridge, 1982; Groombridge and Luxmoore, 1989), utilize the waters and sandy beaches of St. Kitts and Nevis for feeding and for nesting. These species are the hawksbill, leatherback (river turtle), and green turtle (Figure 3). A fourth turtle, the loggerhead, is classified as "vulnerable" by the World Conservation Union and is occasionally reported in offshore waters. In order to prevent the local extinction of these species, government and non-government agencies and groups need to implement measures to conserve and manage remaining stocks. Planning for the conservation and management of sea turtles involves two steps: (1) the identification of habitat upon which sea turtles depend and (2) the elaboration of criteria and the implementation of regulations to ensure that serious habitat degradation is prevented and that all stages of the life cycle are protected to the greatest degree possible.

The objective of this Recovery Action Plan has been to provide specific sea turtle management recommendations which can be translated into regulatory action. If these recommendations are fully incorporated into the legislative and institutional framework of St. Kitts and Nevis, native sea turtles are likely to survive.

The virtually unregulated harvest of sea turtles and eggs over many generations, combined with historical and contemporary stresses on habitat, has resulted in a dramatic decline in the number of sea turtles feeding in local waters and nesting on the beaches. For example, six or more leatherbacks (sometimes referred to as "river turtles") could be observed per night on Conaree Beach 30 years ago, whereas today a hunter may wait several nights without seeing a single turtle. Older fishermen remember the green turtle to be common, especially along the Caribbean and peninsula coasts of St. Kitts; today nesting is rare. Residents recall when the beaches of the southeast peninsula were "covered with sea turtle crawls", both hawksbill and green, during the nesting season; a survey of six peninsula beaches during June-August 1992 revealed not a single green or hawksbill turtle nest. The same scenario has played out in Nevis. Similarly, the historical record provides evidence of sea turtles in local waters in abundances which are nearly unimaginable today. Even over the lifetime of older fishermen and divers interviewed for this Recovery Action Plan, the conclusion is inescapable that populations of juveniles and adults at sea have noticeably diminished. The trend is not so easily seen from year to year, but is unambiguous over the last four decades.

In 1948, a Turtle Ordinance (Cap 99) came into force that protected sea turtles and their eggs between 1 June and 30 September. The Ordinance also protected young turtles less than 20 lb (9 kg) at all times. Because the closed season did not encompass the full breeding season (peak: April-November) and enforcement was inadequate, the Ordinance was insufficient to provide for the long-term conservation of these species. This fact is clearly reflected in the current depleted state of local populations [N.B. it is now well known that the persistent harvest of large juveniles and breeding-age adults virtually assures population collapse; see section 4.23]. The Turtle Ordinance was repealed by the Fisheries Act of 1992, but since there is no specific provision for sea turtle conservation (size limits, seasons) in the new Fisheries Act, the nation now stands without any sea turtle legislation whatsoever. This situation will continue until new Fisheries Regulations are adopted. The draft Fisheries Regulations of 1992 include a moratorium on the harvest of sea turtles and their eggs at all times, and this stance is fully supported by this Recovery Action Plan. If a period of harvest is inevitable prior to the Regulations coming into force, then interim regulations declaring a *maximum* size limit and a closed season from 1 April to 30 November are recommended (see section 4.23).

In addition to historical and present-day deficiencies in national legislation, there are other threats to the survival of sea turtles that need to be considered and addressed. At the present time, sea turtles in St. Kitts and Nevis are jeopardized by three main factors: (1) the harvest of turtles and eggs, (2) the destruction of nesting and foraging habitats as a result of a rising human population, pollution, and increasing development and use, and (3) an under-staffed and insufficiently equipped Fisheries Division. A shortage of funding and material supplies (including a boat) hinders the Fisheries Division from carrying out a number of important activities, including implementing comprehensive surveys of turtle populations, purchasing measuring tools, tags, tagging equipment, and other basic research supplies, conducting regular extension and community outreach programmes, and monitoring compliance with fisheries and conservation legislation. Conservation efforts are also hindered, to varying degrees, by the following:

1. The coastlines of the St. Kitts and Nevis include about 30 km of sandy beaches. It is impossible with present resources to carry out regular and comprehensive patrols of all beaches throughout the year, or even during the eight months (April-November) when sea turtles would be most likely to nest. Lacking sufficient staff and transportation, neither the Fisheries Division nor the non-government conservation community has been able to systematically collect even the most basic information (e.g., how many nests are laid each year).

2. The marine areas of St. Kitts and Nevis (especially St. Kitts, with the exception of the Southeast Peninsula) have not been thoroughly surveyed or mapped with regard to the distribution or health of sea grass and coral reefs. These ecosystems provide the majority of food items for sea turtles resident or itinerant in local waters. Similarly, patterns of usage have not been studied. The areas most frequented by turtles are known only in a very general way. Thus, it has not been possible to determine which areas would serve most effectively as special conservation sites, or reserves, for sea turtles.

3. Due to the infrequency of beach and at-sea surveys and the complete absence of field conservation efforts aimed at apprehending sea turtle poachers, poachers have been able to kill turtles under-sized and/or out of season (when there was a season) and dig nests without being

caught. This is especially true with regard to digging nests. There was a consensus among persons interviewed for this Recovery Action Plan that the vast majority of eggs are collected each year and that this has continued for generations.

4. There has been no attempt at record-keeping regarding the number of turtles harvested each year. Attempts to obtain this information by interviewing fishermen and other residents have generally resulted in conflicting reports. For example, one group of five local spear-fishermen reported that each of them killed an average of one turtle per month, for an annual tally of about 60 turtles; other fishermen contend that that level of take is impossible. One regular diver reported seeing turtles on "80%" of his dives; others contend that encounters with turtles are rare at best. Some say that staying up all night waiting to take an egg-bearing female is a thing of the past; others say that in their village it is still common. While the qualitative trends are obvious, quantitative data capable of describing recent population declines are not available.

The constraints described above have made it difficult to reach conclusions on the distribution and size of nesting assemblages, nesting frequency and success, distribution and size of foraging populations, distribution and health of important feeding grounds, the number of fishermen involved in the harvest, and the number (and species) of turtles landed each year. Nonetheless, it is clear from interviewing local fishermen that nesting turtle stocks have noticeably declined from pre-World War II levels. Nesting populations of leatherbacks (river turtles) and green turtles appear to have suffered the most dramatic declines as a direct result of over-exploitation. In the future, the commercial development of beachfront property will place an additional burden on already depleted populations.

4.62 Goals and objectives

The broad goals of the proposed Sea Turtle Conservation Programme are to obtain comprehensive and accurate data on the distribution of sea turtle nesting and foraging populations and to promote the conservation and recovery of remaining sea turtle stocks. The specific objectives of the Programme are as follows:

1. Determine nest density and nest success to provide credible estimates of reproduction at two important nesting beaches on each island over five consecutive years, based on ground surveys. Estimate leatherback (river turtle) nesting on St. Kitts using ground and/or aerial surveys of Atlantic beaches and Sandy Point/Belle Tete.

2. Collect information relative to the distribution and abundance of turtles at sea over five consecutive years based on sightings data assembled during proposed coral reef monitoring programmes, as well as taking advantage of a volunteer sightings network.

3. Identify critical nesting and foraging habitats, based on the results of field surveys described in 1. and 2. above, and develop holistic management plans for critical habitats.

4. Increase our understanding of the residency patterns and movements of local sea turtles, including evaluating the extent to which turtles are shared with neighbouring political jurisdictions, by initiating tagging (and bio-telemetry, if possible) programmes.

5. Quantify or closely estimate the annual exploitation of sea turtles, based on user and market surveys, and the number of hunters/fishermen involved in the harvest. Evaluate alternative sources of revenue for those who partially depend on turtle-derived income.

6. Revise existing legislation to protect all species of sea turtle at all times and enforce all coastal conservation and management acts which provide the legislative background to protect habitat deemed critical to sea turtles.

7. Improve law enforcement by increasing manpower and training personnel, both employed and volunteer, and increasing public awareness.

8. Promote community support of and involvement in sea turtle conservation by increasing public awareness. Sponsor and/or promote education programmes in the schools, libraries, and communities and distribute press releases, brochures, posters, etc.

9. Solicit assistance from the public in documenting sea turtle nestings and sightings, reporting illegal activities, and safeguarding turtles and nests.

4.63 Activities

The following activities are proposed in order to meet stated goals and objectives:

1. Appoint/hire a Coordinator for the National Sea Turtle Conservation Programme and designate an agency or group as a depository for data collected; i.e., to assemble, maintain, and update sea turtle information. This should logically be either the Fisheries Division or an interested conservation NGO on each island.

2. Urge passage and implementation of the 1992 Fisheries Regulations which would place a moratorium on the capture and sale of sea turtles and their eggs. Include sea turtles on the Third Schedule of the National Conservation and Environment Protection Act (NCEPA). Urge ratification of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean (Cartagena Convention).

3. Conduct interviews to estimate the number of sea turtles captured per year during the recent (1980's) and historical (1920-1960) past. Conduct interview and market surveys to determine the current number of turtles caught per year; continue data-collection until a moratorium is passed. Determine the number of turtles involved, as well as size, species, place and method of capture, and fate (market). Determine the number of fishermen involved.

4. Undertake daily ground surveys of nesting beaches over five consecutive nesting seasons, with emphasis on two Index Beaches selected for each island (see section 4.291). With the technical support of WIDECAST, employees and volunteers will be trained for this purpose by the Division of Fisheries and/or the NGO community (e.g., NHCS, SCHS, Jaycees).

5. Conduct biweekly aerial surveys during the months of April, May and June over three consecutive years, with emphasis on the nesting of leatherback or river turtles along the Atlantic coast of St. Kitts and the Sandy Point/Belle Tete area.

6. Initiate long-term tagging studies at accessible and significant nesting grounds and capture-tag-release studies at important foraging sites. There is little in-house expertise in this regard; training in methodology will be solicited from WIDECAST personnel in Antigua, Barbados, the BVI, and/or the USVI.

7. Acquire field equipment and data collection materials, such as measuring tapes, tags, flashlights, clipboards, a small dinghy, and outboard engine. These may be obtained by direct purchase or by soliciting the donation of items.

8. Provide for the long-term protection of important habitats by establishing Sea Turtle Refuges or other protected areas. Candidate areas include Southeast Peninsula beaches and the Atlantic coast of St. Kitts from Cayon River to Key Ghaut; on Nevis, Hurricane Hill beach is a promising site. Hire and train wardens to enforce compliance with appropriate regulations.

9. Develop holistic management plans for critical nesting and foraging habitats within the context of existing legislation, taking into account the specific recommendations of this Recovery Action Plan.

10. Improve enforcement by hiring conservation enforcement personnel (most likely under the Divisions of Fisheries or Conservation, Department of Agriculture) and encouraging citizens to report any incidents of illegal or harmful behaviour toward sea turtles. Enlist the media in publicizing arrests, convictions, and penalties.

11. Provide training opportunities for field personnel in data collection techniques. Whenever possible, encourage persons to attend relevant training programmes overseas (such as the training course offered at Tortuguero, Costa Rica) or visit ongoing research projects in neighbouring islands (such as the leatherback research project at Sandy Point National Wildlife Refuge, St. Croix, and the hawksbill research project at Jumby Bay Resort, Antigua).

12. Host workshops for field survey personnel, SCUBA dive operators, yacht and charterboat crews, etc. to provide training in sea turtle identification. This will promote accurate reporting of nesting and at-sea sightings, as well as enhance public awareness of depleted turtle stocks and the effects of poor diving and boating etiquette. Provide volunteers with log books.

13. Record sightings of sea turtles as part of ongoing SCUBA dive and charter boat operations and proposed coral reef monitoring programmes. Enlist the support of WIDECAST in the design of data sheets for this purpose and the training of participants.

14. Host "Town Meetings" on both islands, or take advantage other relevant forums (e.g., meetings of fisherman's cooperatives) for fishermen in order to provide them with information on sea turtle biology and conservation, to solicit their support for a ban on turtle fishing, and to educate them on the alternatives to turtle harvest.

15. Expand the existing environmental education programme for school children and the general public.

- (a) Purchase audio-visual materials and literature on sea turtle biology and conservation.
- (b) Distribute the WIDECAST "Wider Caribbean Sea Turtles" identification mini-poster to aid the public in accurately reporting sea turtle sightings.
- (c) Design and print a "Sea Turtles of St. Kitts and Nevis" brochure.
- (d) Produce a series of five mini-posters featuring sea turtle conservation messages and place them in public locations throughout the federation. Enlist the creativity of school children in designing slogans and artwork.
- (e) Expand the local circulation of *Heritage*, *EcoNews*, and other environmental newsletters, particularly between islands. Include regular features on endangered sea turtles and local efforts to conserve them in these publications.
- (f) Publicize the availability of sea turtle information in WATS reports, the Marine Turtle Newsletter, and all WIDECAST publications including this Action Plan.
- (g) Organise and find funding for a national "Sea Turtle Awareness Week".
- (h) Support the public libraries in their efforts to use sea turtles as the topic focus of summer programmes designed for community children.
- (i) Write hoteliers and restaurant and store owners to encourage them not to sell sea turtle parts or products.
- (j) To enhance the education of tourists (e.g., informing them of restrictions on the purchase and transport of turtle products, including tortoiseshell), produce:
 - a sign board about sea turtle conservation for each airport,
 - fliers to be distributed by Customs officials, and
 - brochures to be available at hotels.

16. Enlist the active support of coastal zone management authorities (e.g., NCEPA Conservation Commission) and other governing bodies to fulfill the following recommendations:

- (a) Encourage land developers to view healthy turtle populations as important to successful development schemes, especially beachfront tourism.
- (b) Fully develop, implement and enforce restrictions on beach sand mining.
- (c) Fully develop, implement and enforce coastal development guidelines.
- (d) Adopt strong restrictions on beachfront lighting in building permit procedures.
- (e) Regulate setbacks, armouring (e.g., groynes), beach replenishment, clearing coastal vegetation, and beach driving.
- (f) Institute effective mechanisms for disposal of solid and industrial waste.
- (g) Revitalise the Pesticide Board.
- (h) Install a national system of moorings, with supporting legislation, and enforce a ban against anchoring in coral reef or sea grass communities.

These activities, which should be undertaken in a coordinated manner by Government (e.g., Division of Fisheries) and non-government groups (e.g., NHCS, SCHS) -- with the active support of industry and community groups, such as fisherman's cooperatives, Jaycees, and coastal land-owners -- can be summarized as follows:

Activity	Year	1	2	3	4	5
Select Programme Coordinator and Lead Organization		X				
Determine size/number turtles caught per year; market surveys		X	X			
Designate Index Beaches		X				
Comprehensive nesting beach surveys		X	X	X	X	X
Aerial survey leatherback nesting beaches		X	X	X		
Ongoing marine habitat surveys		X	X	X	X	X
Town Meetings, workshops		X	X			
Adopt Fisheries Regulations to fully protect all species of sea turtle; strengthen NCEPA		X	X			
Ongoing personnel training		X	X	X	X	X
Ongoing reporting of sightings by volunteer network		X	X	X	X	X
Print "Sea Turtles of St. Kitts/Nevis" brochure; host Sea Turtle Awareness Week; distribute fliers, posters, brochures, letters, etc.		X	X			
Ongoing environmental awareness; acquire A/V materials, literature		X	X	X	X	X
Airport display		X				
Compile existing data, formulate management plans for critical nesting areas		X	X	X	X	

continued...

Activity	Year	1	2	3	4	5
Long-term protection of habitat				X	X	X
Appointment/training of two Wardens or existing Fisheries Inspectors				X	X	X
Cooperate with Coastal Zone Management authority to implement recommendations of the Recovery Plan		X	X	X	X	X
Acquisition of field and camping equipment for survey work		X	X	X		
Ongoing tagging studies in nesting and feeding areas		X	X	X	X	X

4.64 Results and outputs

Results and outputs of the proposed five-year Sea Turtle Conservation Programme can be summarised as follows:

1. Town Meetings in turtle fishing villages will be held. Sea turtle conservation materials will be provided to fisherman's cooperatives.

2. Comprehensive and enforceable legislation will be in place for the protection of sea turtles and their habitats. Such legislation will be rooted in the biological reality that sea turtles are endangered species and should no longer be harvested. Dialogue and the politics of inclusion will ensure broad community support for a moratorium.

3. Sea Turtle Refuges will be established to protect important nesting grounds.

4. Important nesting and foraging sites will be identified. Management plans will be developed for at least one important sea turtle nesting area and one important foraging area on each island, based on recommendations provided in this Recovery Action Plan.

5. Two permanent Fisheries or conservation staff members will have received formal training in sea turtle conservation and management.

6. A Manual will be developed describing how to conduct beach surveys, complete sightings data forms, etc.

7. Annual reports will be published by the Lead Agency for the National Sea Turtle Conservation Programme summarising data collected during nesting beach surveys, sightings accumulated during marine habitat surveys, results of tagging efforts, and other relevant survey or research initiatives. A comprehensive report will be prepared summarizing data collected during interviews with turtle fishermen and market surveys.

8. All turtle nets identified in the Fisheries Division Frame Survey will be purchased or otherwise removed from commission.

9. Public awareness will be improved by (i) developing a "Sea Turtles of St. Kitts and Nevis" brochure to distribute to the resident public, (ii) revising the Educational Packet for teachers, (iii) posting/distributing signs, fliers and brochures to inform tourists of restrictions on the transport of tortoiseshell and other turtle products, (iv) producing a tourist-oriented video to educate visitors about regulations concerning the marine environment in general and opportunities to participate in marine (e.g., yacht-based) surveys, (v) making copies of environmental newsletters and sea turtle reports available to residents of both islands, (vi) organizing a "Sea Turtle Awareness Week" to rally and involve the general public in sea turtle conservation, (vii) sponsoring a letter-writing campaign or other contact directed toward hoteliers, restaurants, and store owners encouraging them not to sell sea turtle products, and (viii) convening a public for-um, with follow-up by news release, letters and other forms of communication, to encourage the Conservation Commission and other governing bodies to implement the recommendations of this Recovery Action Plan.

4.65 Budget

Financial support (approximately US\$ 50,000/yr) for the Sea Turtle Conservation Programme is needed. Proposals will be submitted to WWF-UK, OECS-NRMU, and other potential donors. Excluding wages for wardens and other Government employees, projected costs to implement a five-year Sea Turtle Conservation Programme are as follows:

Item	Yr 1	2	3	4	5	Total US\$
Wage: Sea Turtle Programme Coord.	12000	12000	12000	12000	12000	60000
Wages: 4 beach patrollers @ \$1800/6 mo (part-time, early morning surveys)	7200	7200	7200	7200	7200	36000
Wages: 4 taggers @ \$3000/3 mo in field, 1 mo in office	---	---	12000	12000	12000	36000

continued...

Item	Yr 1	2	3	4	5	Total US\$
Tags/pliers	---	---	1000	1000	1000	3000
Training/follow-up	2000	2000	2000	2000	2000	10000
Office support	3000	3000	3000	3000	3000	15000
Field transport	5000	5000	5000	5000	5000	15000
Communication (radios)	4000	---	---	---	---	4000
Aerial surveys (\$200 ea; 2/mo for 3 mo)	1200	1200	1200	---	---	3600
Field supplies	2000	1000	1000	1000	1000	6000
Dinghy & engine (2 @ \$5000 ea)	10000	---	---	---	---	10000
Dinghy fuel	500	500	500	500	500	2500
Buy-back nets	2000	2000	---	---	---	4000
A/V, literature, educ. materials	1000	1000	1000	1000	1000	5000
Town Meetings	500	500	---	---	---	1000
Airport displays (1 each island)	3000	---	---	---	---	3000
Contingencies (10%)	5340	3540	4590	4470	4470	22410
TOTAL/YR	58740	38940	50490	49170	49170	
GRAND TOTAL						US\$ 236510

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Table 1. Sea turtle nesting activity on Southeast Peninsula beaches, St. Kitts, 26 June to 31 July 1989. The number of nests observed during the study period ("new nests") and those already hatched or incubating at the time the study began ("old nests") are reported by d'Arbeau (1989). L = leatherback, G = green turtle, H = hawksbill, ? = unspecified. The survey was conducted after peak leatherback nesting and prior to peak hawksbill nesting and thus certainly underestimates nesting activity by these species. *Notes:* (1) Turtle Bay and an unnamed bay to the southwest (Figure 5) are frequently cited interchangeably, (2) cobble shorelines at Ballast Bay and Whitehouse Bay were not surveyed since they do not possess adequate nesting requirements, (3) a 1992 follow-up survey (29 June-8 August) reported considerably different results, including zero crawls on South Friar's Bay beach. The basis for the discrepancies between 1989 and 1992 are not clear, but underscore the need, as recommended by this Recovery Action Plan, for comprehensive full-season beach surveys.

Beach	Species	New nests	Old nests	Total nests
North Friar's	G	4	--	4
	?	0	32	32
Turtle Bay	H	6	--	6
	G	1	--	1
	?	0	51	51
Canoe Bay	H	8	--	8
	G	2	--	2
	?	0	42	42
Sand Bank Bay	G	5	--	5
	L	4	--	4
	?	0	?	?
Mosquito Bay	H	7	--	7
	G	2	--	2
	?	0	46	46
Cockleshell Bay	H	4	--	4
	G	1	--	1
	?	0	26	26
Banana Bay	H	7	--	7
	?	0	24	24
Major's Bay	H	30	--	30
	?	0	177	177

Table 1, continued.

Beach	Species	New nests	Old nests	Total nests
South Friar's	H	16	--	16
	G	9	--	9
	L	7	--	7
	?	0	130	130

Table 2. Predators of sea turtle hatchlings on the beaches of the Southeast Peninsula, St. Kitts, 23 June to 31 July 1989 (from d'Arbeau 1989). "Tracks on land" terminate prior to reaching the sea, presumably because of predator encounters. Likely predators are specified, and losses to predators during the study period are estimated for each of seven beaches. *Note:* Turtle Bay and an unnamed bay to the southwest (Figure 5) are frequently cited interchangeably.

Beach	Tracks on land	Tracks to sea	Total tracks	Predators	% lost
Turtle Bay	89	379	468	crabs, birds	19.01
Canoe Bay	158	420	584	crabs, birds, mammals	27.05
Mosquito Bay	110	485	595	crabs, birds	18.45
Cockleshell Bay	27	227	250	crabs, birds	10.80
Banana Bay	26	117	143	crabs, birds	18.18
Major's Bay	421	1128	1549	crabs, birds, mammals	27.17
South Friar's	304	1439	1743	birds, mammals, desiccation	17.44
Total	1135	4201	5332		21.28

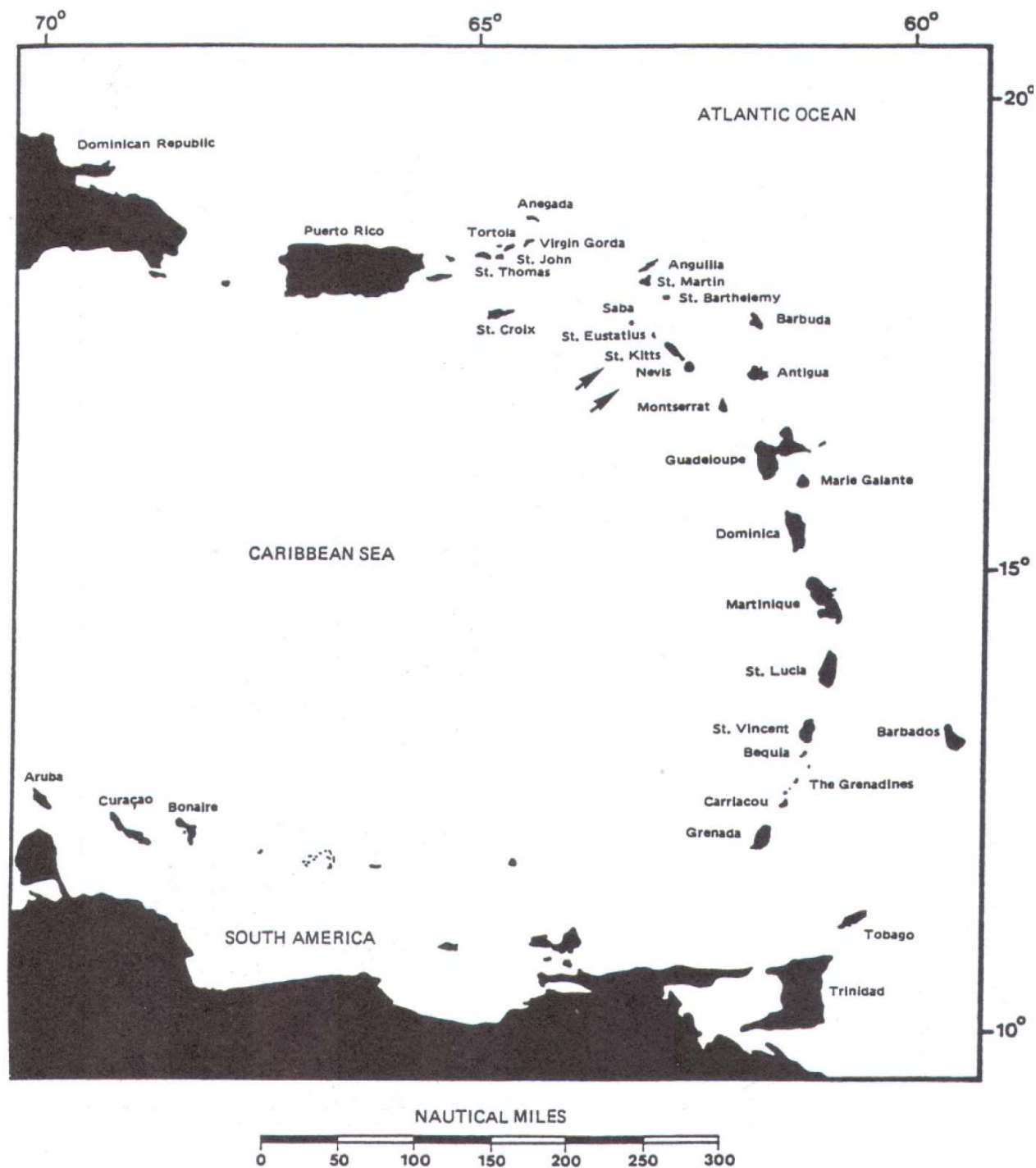


Figure 1. The two island nation of St. Kitts and Nevis is situated amongst the Lesser Antilles in the northeastern Caribbean Sea (source: ECNAMP, 1980). See Figure 2 for detail.

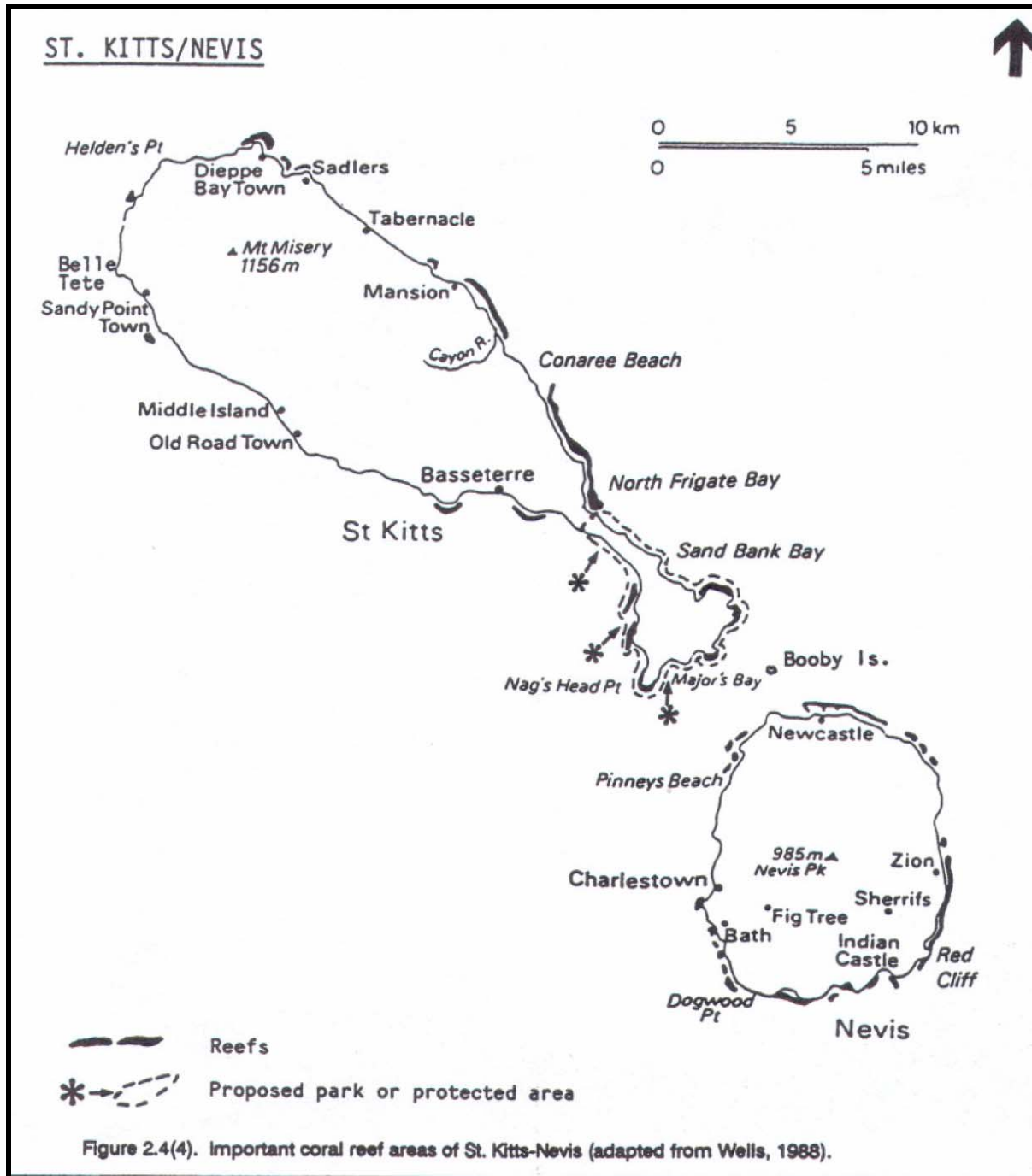


Figure 2. Selected features and landmarks in St. Kitts and Nevis (source: CCA, 1991). *Note:* Newcastle, Nevis, has also been proposed as a marine protected area.

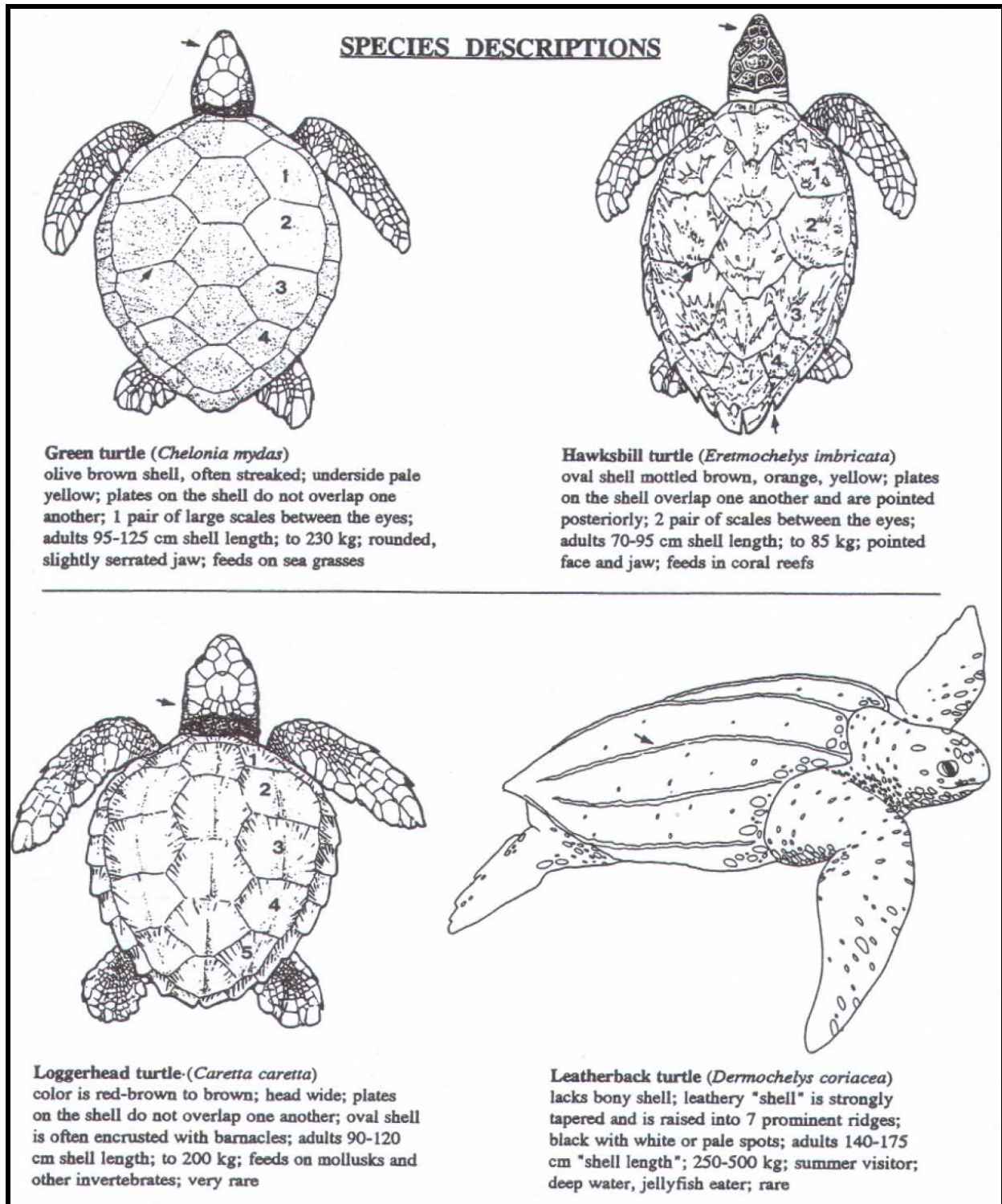


Figure 3. A guide to the sea turtles of St. Kitts and Nevis. Green and hawksbill turtles of various sizes are encountered year-around. The leatherback is a seasonal visitor, arriving in March or April for a four-month nesting season. The loggerhead is rarely seen.

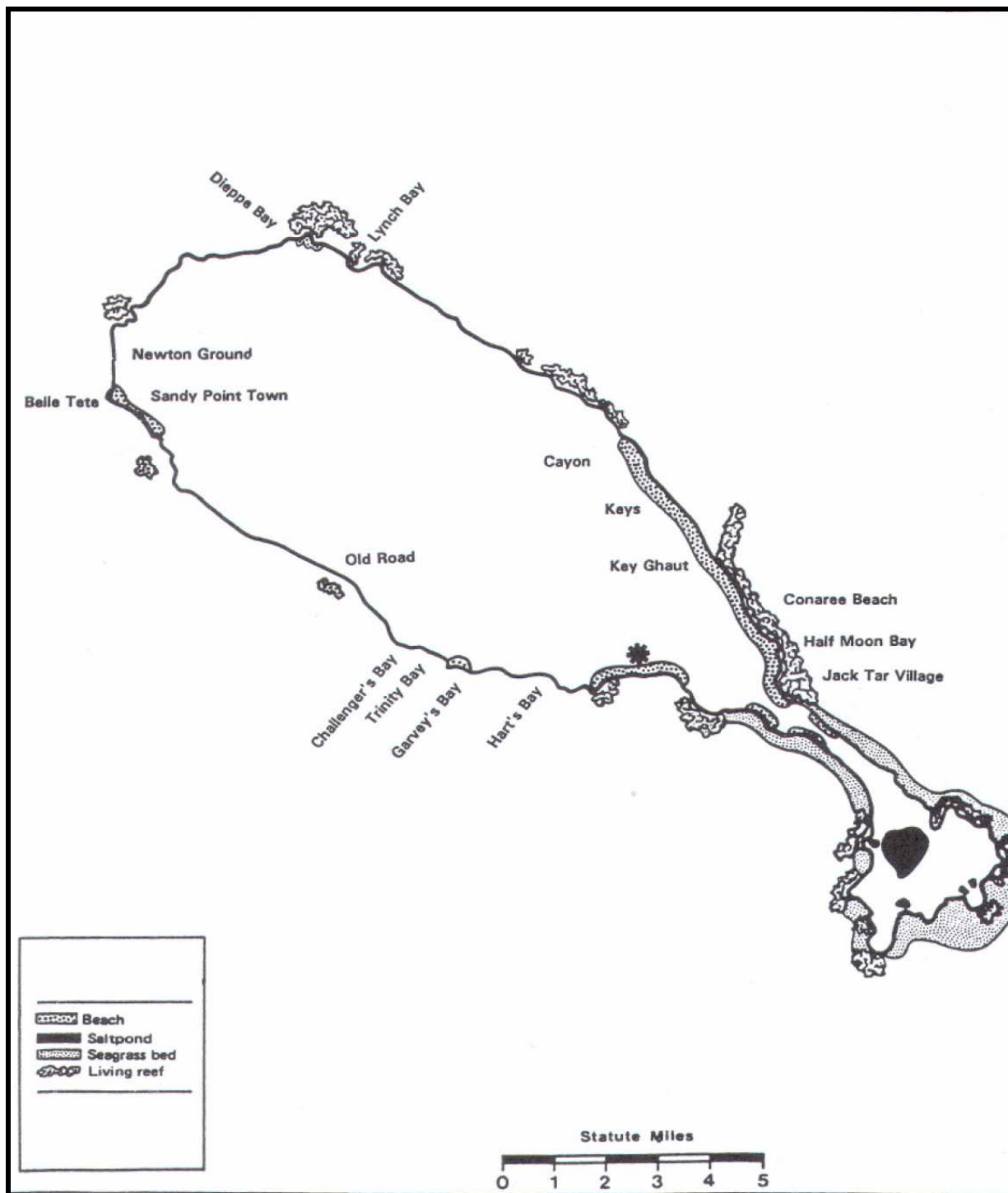


Figure 4. The sandy beaches and offshore marine features, including major sea grass communities and living coral reef, of St. Kitts (source: modified from ECNAMP, 1980). See Figure 5 for detail of the Southeast Peninsula.

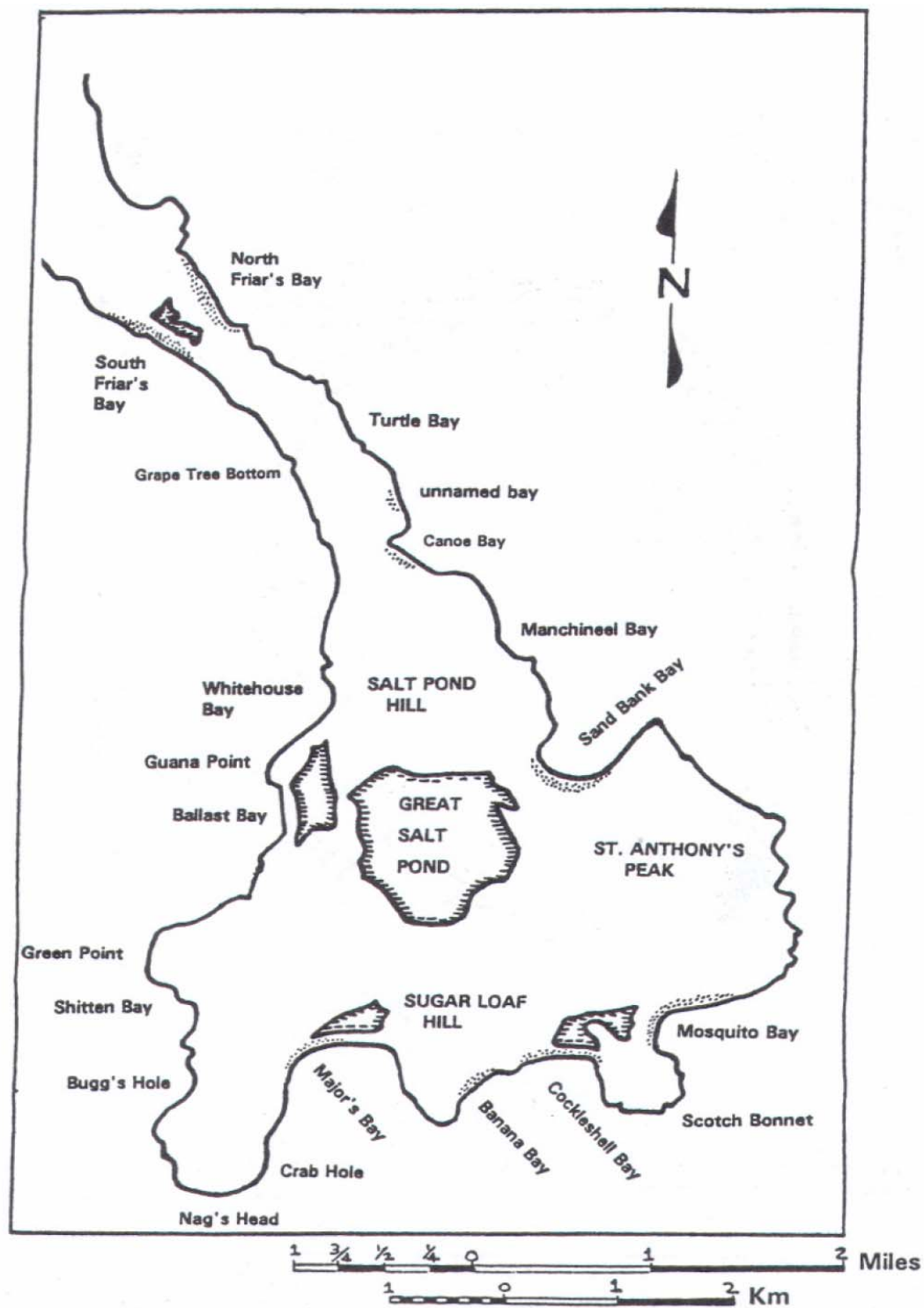


Figure 5. The sandy beaches (stippled areas) of the Southeast Peninsula, St. Kitts.

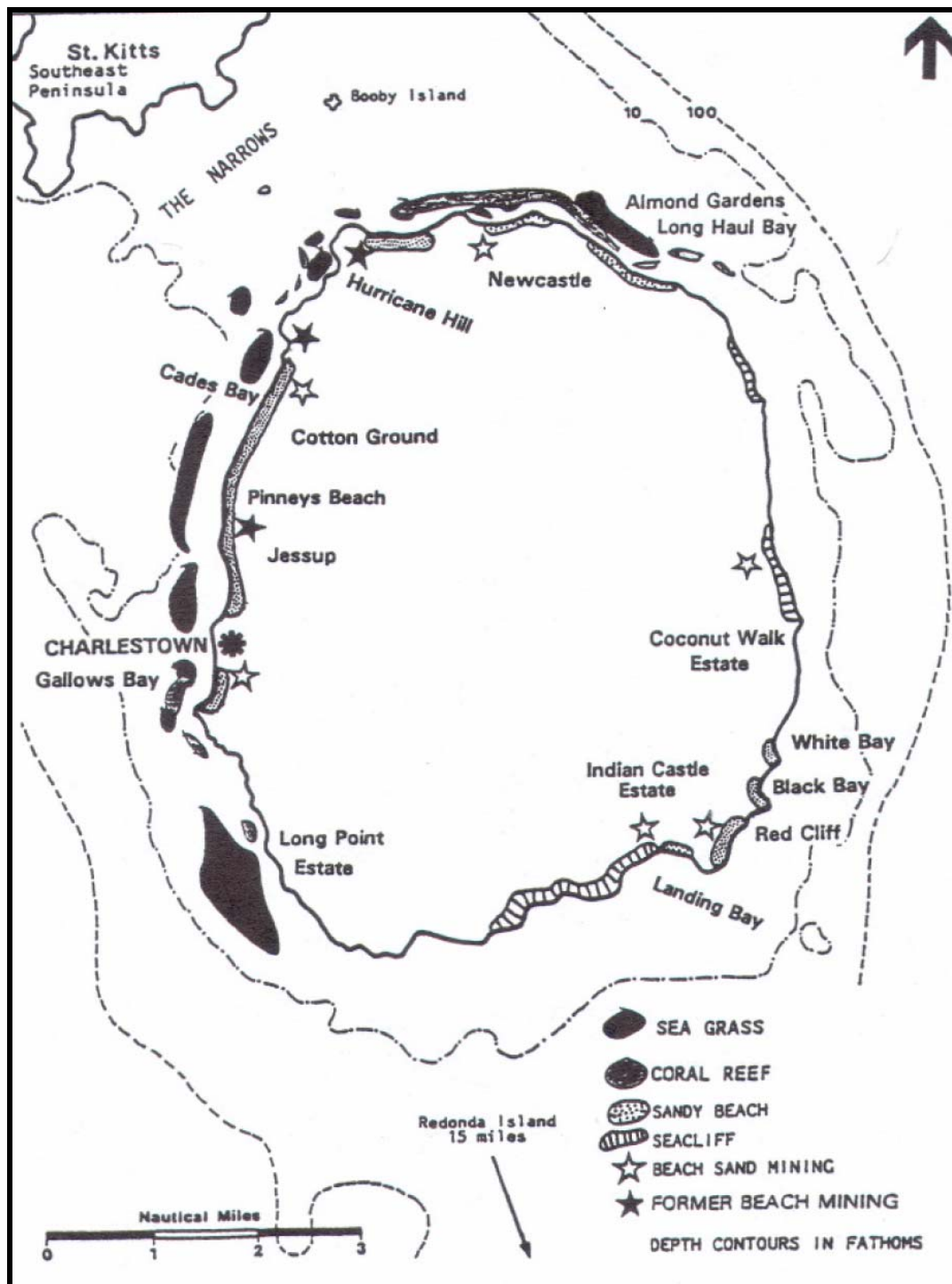


Figure 6. The sandy beaches, beach sand mining sites, and offshore marine features, including major sea grass communities and living coral reef, of Nevis (source: modified from CCA, 1991; Robinson, 1991).

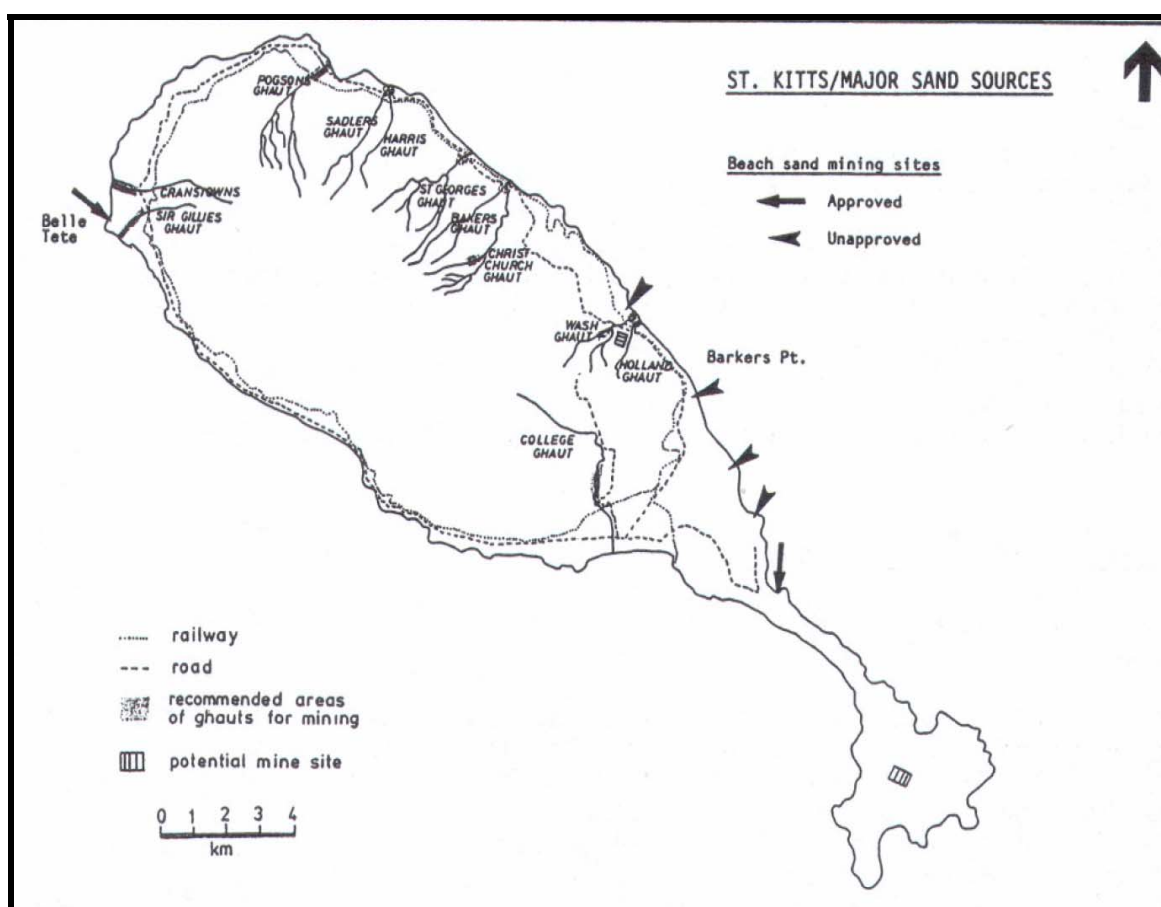


Figure 7. Major sand sources in St. Kitts and beach sand mining locations (source: modified from Cambers, 1988 in CCA, 1991).

APPENDIX I

Diana Honebrink, a Peace Corps Volunteer and environmental studies teacher at Cayon, Molineux, and Estridge Primary Schools in St. Kitts explained the WIDECAST Sea Turtle Recovery Action Plan to her students and asked them to participate in the development of this Plan by interviewing parents and friends about sea turtles. The information was gathered informally and is presented below as the children submitted it to Mrs. Honebrink. It is clear from the information provided that sea turtles, particularly leatherbacks, supplement the diet of residents in villages along the Atlantic coast. The turtles are killed while nesting and the eggs are generally (but not always) taken.

* * *

INTERVIEW ON SEA TURTLES

Eustace Berkley

Grade 6A, Cayon Primary, 5 October 1992

Interviewee: "Lucky", Keys Village

Q: How many times did you go turtle hunting for the past 12 months? A: About six times.

Q: How many turtles did you catch for the past 12 months? A: I caught 12 turtles.

Q: When was the last time you caught a turtle? A: Since last year.

Q: What time of day or night was it? A: In the day.

Q: How did you go about capturing or killing the turtle? A: Go in front and chop off its neck.

Q: Did you catch any turtle for the first time? A: No.

Q: How many did you catch for the second time? A: Around three turtles.

* * *

INTERVIEW ON SEA TURTLES

Shawna Gilbert

Grade 6A, Cayon Primary, October 1992

Interviewee: Arnold Benjamin, Ottleys Village

Q: How many times did you go turtle hunting for the past twelve months? A: Six months.

Q: How many turtles did you catch for the past 12 months? A: Three turtles.

Q: When was the last time you caught a turtle? A: In June.

Q: What time of day or night was it? A: 11:00 pm.

Q: What did you use the shell for? A: To make jewelry.

Q: How does the turtle meat taste? A: Like beef or pork.

Q: What do turtles eat? A: Grass and conchs.

Q: Are the turtles hard to catch? A: Yes. Sometimes you have to hunt all night.

* * *

INTERVIEW ON SEA TURTLES

Jamila Browne

Grade 6A, Cayon Primary, October 1992

Interviewee: Winston Hendrickson

Q: How many times did you go turtle hunting for the past twelve months? A: Once.

Q: How many turtles did you catch for the past 12 months? A: One.

Q: When was the last time you caught a turtle? A: Two years ago.

Q: What time of day or night was it? A: 9:00 pm.

Q: How did you go about capturing and/or killing the turtle? A: You have to wait until the turtle reach on top of the sand.

Q: When does turtle hunting take place? A: April until the end of June.

Q: Did you ever find a turtle with eggs? A: Yes, but never took their eggs.

Q: What time of the night do you usually go to catch turtles? A: At 9 to 12:00 o'clock.

* * *

INTERVIEW ON SEA TURTLES

Alvin Mitcham

Grade 6A, Cayon Primary, 12 October 1992

Interviewee: Winston (Wincy) Christopher, Taylors Village, Basseterre

Q: How do turtles taste? A: Turtles taste like beef and pork.

Q: What did you do to catch the turtle? A: In order to catch the turtle I shot it.

Q: How do the eggs taste? A: The eggs taste like boiled Irish potatoes.

Q: When did you catch the turtle? A: I caught the turtle in the night.

Q: How many turtles did you catch? A: I caught two turtles.

Q: When was the last time you caught a turtle? A: The last time I caught a turtle was August.

Q: What time in the day or night did you catch it? A: I caught the turtle at 10 o'clock at night.

Q: How did you kill it? A: I killed it by cutting it in its belly.

Q: What did you do with the meat? A: I sold the meat.

Q: How do the eggs feel? A: The eggs feel soft like a sponge.

Q: How many times did you go turtle hunting? A: I went turtle hunting 12 times for the months of July, August and September.

* * *

INTERVIEWING PEOPLE ABOUT SEA TURTLES

Chrystal Dunrod

Grade 6A, Cayon Primary, October 1992

Interviewee: Winston Hendrickson

Q: Did you ever catch sea turtles? A: About one.

Q: Why do you need it? A: To eat, because you get meat and oil from it. The oil comes from the shell and the meat comes from the body itself.

Q: When was the last time you caught a sea turtle? A: Two years ago.

Q: Did you ever find the eggs, but not the turtle and take the eggs? A: No. Q: Why? A: Because we get more turtles when they hatch out.

Q: How do you know when the turtle is coming in? A: You look up in the sky over the sea and see its tracks, then you go about 9:00 o'clock and the turtle reaches in after midnight.

Q: How do you go about killing the turtle? A: You have to wait until the turtle reaches shore properly and then kill it because if as it reaches out you try to kill it, it will go back into the water and they can swim fast.

Q: How is the turtle killed? A: I kill it by throwing it on its back and cutting its belly.

Q: How many did you hunt for the past 13 months? A: None at all.

Q: When does the turtle season start and end? A: It starts in April and ends in June.

Q: What does turtle meat taste like? A: Something like fish a bit raw.

Final note: Turtle shells can also be used for different items, such as ornaments, chairs, tables

* * *

INTERVIEW ON SEA TURTLES

Canesha Francois

Grade 6A, Cayon Primary, October 1992

Interviewee: Dezroy Williams, Cayon

Q: How many times did you catch a turtle? A: One time.

Q: How many turtles did you catch? A: I caught two turtles.

Q: When was the last time you caught a turtle? A: Two months ago.

Q: What time of day or night was it? A: It was 9:15 in the night on the 24th of August 1992.

Q: How did you go about capturing and/or killing the turtle? A: In the day I saw its track in the sky so I went down to the bay about 7:30 pm and waited.

Q: What do you use the shell for? A: For souvenirs.

Q: How did you make turtle oil? A: While the turtle is boiling in what we called a "copper", the oil floats on top and you scoop it out with a spoon.

Q: Are turtles hard to catch? A: Sometimes, it depends on the position it is in.

* * *

SEA TURTLES

Lissimba Wilkes

Grade 6B, Cayon Primary, October 1992

Interviewee: James Skelton, Keys Village

From February to May is turtle season. People know when to hunt for turtle because they see a cloud in the sky [that] looks different to the other clouds in the sky. When people see this cloud they know that a turtle is coming in on land or is on land. When people catch turtles they go with their eggs and make pancakes with them because turtle eggs can't just fry like a fowl egg. A turtle lays up to two hundred eggs and only about fifty may hatch, but when they go to the sea only about three will live. Mr. Solas told me that he was the master of catching turtles in Keys. He could have caught three to five turtles a year. He goes in front of the turtle to catch it. He

chops off its head to kill it. If he goes to the back of the turtle it would blind him by knocking sand in his eyes with its fins. If he holds the turtle it could pull him into the sea and drown him.

* * *

SEA TURTLES

Vendol James

Grade 6B, Cayon Primary, October 1992

Interviewee: Mr. David of Nevis

The time of the year people hunt for turtles is from the first of January to the last of May. People hunt for turtles when they see a long white track in the sky which they sometimes call the Milky Way. The kinds of meat in a turtle are beef, pork, and mutton. Turtle oil come from a turtle's fat.

* * *

SEA TURTLES

Keith Archibald

Grade 6B, Cayon Primary, October 1992

Interviewee: Gloria Archibald

People hunt for turtle in the month of April. They know when to hunt for turtles because they see their tacks in the sky. People catch turtle when they come on he shore to lay their eggs. The turtle will leave their eggs covered in the sand to hatch. When the little ones are hatched, they head back for the sea to live. Turtles have four fins. Turtle shell is used to make ornaments and things like rings, and earrings.

* * *

SEA TURTLES

Felicia Sutton

Grade 6B, Cayon Primary, October 1992

Interviewee: James Skelton, Keys Village

When people see the cloud in the sky shaped like a turtle they know it is turtle time. People hunt turtles from March to May. Turtle eggs can make pancakes. You have to put in flour, sugar, water, and oil and eggs. To get turtle oil you have to boil the turtle and skim off the oil. Turtle grow with the shell to keep the turtle very soft and to protect it. To catch a turtle you have to go in front of the turtle. If you go behind the turtle it will skid up sand in your face with its fins.

* * *

SEA TURTLES

Karen Crawford

Grade 6B, Cayon Primary, October 1992

Interviewee: Mikey Blake, St. Johnson Village, Basseterre

People hunt turtle during the time of the year when they are not mating or when the law allows them to hunt. When the turtles come to lay their eggs then the people know when to hunt them. Turtle oil comes from the fat of the turtle meat. Turtle meat is rich in protein. It is something like goat meat.

* * *

SEA TURTLES

Semone Stapleton

Grade 6B, Cayon Primary, October 1992

Interviewee: David Williams, Lower Cayon

The turtle season is from January to March. They usually show their sign in the sky. The turtle oil comes from the back or shell of the turtle. The turtle has two kinds of meat -- pork and beef. People wait until the turtle comes on shore to lay her eggs. They will sneak up to it and cut off the turtle's head.

* * *

SEA TURTLES

Marissa Huggins

Grade 5A, Cayon Primary, October 1992

A turtle is a reptile that can live in water and also on land. They can live on land for as long as seven days if they are in a cool spot. They live in water most of their lives. They don't have gills like ordinary fishes, so therefore they have to come to the surface for air like whales and dolphins. They lay about 200 eggs or more deep in the sand for protection from man and animals. They take about two months to hatch into small baby turtles. When they hatch (late in the afternoon or full moon) they crawl to the edge of the sea very close to the shore and live there until they begin to grow big. After they have grown, they go in the deep to live because they are able to protect themselves. Sometimes they are attacked by predators when they are waiting in the shore to grow large.

* * *

SEA TURTLES

Ineta Richardson

Grade 5A, Cayon Primary, October 1992

Turtles come out of the water and go in the sand, take their fins and dig the hole, go in and lay the eggs, come back out and cover up the hole with the eggs and go back in the water.

SEA TURTLES

Abigail Thompson

Grade 5A, Cayon Primary, October 1992

Turtles are known as reptiles. They have hard backs as a shell. They like to live in swamp areas. The turtle oil can be used to cure very bad colds. Men who catch turtles say they often follow the turtles' tracks on the sea water to know where they are, these tracks lead them to where they lay their eggs.

* * *

SEA TURTLES

Edward Smith

Grade 5B, Cayon Primary, October 1992

A cloud in the shape like a turtle tells people when to get turtles.
From April to May people hunt turtles.
Turtle eggs can make pancakes.
To get turtle oil, you have to skim off the oil.

* * *

ALL ABOUT TURTLES

Voslyn Charles

Grade 5B, Cayon Primary, October 1992

Keys Village, St. Kitts

The cloud in the sky sometimes looks like a turtle.
From March to May people go hunt for turtles.
People use turtle oil to make medicine.
People eat turtle meat.

* * *

WHAT WE KNOW ABOUT TURTLES

Louise Jones

Teacher, Grade 5, Estridge Primary School

October 1992

Fishermen say they know when turtles are coming in to lay their eggs, they see the track in the sky. Whether this is true or not they are often successful in catching a turtle when they go to the beach. Turtles lay over one hundred eggs, their eggs when cooked (recipe below) [are] a delicacy. It is said that the turtle consists of different types of meat: beef, pork, mutton. The oil is used to give children when they have a cold. The turtle is so large that it takes a tractor to transport it from the beach to the village where it is cut up and sold. The village of Keys for many years was almost dubbed Turtle Village, every now and then there would be turtle to be

sold at the road side, passers by would stop and purchase what they wanted. Many people do not eat turtle meat as they say it smells too "rawish", but it tastes delicious. The fin is boiled and that is very gluey, you can go where they boil it and get it free, just carry a container. The turtle scent is so strong that for more than a week it can still be smelt in the village. The fisher-man takes a machete with him when he goes to catch a turtle, they say you wait until she finishes digging her hole to lay her eggs and when she starts [to] cover them back over they go in front of her and turn her over on her back; if they go behind her the amount of sand she kicks up to cover the eggs will blind them.

Recipe

Beat eggs and mix with herbs, seasoning,
and a little flour. Heat cooking oil in pan
and drop in small amounts to make a fritter.

* * *

TURTLES

Verzelle Smithen

Grade 6, Estridge Primary, October 1992

Interviewee: Nolma Lowry

Turtles are very heavy.

Turtles dig three feet and then cover their eggs.

To catch turtles you turn them over on their backs so they can't get away from fishermen who love to capture them.

When the turtle finishes laying her eggs, she covers them and goes back to the sea.

Turtles dig a nest hole with their fins and people take away their eggs for food.

When tractors come and people run their vehicles on the sand, the eggs are all crushed.

Turtle meat is very delicious and the eggs are eaten like salt fish cakes.

* * *

TURTLES

Clytie Willette

Grade 6A, Molineux Primary, October 1992

Turtles are reptiles. They lay eggs on land. After the eggs are hatched the turtles walk straight into the sea. A turtle lays about one hundred eggs. Some turtles live in the sea and some live on land. In St. Kitts, fishermen like to catch turtles. Turtles feed their young ones by giving them fishes, big ones and little ones. Here in St. Kitts we have different types of turtles. The heads of the turtles are very small. Smaller than their bodies. We get food from the turtles and turtle eggs. The largest turtle is the Leatherback. People use turtle-back for decorations. The eggs take about two months [to incubate]. When the turtles hatch not all of them would go back to the sea. Some people take them to their homes for pets.

TURTLES

Allison Percival

Grade 6A, Molineux Primary, October 1992

Turtles are reptiles with shells. The top shell and the bottom shell join at the sides. The turtle, like all reptiles, is "cold-blooded". This means that its temperature is cold blooded and stays the same as the temperature of its surroundings, air or water. Freshwater turtles like other turtles can be beautiful or ugly. Their names often tell you which they are. The Painted turtle and the Mud turtle both live in ponds but you know which is handsomer. The ugliness of a turtle can be to its advantage. The Matamata, a South American turtle, looks like a floating log. Large sea turtles spend almost all of their life in the sea. The female comes out on land only to lay her eggs. Turtles lay from 2 to 200 eggs at one time, depending on the variety of turtle. There are seven types of sea turtle: Green turtle, Flatback, Hawksbill, Loggerhead, Atlantic Ridley, Pacific Ridley, and Leatherback. The Leatherback is a different turtle to all of the turtles, it is also one of the largest turtles in the sea. After two months the little hatchlings will hatch. They are only 2 inches big when they will find themselves walking on the sand.

* * *

TURTLES

Joanne Williams

Grade 6A, Molineux Primary, October 1992

Interviewee: Estella Williams

There are seven types of turtles. The Green turtle, the Flatback, the Hawksbill, the Loggerhead, the Atlantic Ridley, the Pacific Ridley. They all have hard shells. The largest turtle is the Leatherback. It has a leathery "shell". The turtles live in three destinations. They are land, sea, and freshwater. When the female turtles are ready to get their young, they go out to the beach, dig a hole and lay about one hundred eggs. Afterwards they cover their eggs and go back to the sea. The eggs take two month to hatch. When the little turtles hatch, not all of them return to the sea. Out of that hundred, only about two return to the sea because people know when a turtle is on the beach. They will see a turtle track in the sky, so people hurry to the beach to see if they find any turtles. Yes! People may find turtles and take them home for pets. And some take them home for decoration.

* * *

TURTLES

Samuel Bedford

Teacher, Grade 6A, Molineux Primary School

October 1992

The turtle season lasts from May to June, normally. Men *claim* that they know when a turtle comes on land because (a) a star pitches in the night in the area where the turtle is located (about to lay eggs) or (b) they see a track looking similar to that of a turtle's in the sky late in the afternoon or evening. Turtles make a track as they move to the shore and normally travel in a

straight line, then lay their eggs. If the turtle feels uneasy she makes a false track. Mr. Charles Solas, a former famous "turtle catcher" (or notorious) related that he normally had his dog accompany him. When the dog sees the turtle close beside the grape trees, it begins to bark. Mr. Solas then locates it and beheads the turtle using a machete. He caught a variety of turtles in Keys.

* * *

SEA TURTLES

Allison Percival

Grade 5A, Molineux Primary, 22 June 1992

There are seven types of turtle in the sea. Green turtle, Flatback, Hawksbill, Loggerhead, Atlantic Ridley, Pacific Ridley, and Leatherback. The Leatherback is different from the others because the back is leathery. It is also the biggest turtle in the sea. The lady turtle is the turtle that lays its eggs in the ground. After two months the little hatchlings will hatch, they are only two inches big when they will find themselves walking on the sand. While they are going on the sand [to the sea], maybe an animal eat them or some one make a mistake and mash them. It could be like this someone see them, run towards them and take them up, carry them home and have them as a pet. We should not trouble the little animals because they are useful.

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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 (SPA), 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 (SPA) 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 (SPA) was designed to implement the provisions and requirements of the SPA 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.

