



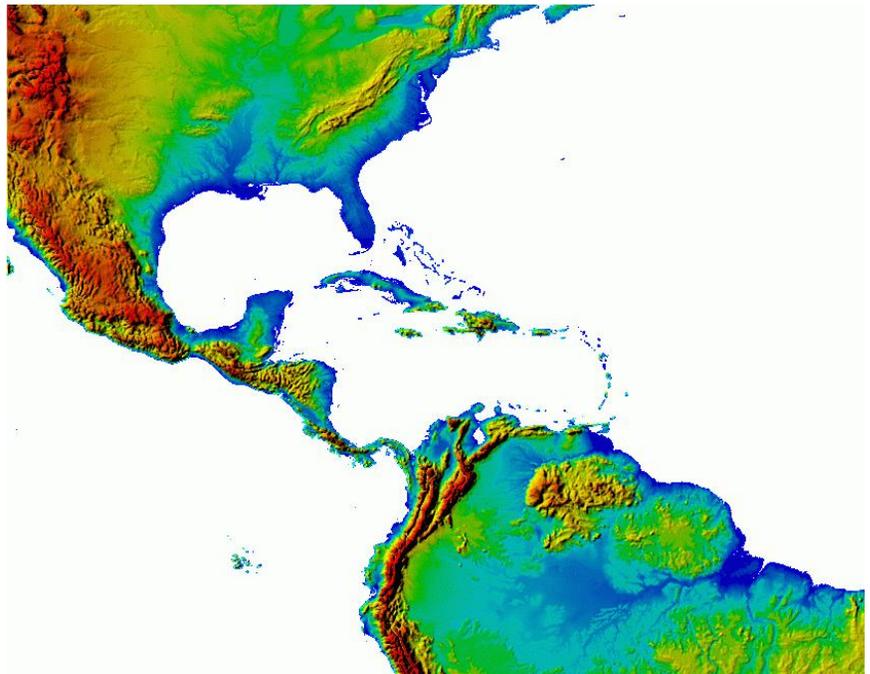
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Sea Turtle Recovery Action Plan for the Republic of Trinidad and Tobago



Prepared by:



WIDECAST

Wider Caribbean Sea Turtle Conservation Network

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**Caribbean Environment Programme
United Nations Environment Programme**



Sea Turtle Recovery Action Plan for the Republic of Trinidad and Tobago

**Forestry Division (Ministry of Housing and the Environment,
Government of Trinidad and Tobago), Save our Seaturtles-
Tobago, and Nature Seekers**



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PREFACE

Of the six species of sea turtle that inhabit the Caribbean Sea, all are classified as Critically Endangered, Endangered, or Vulnerable on the IUCN *Red List of Threatened Species*. In addition to centuries of regulated but largely unmonitored exploitation, sea turtles are accidentally captured and often drowned in active and abandoned fishing gear, resulting in death to uncounted tens (perhaps hundreds) of thousands annually. Coral reef and seagrass degradation, oil spills, chemical waste, persistent plastic and other marine debris, high density coastal development, and an increase in ocean-based tourism have damaged or eliminated nesting beaches and feeding grounds. Population declines are complicated by the fact that causal factors are not always local. Sea turtles are migratory at all life stages, meaning that what appears as a decline in a local population may be a direct consequence of the activities of people many hundreds of kilometers away. Thus, while local conservation is crucial, action is also called for at the regional level.

To adequately protect migratory sea turtles and achieve the objectives of the UNEP/CEP Regional Programme for Specially Protected Areas and Wildlife, *The Strategy for the Development of the Caribbean Environment Programme (1990-1995)* called for “the development of specific management plans for economically and ecologically important species”, making particular reference to endangered, threatened, or vulnerable species of sea turtle. This is consistent with Article 10 of the Cartagena Convention (1983), which states that Contracting Parties shall “individually or jointly take all appropriate measures to protect ... the habitat of depleted, threatened or endangered species in the Convention area.” Article 10 of the 1991 Protocol to the Cartagena Convention concerning Specially Protected Areas and Wildlife (SPAW Protocol) specifies that Parties “carry out recovery, management, planning and other measures to effect the survival of [endangered or threatened] species” and regulate or prohibit activities having “adverse effects on such species or their habitats”. Article 11 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 13th in a series of Sea Turtle Recovery Action Plans prepared by the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), a coalition of Caribbean sea turtle specialists, natural resource managers, and community-based organizations. The objectives of the action plan series are to assist Caribbean governments in the discharge of their obligations under the SPAW Protocol, to promote a regional capability to implement scientifically sound sea turtle management and conservation programs, and to encourage a unified approach among range States. Each action plan summarises 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. This document was developed and peer-reviewed by national stakeholder-led processes, with WIDECAST serving as scientific advisor, and upon completion was submitted to the UNEP/CEP Regional Coordinating Unit (Kingston, Jamaica) and the SPAW Focal Point in Trinidad and Tobago for approval and permission to publish.

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 comprised of Country Coordinators in more than 40 States and territories, and has served the CEP for more than a quarter-century in support of a shared vision to “protecting the marine environment of the wider Caribbean region for the benefit and enjoyment of present and future generations” and ensure “co-ordinated and comprehensive development without environmental damage” (*Preamble*, Cartagena Convention).

ACKNOWLEDGMENTS

Gratitude is extended to the following persons and groups who directly or indirectly contributed substantively to this Recovery Action Plan. Without their assistance and insight, the immense task of compiling this document could never have been completed. Special thanks are extended to Molly Gaskin, Pointe-à-Pierre Wild Fowl Trust, who served as a liaison between WIDECASST and the Republic during the 1980s and laid the groundwork for this document. Mr. Kenneth Fournillier followed Ms. Gaskin as WIDECASST Country Coordinator, and his leadership as the Sea Turtle Focal Point within the Wildlife Section-Forestry Division was instrumental both in helping to establish many of the nation's sea turtle field programs and in developing, in a substantial way, this important document. With Mr. Fournillier's retirement from the Wildlife Section, Mr. Stephen Poon took the task of completing the Recovery Action Plan with a national coalition of partners. Special appreciation is extended to Dr. Carol James, former Head of the Wildlife Section-Forestry Division and retired UNDP Senior Sustainable Development Advisor, for her vision and her diplomacy in establishing a variety of policies which have since borne fruit for the conservation of sea turtles at the grassroots, national and international levels. Ms. Nadra Nathai-Gyan, Dr. James' successor, is also acknowledged for her important contributions to the development of this Recovery Action Plan, her past and present leadership, and her passion for modern and sustainable resource management practices.

This unique document, created to serve as a blueprint for harmonised national research, conservation and management practices in Trinidad and Tobago, has guided, in its various drafts, the nation's development of modern sea turtle management practices for more than a decade. For this reason a great number of professionals, many of them now retired, must be acknowledged for their unswerving dedication to the survival of the nation's rich sea turtle heritage. They are, in so many ways, responsible for a new generation of resource managers who not only share the commitment of their predecessors but bring a scientific rigor to the task that ensures the nation's position as a model and mentor for countries throughout the region, and the world.

In Trinidad, many individuals have given selflessly to the study and conservation of sea turtles. Indeed, much of what we know today rests on the pioneering work of Prof. P. Bacon, Mr. I. Lambie, Mr. D. Rooks, Mr. E. Laforest, Mr. N. Acham, Jim and Linda Geary, Geoff and Kate Gibbs, Mr. D. Simons, Mr. D. Lee-a-Ping, Mr. Y. Guillaume, Mr. R. Mulligan (Blanchisseuse boatman) and other members of the Field Naturalists' Club in the 1960s and 1970s. Studies undertaken by the Pointe-à-Pierre Wild Fowl Trust, Institute of Marine Affairs, and prominent foreign scientists have also contributed meaningfully.

In recent years, sea turtle conservation and monitoring in Trinidad has been conducted mainly by community-based organisations. While dozens of members are actively involved, we would like to acknowledge, in particular, the following founding members: Mr. S. Aguillera, Ms. S. Lakhan, and Mr. C. Mitchell of the Nature Seekers (Matura); Mr. K. Babwah, Mr. L. Bissoon, Mr. T. Boodoo, Mr. S. Ramdial and Mr. G. Sookoo of the Fishing Pond Environmental and Community Group; Mr. G. Lincoln, Mr. L. Peters and Mr. S. Ruiz of what was originally called the Grande Riviere Environment Awareness Trust (GREAT); and Mr. R. Roberts (PAWI Sports, Culture and Eco Club).

These efforts could not have been successful without the support of many who hold key positions in Government, including the Hon. Penelope Beckles, former Minister of Public Utilities and the En-

vironment and Mrs. Jacqueline Ganteaume-Farrell, Permanent Secretary, Ministry of Public Utilities and the Environment; Ms. Ann-Marie Jobity, former Director, Fisheries Division; and Dr. Arthur Potts, former Director of Fisheries in Tobago. Within the Fisheries Division we would like to recognize support from Ms. Nerissa Nagassar and Ms. Christine Chan A. Shing; Ms. Risha Alleyne, Environmental Management Authority; and Ms. Lori Lee Lum, Research Officer and Dr. J. Allan Goodridge, Legal Research, at the Institute of Marine Affairs (IMA). Finally, Mr. Richard Laydoo, former Co-ordinator, UNDP/Global Environment Facility (GEF) Small Grants Programme, has been very supportive of community-based efforts over the years.

Similarly, in Tobago there are many individuals who are dedicated to the survival of endangered sea turtles, and who have laboured against formidable odds to realise their conservation victories. We offer our sincere appreciation to the following persons who have assisted in this document: Ms. Wendy Herron, Founder, SOS Tobago and the group's volunteers, collaborators and staff; Ms. Pat Turpin, Environment TOBAGO; Mr. G. McFarlane, Director, Buccoo Reef Trust, Tobago House of Assembly (THA); Mr. Raye Sandy (Former Director, Department of Natural Resources and the Environment (DNRE) THA and his staff within the THA, including Ms. Angela Ramsey, Mr. Jackie Johnson, Mr. Selwyn Davis and others; Mr. Errol Caesar (Former Director, Department of Marine Resources and Fisheries (DMRF) THA) and his staff and officers of the Fisheries Division (THA) including Mr. David Shim (former Manager, Buccoo Reef Marine Park); Mr. G. S. Beard, former Secretary for Tourism, Environment and Information (THA); and Mr. J. Ottermann (former Manager, Turtle Beach Hotel).

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Last but not least, the authors wish to thank the many friends and colleagues who comprise the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), without whom we would still be working alone and from whom we have learned so much.

We dedicate this Recovery Action Plan to those who have gone before us

Many people do not know that the Field Naturalists' Club (FNC) of Trinidad and Tobago began a formal programme of beach monitoring and sea turtle conservation in 1965. In 1962, a young Customs Officer, Mr. Ian Lambie, was called upon to investigate the loss of some 8mm film. The film was never recovered, but the story it told ignited enough interest within the membership of the FNC that sea turtle conservation in Trinidad and Tobago was born. The film depicted the slaughter of a giant egg-bearing turtle, a leather-back sea turtle, on Matura Beach. At that time, the carcasses were floated out to sea to attract sharks that were then shot for sport. We have come a long way as a nation in 50 years with regard to our understanding of and respect for the role that sea turtles play in our ecology, economy, and culture. With our progress has come an enhanced capacity to manage our sea turtle resources wisely, and a recognition that there is still much to be done to ensure that our sea turtles will survive to inspire wonder in our children and their children for all time to come.

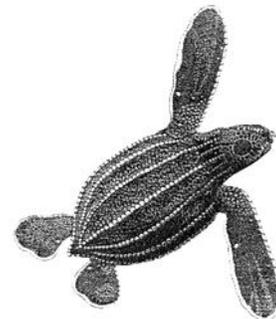


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LIST OF ACRONYMS

CANARI	Caribbean Natural Resources Institute
CBO	Community-Based Organisation
CCA	Caribbean Conservation Association
CCC	Civilian Conservation Corps
CEC	Certificate of Environmental Clearance
CEP	UNEP Caribbean Environment Programme
CFTDI	Caribbean Fisheries Training Development Institute
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
DMRF	THA Department of Marine Resources and Fisheries
DNRE	THA Department of Natural Resources and Environment
DOS	U.S. Department of State
EIA	Environmental Impact Assessment
EMA	Environmental Management Authority
FAO	United Nations Food and Agricultural Organisation
FD	Forestry Division
FNC	Field Naturalists' Club of Trinidad and Tobago
GEF	Global Environment Fund
GREAT	Grande Riviere Environmental Awareness Trust
GRNTGA	Grande Riviere Nature Tour Guide Association
IMA	Institute of Marine Affairs
IUCN	World Conservation Union [formerly the International Union for the Conservation of Nature and Natural Resources]
NGO	Non-Government Organisation
NMFS	U.S. National Marine Fisheries Service
NSTDTT	National Sea Turtle Database of Trinidad & Tobago
SGP	Small Grants Program
SOS	Save Our Sea Turtles, Tobago
SPAW	Specially Protected Areas and Wildlife
STRAP	Sea Turtle Recovery Action Plan
TED	Turtle Excluder Device [Trawler Efficiency Device]
THA	Tobago House of Assembly
TSPCA	Tobago Society for the Prevention of Cruelty to Animals
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USFWS	United States Fish and Wildlife Service
USVI	United States Virgin Islands
UWI	University of the West Indies
WASA	Water and Sewage Authority
WATS	Western Atlantic Turtle Symposium
WIDECAS	Wider Caribbean Sea Turtle Conservation Network

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ABSTRACT

Five species of sea turtle are found in the Republic of Trinidad and Tobago. Records of exploitation date to the early 17th century, and a legal fishery persists in the form of a five-month open season established in 1975. The full extent of the fishery is unknown, but landing records indicated an annual at-sea take well over 1,000 turtles in 1980, the last year for which data are available. Similarly, there are no data to indicate the numbers of turtles poached from nesting beaches, but surveys in the 1970s and 1980s estimated that 30% of turtles nesting at Matura Beach and 100% of turtles nesting near villages on the north coast (Trinidad) were killed each year. Progress since that time has included declaration of some of the nation's most important nesting grounds – Fishing Pond and Matura Beach in 1990 and Grande Riviere in 1997 – as Prohibited Areas under the Forests Act, reducing take at these beaches to nearly zero. Community-based groups, most operating under co-management agreements with Government, are credited with ending the slaughter. Today the Republic supports the largest leatherback nesting population in the insular Caribbean.

Contemporary challenges to sea turtle management and conservation include an unmonitored, open access fishery; continued poaching of turtles and eggs in remote areas; archaic sea turtle regulations that ignore the basic principles of sustainable use; physical development of nesting beaches; incidental capture and drowning of sea turtles in fisheries; incomplete population monitoring; inattentive law enforcement; unidentified and unprotected foraging grounds and migratory corridors; and gaps in public awareness. To meet these challenges and strengthen the regulatory framework, this Sea Turtle Recovery Action Plan (STRAP) makes recommendations in keeping with the National Biodiversity Strategy and Action Plan (NBSAP), as well as national obligations under international treaties (e.g., SPAW Protocol) that promote conservation of threatened species and habitats, and emphasises an integrated approach.

To manage and protect important habitat, the STRAP recommends that: a national survey be undertaken to identify critical habitats; an inclusive national network of protected and managed areas be created to safeguard critical habitats; the management framework for protected areas be strengthened to ensure that these areas fulfill their stated objectives; and coastal zone management (and monitoring) capacity be improved, including through environmental impact assessment, particularly in relation to tourism and other beachfront development. Further to the development and implementation of area-specific management plans, the STRAP recommends that: planning processes involve local coastal zone authorities, governing councils and community groups; regulations provide for enforcement and promote compliance; and public (resident, tourist) education and awareness be a priority. Where formal protected area status is not feasible, regulatory guidelines and/or zoning ordinances should be enacted and enforced to restrict potentially harmful activities. When such restrictions (e.g., setbacks, lighting) are imposed on beachfront construction, a registered architect, professional engineer, or other authority should be designated by Government to monitor compliance

To prevent degradation of nesting beaches, the STRAP recommends that: beach sand mining be prohibited throughout the Republic; a national Lighting Ordinance be adopted and lighting restrictions be imposed (and enforced) as a condition for obtaining approval for coastal construction; national planning legislation adopt a strong stance regarding setbacks for beachfront development and require mixed-species vegetated buffer zones between built facilities and sandy beaches; hard engineering options (e.g.,

seawalls) for beach protection be regarded only as a last resort; annual beach clean-ups emphasise nationally standardised collection methods and analysis; routine cleaning and maintenance of nesting beaches and bordering waterways be conducted using manual labour (vs. heavy machinery); motorised vehicles not be allowed to drive on sandy beaches (with the exception of authorised patrol or emergency vehicles); in cases where beach rebuilding is unavoidable, replacement sand be similar (e.g., grain size, organic content) to that which was eroded, thereby making every effort to maintain the suitability of the beach for the incubation of sea turtle eggs; and during the planning stages of large-scale public gatherings on nesting beaches, local sea turtle experts be invited to advise organisers concerning the timing and location of such gatherings and that permitting agencies pay heed to their advisements.

To prevent degradation of marine habitat, the STRAP recommends that: prohibitions on the use of poisons and chemicals in fishing be strictly enforced; existing pollution laws be reviewed for completeness and enforceability, and strengthened as needed; industries be monitored to confirm that discharges are duly registered with Government and properly identified as to content; watercourses and near-shore zones be regularly monitored for the presence of harmful chemicals and noxious substances; laws relevant to the at-sea dumping of garbage be fully enforced (and public awareness of these laws be increased); petroleum exploration and extraction activities be accompanied by independent EIAs and acceptable environmental controls; a comprehensive National Oil Spill Contingency Plan (including a funding mechanism) be adopted and implemented; training (including at the community level) be sufficient to maintain readiness to respond to oiled wildlife; Government give priority to a national watershed sampling and monitoring programme; sewage treatment facilities of sufficient capacity be developed, as a priority, in areas where tourism and urbanisation are compromising human and ecological health; a national system of moorings be developed; and thorough and independent environmental assessments be conducted, reviewed, and approved prior to any dredging or coastal land reclamation.

To manage and protect sea turtles during all life stages, the STRAP concludes that the 1975 Protection of Turtle and Turtle Eggs Regulations (Fisheries Act) do not adequately respond to the need to protect sea turtles, which are classified as Endangered by several international treaties to which Trinidad and Tobago is a Party, and have failed to achieve management that is consistent with the principles and practice of sustainable use. Recommendations include: designating sea turtles as “Environmentally Sensitive Species”; enacting a moratorium on the capture and sale of sea turtles, eggs and products until such time as there is sufficient information to show that a regulated harvest will not lead to population declines; bringing laws and practices into harmony with the provisions of international treaties ratified by Government; empowering all law enforcement agents (including Fisheries Officers, Game Wardens and their deputies) with jurisdiction to enforce sea turtle protection regulations; expanding the Environmental Police Section within the EMA; and increasing monetary fines and other penalties for offences.

The STRAP further recommends that if any exploitation is to continue, a comprehensive Frame Survey should assess the extent and economic importance of sea turtle exploitation at the national level (including the nature and extent of illegal exploitation and trade) and restrictions on the fishery should reflect the biological parameters of sea turtles, promote population recovery and maintenance, and implement an enforceable, high-compliance monitoring program aimed at establishing trends and monitoring these over time (see section 4.213 for details). Finally, credible scenarios for enhancing alternative sources of income for turtle fishers should be developed and implemented; studies into the offshore behaviour, distribution, and movements of sea turtles should be undertaken, especially to in-

form policy on reducing bycatch; policies should restrict the use of fishing techniques that demonstrate high levels of bycatch and should promote viable alternatives that both minimise bycatch and protect fisher livelihoods; workshops and other extension activities should continue as a priority; compliance should be regularly monitored (such as by vessel boardings); and fines, equipment confiscation, and other appropriate penalties should be consistent with the law. Gillnets should be banned in inter-nesting areas.

It is recommended that Government place priority on supporting and strengthening established programmes, as well as replicating these models to other nesting grounds, especially in Tobago and at sites important to hawksbill nesting; that collection and reburial of eggs (including to hatcheries), be undertaken only after there is documented evidence of a threat serious enough to warrant such action; and that dogs found roaming the nesting beach be collected and impounded. Captive rearing is not considered to be a viable conservation or management option at this time.

Recognising that it is neither practical nor necessary to monitor all sandy beaches at all times, Index Beaches should be designated and monitored for long-term fluctuations in nesting numbers and hatch success. Research should also be undertaken to describe the range and movements of sea turtles offshore, as well as long-term fluctuations in population size. The STRAP recognises the value of co-management in achieving conservation successes to date, and recommends that Government and community-based organisations continue to pursue and formalise, in good faith, these important partnerships. In support of conservation and employment goals, and in the interest of a sustainable non-consumptive use of the sea turtle resource, the STRAP recommends that Government promote well-designed, village-based sea turtle ecotourism; that carrying capacity, as well as mandatory use of an accredited guide, be formalised as necessary in order to provide for the strongest protection of fragile areas; and that a comprehensive Sea Turtle Eco-tourism Plan be developed based on a critical evaluation of experience to date. With regard to special considerations for Turtle Watching at sea, stakeholders should solicit input from Caribbean whale watching enterprises concerning best practices. As sea turtles are migratory at all life stages, the STRAP recommends that Government negotiate bilateral agreements, as well as participate in international treaties that both protect sea turtles and support the nation's strategic interests, and that genetic research be conducted to define the genotypes comprising nesting and foraging populations, and how these relate to populations elsewhere in the region.

To promote public awareness, a national programme should seek to educate citizens on the legal and conservation status of endangered sea turtles; marine biology and conservation units should become a standard aspect of the national curriculum; Fisheries Extension personnel should inform fishers, as well as industry representatives and cooperatives, about the plight of sea turtles (discourage violations, encourage reporting); and notices should be placed in airport arrival and departure lounges, as well as in cruiseship ports and popular yacht arrival bays, to alert arriving tourists about relevant regulations. Every advantage should be taken of existing venues to share information; Government agencies should coordinate with one another; field personnel should be regularly updated concerning the nation's research and management priorities, emphasis should be placed on maintaining ties with range States; and every opportunity should be taken for sea turtle workers to participate in international technical meetings.

A National Sea Turtle Conservation Programme should be implemented to lend impetus to training personnel, collecting long-term data on nesting and foraging assemblages, protecting critical habitat, encouraging participation by rural communities and the general public in sea turtle conservation actions, strengthening the regulatory framework, and evaluating sustainable alternatives to consumptive use.

RESUMEN

En la República de Trinidad y Tobago se encuentran cinco especies de tortugas marinas. Los registros de explotación datan de inicios del Siglo XVII y la pesquería legal persiste en forma de una temporada abierta de cinco meses establecida en 1975. La verdadera magnitud de la pesquería se desconoce, pero los registros de descargas indicaban una captura anual en el mar de bastante más de 1.000 tortugas en 1980, el último año para el cual existen datos. De manera similar, no existen datos que indiquen el número de tortugas tomadas ilegalmente en playas de anidación, pero censos realizados en las décadas de 1970 y 1980 estimaron que el 30% de las tortugas que anidaban en Matura Beach y el 100% de las tortugas que anidaban cerca de aldeas en la costa norte (Trinidad) morían cada año. Los avances logrados desde entonces han incluido la declaración de algunas de las áreas de anidación más importantes del país – Fishing Pond y Matura Beach en 1990 y Grande Riviere en 1997 – como Áreas Prohibidas bajo la Ley de Bosques, reduciendo las capturas en estas playas a casi cero. Se da crédito a los grupos comunitarios, mayormente operando bajo acuerdos de co-gestión con el gobierno, por poner fin a esta matanza. Hoy día, la República respalda la población anidadora de tortugas laúd más grande del Caribe insular.

Los retos contemporáneos para la conservación y ordenación de las tortugas marinas incluyen una pesquería no monitoreada, de acceso abierto; la continua caza ilegal de tortugas y sus huevos en áreas remotas; reglamentos arcaicos sobre tortugas marinas que ignoran los principios básicos del uso sustentable; el desarrollo físico de playas de anidación; la captura incidental y el ahogamiento de tortugas marinas en las pesquerías; el monitoreo incompleto de las poblaciones; la distraída aplicación de la ley; corredores migratorios y áreas de alimentación sin identificar y sin proteger; y deficiencias en la sensibilización pública. Para enfrentar estos retos y fortalecer el marco reglamentario, el presente Plan de Acción para la Recuperación de Tortugas Marinas (STRAP, por sus siglas en inglés) plantea recomendaciones en línea con el Plan de Acción y Estrategia de Biodiversidad Nacional (NBSAP), así como obligaciones nacionales bajo tratados internacionales y regionales (tales como el Protocolo SPAW) para fomentar la conservación de especies amenazadas y sus hábitats y resalta un enfoque integrado.

Para gestionar y proteger hábitats importantes, el STRAP recomienda: realizar un censo nacional para identificar hábitats críticos; crear una red nacional incluyente de áreas protegidas y ordenadas para salvaguardar los hábitats críticos; fortalecer el marco de gestión para áreas protegidas para asegurar que estas cumplan con sus objetivos señalados; y mejorar las capacidades en gestión (y monitoreo) de zonas costeras, incluyendo a través de la evaluación de impactos ambientales, particularmente con relación al turismo y otros desarrollos frente a las playas. Además de elaborar e implantar planes de ordenación específicos por área, el STRAP recomienda que: los procesos de planificación involucren a autoridades locales de las zonas costeras, consejos de gobierno y grupos comunitarios; los reglamentos dispongan la aplicación de la ley y promuevan el cumplimiento; y la educación y sensibilización del público (residentes, turistas) sea una prioridad. Donde no sea factible, la condición formal de área protegida deberán promulgarse y aplicarse lineamientos reglamentarios y/u ordenanzas de zonificación para restringir actividades potencialmente dañinas. Cuando se imponen restricciones (tales como líneas de propiedad retiradas, iluminación) para construir en playas, un arquitecto inscrito, ingeniero profesional u otra autoridad debería ser designado por el gobierno para monitorear el cumplimiento.

Para evitar la degradación de las playas de anidación, el STRAP recomienda: prohibir la extracción de arena de playas en toda la República; adoptar una Ordenanza de Iluminación nacional e imponer (y aplicar) restricciones a la iluminación como condición para obtener la aprobación para construcciones costeras; adoptar una posición fuerte en las leyes nacionales de planificación con respecto a líneas de propiedad retiradas para desarrollos en playas y zonas de amortiguamiento vegetadas con una mezcla de especies entre las instalaciones construidas y las playas de arena; considerar opciones de ingeniería costera (por ejemplo malecones) para proteger playas sólo como último recurso; limpiar anualmente las playas para enfatizar métodos de recolección y análisis estandarizados a escala nacional; conducir la limpieza rutinaria y de mantenimiento de playas de anidación y cursos de agua colindantes utilizando trabajo manual (vs. maquinaria pesada); no permitir el paso de vehículos motorizados por las playas arenosas (con la excepción de vehículos autorizados de patrullaje o de emergencia); en casos donde sea inevitable la reconstrucción de playas, que la arena de reemplazo sea similar (por ejemplo granulometría, contenido orgánico) a aquella que se había erosionado, haciendo así todo esfuerzo posible por mantener la sustentabilidad de la playa para la incubación de huevos de tortugas marinas; y durante las etapas de planificación de grandes aglomeraciones de público en playas de anidación, invitar a expertos locales en tortugas marinas a aconsejar a los organizadores sobre el momento y la ubicación de dichas aglomeraciones y que las agencias de concesión de permisos presten atención a sus consejos.

Para evitar la degradación del hábitat marino, el STRAP recomienda aplicar estrictamente prohibiciones al uso de venenos y químicos en la pesca; estudiar las leyes existentes sobre contaminación para determinar su integralidad y aplicabilidad y su fortalecimiento según sea necesario; monitorear industrias para confirmar que sus descargas estén debidamente registradas ante el Gobierno y apropiadamente identificadas en cuanto a su contenido; monitorer regularmente los cursos de agua y zonas del litoral para detectar la presencia de químicos dañinos y sustancias peligrosas; aplicar a cabalidad las leyes pertinentes al desecho en el mar de basura (y la mayor sensibilización pública sobre estas leyes); acompañar las actividades de exploración y extracción petrolera con EIA independientes y controles ambientales aceptables; adoptar e implantar un Plan de Contingencia Nacional completo para Derrames de Hidrocarburos (incluyendo un mecanismo de financiamiento); brindar la suficiente capacitación (incluyendo a nivel comunitario) para permanecer preparados para responder a vida silvestre cubierta de petróleo; que el gobierno dé prioridad a un programa nacional de muestreo y monitoreo de cuencas hidrográficas; desarrollar instalaciones de tratamiento de aguas negras con suficiente capacidad, como prioridad, en áreas donde el turismo y la urbanización estén comprometiendo la salud humana y ecológica; desarrollar un sistema nacional de atracaderos; y conducir, examinar y aprobar evaluaciones ambientales completas e independientes antes de cualquier dragado o reclamación de tierras costeras.

Para ordenar y proteger a las tortugas marinas durante todas sus etapas de vida, el STRAP concluye que los Reglamentos para la Protección de Tortugas y Huevos de Tortuga de 1975 (Ley de Pesca) no responde adecuadamente a la necesidad de proteger a las tortugas marinas, que han sido clasificadas como en peligro de extinción por varios tratados internacionales a los cuales Trinidad y Tobago es Parte y han fallado en lograr una ordenación consistente con los principios y las prácticas del uso sustentable. Las recomendaciones incluyen designar a las tortugas marinas como “Especies Ambientalmente Sensibles”; promulgar una moratoria a la captura y venta de tortugas marinas, huevos y productos hasta tanto haya suficiente información para mostrar que la toma regulada no llevará a caídas en las poblaciones; armonizar las leyes y prácticas con las disposiciones de tratados internacionales ratificados por el gobierno; dar poder a todos los agentes de aplicación de la ley (incluyendo Funcionarios de Pesquerías, Guardaparques y sus suplentes) con jurisdicción para aplicar los reglamentos sobre pro-

tección de tortugas marinas; ampliar la Sección de la Policía Ambiental con la EMA; e incrementar las multas monetarias y otras sanciones por delitos.

El STRAP además recomienda que si ha de continuar la exploración, un Censo Marco integral debe evaluar la magnitud y la importancia económica de la explotación de tortugas marinas a escala nacional (incluyendo la naturaleza y magnitud del comercio y la explotación ilegal) y las restricciones a la pesquería deberían reflejar los parámetros biológicos de las tortugas marinas, promover la recuperación y el mantenimiento de las poblaciones y poner en práctica un programa de monitoreo aplicable y de alto cumplimiento dirigido a establecer tendencias y monitorearlas a lo largo del tiempo (ver detalles en la sección 4.213). Finalmente, se deben desarrollar y poner en marcha escenarios creíbles para mejorar las fuentes alternas de ingresos para los pescadores de tortugas; se deben realizar estudios sobre el comportamiento en altamar, la distribución y el movimiento de las tortugas marinas, especialmente para informar toda política sobre reducción de captura incidental; las políticas deben restringir el uso de técnicas pesqueras que demuestren altos niveles de captura incidental y deben fomentar alternativas viables que minimicen la captura incidental y a la vez protejan el sustento de los pescadores; se deben continuar los talleres de trabajo y otras actividades de extensión como prioridad; se debe monitorear con regularidad el cumplimiento (por ejemplo a través de abordaje de buques); y las multas, confiscación de artes de pesca y otras sanciones apropiadas deben ser consistentes con la ley. Se deben prohibir las redes agalleras en áreas de inter-anidación.

Es recomendable que el gobierno asigne prioridad al apoyo y fortalecimiento de programas establecidos y que replique estos modelos en otras áreas de anidación de tortugas, especialmente en Tobago y en sitios importantes para la anidación de tortugas carey; que la recolección y entierro nuevamente de huevos (incluyendo en incubadoras) se realice solo después de contar con evidencia documentada sobre una amenaza lo suficientemente seria como para ameritar dicha acción; y que los perros que sean encontrados deambulando por las playas de anidación sean recogidos e incautados. La cría en cautiverio no es considerada una opción viable de conservación u ordenación en este momento.

Al reconocer que ni es práctico ni necesario monitorear todas las playas de arena en todo momento, se deberían designar y monitorear Playas de Índice por fluctuaciones a largo plazo en el número de nidos y en el éxito de incubación o eclosión. También deben emprenderse investigaciones para describir la distribución y los movimientos de tortugas marinas en altamar, así como fluctuaciones de largo plazo en el tamaño de la población. El STRAP reconoce el valor de la co-ordenación para lograr los éxitos de conservación hasta la fecha y recomienda que el gobierno y las organizaciones comunitarias continúen buscando y formalizando, de buena fe, estas alianzas importantes. Para apoyar las metas de conservación y empleo y para defender el uso no consuntivo sustentable del recurso, el STRAP recomienda que el gobierno promueva el ecoturismo de tortugas marinas, bien diseñado, y basado en las aldeas; que la capacidad de acarreo y el uso obligatorio de un guía acreditado sean formalizados para poder brindar la mayor protección a áreas frágiles; y que un Plan de Ecoturismo de Tortugas Marinas integral sea elaborado con base en una evaluación crítica de la experiencia hasta la fecha. Con respecto a consideraciones especiales para la Observación de Tortugas en el mar, los interesados deberían solicitar los insumos de empresas caribeñas de observación de ballenas con respecto a mejores prácticas. Como las tortugas marinas son migratorias en todo estadio de vida, el STRAP recomienda que el gobierno negocie acuerdos bilaterales y que participe en tratados internacionales que protejan a tortugas marinas y a la vez apoyen los intereses estratégicos del país y que se conduzcan investigaciones genéticas para definir los genotipos que componen las poblaciones de anidación y alimentación y cómo se relacionan estas a poblaciones en otras partes de la región.

Para fomentar la sensibilización pública, un programa nacional debería buscar educar a los ciudadanos acerca del estado legal y de conservación de las tortugas marinas en peligro de extinción; las unidades de conservación y biología marina deberían convertirse en elemento normal del currículo nacional; el personal de Extensión de Pesquerías debería informar a los pescadores, así como a las cooperativas y representantes de la industria, sobre la situación de las tortugas marinas (disuadir violaciones, fomentar reportes); y avisos deberían ser colocados en las salas de arribo y de partida en aeropuertos, así como en puertos de cruceros y en bahías populares para el arribo de yates, alertando a los turistas entrantes sobre los reglamentos pertinentes. Debe aprovecharse todo sitio existente para compartir información; las agencias gubernamentales deberían coordinar entre sí; el personal de campo debería ser regularmente actualizado con respecto a las prioridades de gestión e investigación del país; debería darse énfasis a mantener vínculos con los Estados de distribución; y se debe aprovechar toda oportunidad para que quienes trabajen con tortugas marinas participen en reuniones técnicas internacionales.

Un Programa Nacional de Conservación de Tortugas Marinas debería ser puesto en marcha para dar mayor ímpetu a la capacitación de personal, la toma de datos a largo plazo sobre ensambles de anidación y alimentación, la protección de hábitats críticos, la mayor participación de comunidades rurales y el público en general en acciones relacionadas a la conservación de tortugas marinas, el fortalecimiento del marco reglamentario y la evaluación de alternativas sustentables al uso consuntivo.

RESUME

Cinq espèces de tortues marines se trouvent en République de Trinidad et Tobago. Les rapports sur l'exploitation remontent au début du 17^{ème} siècle, et une pêcherie légale perdure sous la forme d'une saison ouverte de cinq mois établie en 1975. L'étendue totale de la pêcherie est inconnue, mais les rapports de débarquement indiquent des prises en mer annuelles au-delà de 1000 tortues en 1980, dernière année pour laquelle des données sont disponibles. De même, il n'y a pas de données indiquant le nombre de tortues braconnées sur les plages de ponton, mais des enquêtes dans les années 1970 et 1980 ont estimé que 30% des tortues pondant à Matura Beach et 100% des tortues pondant près des villages sur la côte Nord (Trinidad) étaient tuées chaque année. Les progrès réalisés depuis lors incluent le classement de certains des sites de pontons les plus importants du pays – Fishing Pond et Matura Beach en 1990, et Grande Rivière en 1997 – comme Aires interdites dans le cadre de la loi sur les forêts (Forests Act) ce qui a conduit à une réduction des prises sur ces plages à un niveau presque nul. Le crédit de la fin du massacre revient à des groupes communautaires, opérant pour la plupart dans le cadre d'accords de gestion avec le Gouvernement. Aujourd'hui, la République détient la population de tortues luth en nidification la plus importante de la Caraïbe insulaire.

Les défis actuels pour la conservation et la gestion des tortues marines incluent une pêcherie non surveillée dont l'accès est libre ; la poursuite du braconnage des tortues et des œufs dans les zones reculées ; des réglementations archaïques sur les tortues marines qui ne tiennent pas compte des principes de base de la gestion durable ; le développement physique des plages de ponton ; les captures accidentelles et les noyades de tortues dans les pêcheries ; un suivi des populations incomplet ; une application défaillante des réglementations ; la non-identification et la non-protection des zones d'alimentation et des corridors de migration ; et les lacunes en matière de sensibilisation du public. Pour traiter ces défis et renforcer le cadre réglementaire, le présent Plan d'action pour la restauration des tortues marines (Sea Turtle Recovery Action Plan – STRAP) émet des recommandations en cohérence avec la Stratégie nationale et plan d'action pour la biodiversité et avec les obligations nationales émanant des traités régionaux (comme par exemple le protocole SPAW) et internationaux visant à promouvoir la conservation des espèces menacées et de leurs habitats, et met l'accent sur une approche intégrée.

Pour gérer et protéger les habitats importants, le STRAP recommande de : entreprendre un inventaire national pour identifier les habitats critiques ; créer un réseau national intégré des aires protégées et gérer pour sauvegarder les habitats critiques ; renforcer le cadre de gestion des aires protégées pour garantir que ces aires remplissent les objectifs qui leur sont fixés ; et améliorer les capacités de gestion (et de suivi) des zones côtières, notamment par l'évaluation des impacts environnementaux particulièrement en lien avec le tourisme et les autres développements du front de mer. Suite au développement et à la mise en œuvre de plans de gestion spécifiques à chaque zone, le STRAP recommande : que les processus de planification impliquent les autorités locales des zones côtières, les conseils locaux et les groupes communautaires ; que l'application et la promotion du respect des réglementations soient garanties ; et que l'éducation et la sensibilisation du public (résidents, touristes) soient une priorité. Là où un statut formel d'aire protégée n'est pas possible, des lignes directrices réglementairement contraignantes et/ou des ordonnances de zonage devraient être prises et appliquées afin de réduire les activités potentiellement nuisibles. Lorsque de telles restrictions (par exemple recul des constructions, éclairage) sont imposées à la

construction du front de mer, un architecte enregistré, un ingénieur professionnel ou une autre autorité devrait être désigné par le gouvernement afin de surveiller leur respect.

Afin de prévenir la dégradation des plages de ponte, le STRAP recommande : d'interdire la récolte de sable sur les plages dans toute la République ; d'adopter un ordonnance nationale sur l'éclairage et d'imposer (et d'appliquer) des restrictions d'éclairage, comme condition à l'approbation des constructions côtières ; que la législation nationale sur la planification adopte une position forte sur le recul des constructions pour le développement du front de mer et prévoit des zones tampons végétalisées avec un mélange d'espèces entre les constructions et les plages de sable ; que les options de protection des plages par des installations "en dur" (par exemple digues) soient considérées uniquement comme un dernier recours ; que les opérations annuelles de nettoyage des plages mettent l'accent sur des méthodes harmonisées au niveau national pour la collecte et l'analyse de données ; que les opérations de routine de nettoyage et de maintenance des plages et des eaux environnantes soient conduites manuellement (plutôt que mécaniquement) ; que les véhicules motorisés ne soient pas autorisés à circuler sur les plages de sable (à l'exception des patrouilles autorisées ou des véhicules d'intervention d'urgence) ; dans les cas où la restauration des plages est inévitable, que le sable de remplacement soit similaire (par exemple taille des grains, contenu organique) à celui qui a été érodé, de manière à faire tous les efforts possibles pour que la plage reste adaptée à l'incubation des œufs de tortues marines ; et que, pendant les phases de planification de rassemblements publics de grande ampleur sur les plages de ponte, des experts locaux en tortues marines soient invités pour conseiller les organisateurs sur la date et le lieu de ces rassemblements, et que les agences qui délivrent les permis tiennent compte de leurs conseils.

Pour prévenir la dégradation des habitats marins, le STRAP recommande : d'appliquer strictement l'interdiction de l'utilisation de poisons et de produits chimiques pour la pêche ; de réviser les lois existantes sur la pollution pour vérifier leur complétude et la faisabilité de leur application, et de les renforcer en tant que de besoin ; de surveiller les industries pour confirmer que les décharges sont dûment enregistrées auprès des autorités et que leur contenu est identifié correctement ; de suivre régulièrement la présence de produits chimiques et de substances nocives dans les cours d'eau et les zones proches des côtes ; d'appliquer intégralement les lois relatives au déversement de déchets en mer (et augmenter la sensibilisation du public à ces lois) ; d'accompagner l'exploration pétrolière et les activités extractives par des études d'impact environnemental indépendantes et des contrôles environnementaux corrects ; d'adopter et de mettre en œuvre un plan intégré de événements de pollution par les hydrocarbures (incluant un mécanisme de financement) ; de former suffisamment (y compris au niveau des communautés) pour maintenir une capacité à prendre en charge les espèces menacées ; que le gouvernement donne la priorité à un programme national de suivi et d'échantillonnage des bassins versants ; de développer des infrastructures de traitement des eaux usées de capacité suffisante, en priorité, dans les zones où le tourisme et l'urbanisation compromettent la santé humaine et écologique ; de développer un système national de mouillages ; et de conduire, analyser, et approuver des évaluations d'impacts environnementaux avant tout dragage ou réclamation foncière côtière.

Afin de gérer et protéger les tortues marines durant toutes les phases de leur cycle de vie, le STRAP conclut que les réglementations de 1975 pour la protection des tortues et de leurs œufs (Fisheries act) ne répondent pas de manière adéquate au besoin de protéger les tortues marines, qui sont classées comme En danger par plusieurs traités internationaux auxquels Trinidad et Tobago est Partie, et qu'elles

ont échoué à parvenir à une gestion qui soit cohérente avec les principes et pratiques de l'utilisation durable. Les recommandations comprennent : le classement des tortues marines comme "Espèces environnementalement sensibles" ; la prise d'un moratoire sur la capture et la vente des tortues marines, de leurs œufs et des produits issus des tortues jusqu'à ce qu'il y ait suffisamment d'information pour démontrer qu'une collecte réglementée ne conduira pas à un déclin des populations ; l'harmonisation des lois et des pratiques avec les traités internationaux ratifiés par le gouvernement ; le commissionnement de tous les agents chargés de l'application des lois (y compris les officiers du département des pêches, les garde-chasses et leurs adjoints) en matière d'application des réglementations sur les tortues marines ; l'extension de la section Police de l'environnement au sein de l'EMA ; et l'augmentation des amendes et des autres sanctions pour les infractions.

Le STRAP recommande également, si l'exploitation doit continuer, qu'un cadre de surveillance intégré évalue l'étendue et l'importance économique de l'exploitation des tortues marines au niveau national (y compris la nature et l'étendue de l'exploitation et du commerce illégal) et que les restrictions en matière de pêche reflètent les paramètres biologiques des tortues marines, qu'elles promeuvent la restauration et le maintien des populations, et qu'un programme de suivi applicable, à haut degré de conditionalité, soit mis en œuvre afin d'établir des tendances et de les suivre au cours du temps (voir section 4.213 pour plus de détails). Enfin, des scénarios crédibles d'amélioration des sources alternatives de revenus pour les pêcheurs de tortues devraient être développés et mis en place ; des études sur le comportement des tortues marines au large, leur distribution et leurs mouvements devraient être entreprises, en particulier pour renseigner les politiques sur la réduction des captures accidentelles ; les politiques devraient restreindre l'utilisation de techniques de pêche qui comportent un haut niveau de captures accessoires et devraient promouvoir des alternatives viables qui minimisent les prises accidentelles tout en protégeant les modes de vie des pêcheurs ; des ateliers et autres activités d'information devraient être poursuivis en priorité ; le respect des réglementations devrait être régulièrement surveillé (par exemple par l'embarquement sur les navires) ; et les amendes, la confiscation de matériel, et les autres sanctions appropriées devraient être cohérentes avec les réglementations. Les filets de fond devraient être interdits dans les zones situées entre les plages de ponté.

Il est recommandé au gouvernement : de donner la priorité au soutien et au renforcement des programmes existants, ainsi qu'à la reproduction de ces modèles sur d'autres sites de ponté, en particulier à Tobago et dans les sites importants pour la ponté des tortues imbriquées ; de n'entreprendre la collecte et le ré-enfouissement des œufs (y compris dans des écloséries) qu'une fois démontrée l'existence d'une menace suffisamment grave pour justifier de telles actions ; et de récupérer et confisquer les chiens trouvés en train d'errer sur les plages de ponté. L'élevage en captivité n'est pas considéré comme un option viable de conservation ou de gestion pour le moment.

Sachant qu'il n'est ni faisable ni nécessaire de suivre toutes les plages tout le temps, des plages index devraient être établies et suivies pour détecter les fluctuations à long terme des nombres de ponté et du succès des éclosions. Des recherches devraient également être entreprises pour décrire la répartition et les mouvements de tortues marines au large ainsi que les fluctuations de long terme des effectifs. Le STRAP reconnaît le rôle de la co-gestion dans les succès de conservation obtenus jusqu'ici, et recommande que le gouvernement les organisations communautaires continuent à rechercher et à formaliser, de bonne foi, ces partenariats importants. En soutien aux objectifs de conservation et d'emploi, et dans l'intérêt d'une

utilisation durable sans consommation des ressources issues des tortues marines, le STRAP recommande que le gouvernement promeuve un écotourisme lié aux tortues marines bien défini et basé dans les villages ; que la capacité de charge, de même que l'emploi obligatoire d'un guide accrédité, soit formalisé en tant que de besoin pour fournir la protection la plus forte possible aux zones fragiles ; et que Plan écotouristique intégré autour des tortues marines soit développé à partir d'une évaluation critiques des expériences jusqu'à aujourd'hui. En ce qui concerne les considérations spécifiques à l'observation de tortues en mer, les acteurs devraient solliciter des éléments en matière de meilleure pratique auprès des entreprises d'observation des baleines dans la Caraïbe. Comme les tortues marines sont migratrices à tous les stades de leur vie, le STRAP recommande que le gouvernement négocie des accords bilatéraux et participe aux traités internationaux qui à la fois protègent les tortues marines et soutiennent les intérêts stratégiques nationaux, et que des recherches soient menées pour définir les géotypes des populations en nidification et en alimentation et leurs liens avec les populations ailleurs dans la région.

Pour promouvoir la sensibilisation du public, un programme national devrait s'efforcer d'éduquer les citoyens au statut légal et de conservation des tortues marines en danger ; des modules sur la biologie marine et la conservation devraient devenir partie intégrante du cursus national ; les agents du département des pêches devraient informer les pêcheurs, ainsi que les représentants des industries et des coopératives, sur la situation critique des tortues marines (décourager les infractions, encourager les rapports) ; et des panneaux devraient être placés dans les zones de départ et d'arrivée des aéroports, dans les ports de croisière et dans les baies fréquentées par les plaisanciers, pour alerter les touristes sur les réglementations lors de leur arrivée. Tous les canaux existants devraient être mis à profit autant que possible pour partager l'information ; les agences gouvernementales devraient se coordonner entre elles ; les agents de terrain devraient être tenus régulièrement au courant des priorités nationales pour la recherche et la gestion ; l'accent devrait être mis sur le maintien des relations avec les États voisins ; et toute opportunité de participation à des réunions techniques internationales devrait être saisie.

Un programme national de conservation des tortues marines devrait être mis en œuvre donner une impulsion à la formation des personnels, à la collecte de long terme de données sur les populations dans les zones de ponte et d'alimentation, à la protection des habitats critiques, au soutien de la participation des communautés rurales et du grand public aux actions de conservation des tortues marines, au renforcement du cadre réglementaire, et à l'évaluation d'alternatives durable à l'utilisation pour la consommation.

I. INTRODUCTION

The Republic of Trinidad and Tobago is located between 10°00' N and 11°21' N, at about 61°30' W (Figure 1). Trinidad, the larger of the two islands with a land area of approximately 4828 km², is situated 12 km east of Venezuela and is the most southerly island of the Eastern Caribbean archipelago. The climate is tropical, with an average annual temperature of 28.9°C during the day and 23.3°C at night. There are two distinct seasons, dry (January to May) and wet (June to December), though the wet season is often interrupted by a short dry spell during September and October. The location of wetlands and a number of easterly draining rivers in Trinidad affect coastal water quality on the east coast, particularly during the wet season. Coastal waters, with the exception of the north coast and offshore east coast, are generally shallow, calm, rich in nutrients, and highly turbid. Tobago, with the Caribbean Sea along the leeward coast and the Atlantic Ocean to the windward side, is characterized by clear, nutrient deficient and fairly deep water in most places. The coastal zone of both islands varies from rocky and sandy beaches to mangroves and mud flats. Trinidad is the more complex in terms of coastline (Georges, 1983), while Tobago has mainly sandy beaches punctuated by rocky shorelines. Coral reefs are a feature of Tobago waters, with major reefs distributed off the northeastern and southwestern coasts.

Five species of sea turtle are present. Since the early colonial era, sea turtles have been observed nesting on sandy beaches and feeding in local waters; in particular, in seagrass and coral reef areas. Records of exploitation date to the early 17th century. These records are sketchy and discontinuous, but they illustrate how indigenous and customary turtle fishing and utilisation were in this country. Each year the turtle nesting season represented an added source of income to a small and largely artisanal fishing industry; to some extent, this is still true. Historically and up to the present day, sea turtles have been hunted both at sea (using nets and harpoons) and on the nesting beaches. Fanciful legends have grown up around the fishery: for example, nesting is closely associated with the Turtle Star, the brightest star in the heavens (or, according to some, a reddish star hanging low on the horizon); leatherback sea turtles (*Dermochelys coriacea*) are 'doctor turtles', visiting other sea turtles when they are ill (hence the leatherback is always covered with spots); turtle eggs and genitalia are potent aphrodisiacs; and so on. Our rich cultural history of sea turtle folklore still awaits its proper documentation.

The meat, organs and eggs of all species were, and to some extent still are, utilised. The tender meat of the herbivorous green turtle (*Chelonia mydas*) has always been favoured. The shell of the hawksbill turtle (*Eretmochelys imbricata*) has long been used to fashion jewelry and household items, in more recent times it became a source of foreign exchange and the animal was also hunted for its meat. The extent of the harvest has never been quantified. Published studies by UWI Professor P. R. Bacon, IMA Research Officer L. M. Lee Lum [Chu Cheong], and Forestry Division (Wildlife Section) biologists and foreign investigators, as well as a brief period (1969-1980) of landing data archived by the Fisheries Division and unpublished data collected by UWI Master's student Michelle Cazabon-Mannette, comprise all available quantitative data; these are summarised in section 3.3. Fisheries Division data indicate that Carenage, Trinidad, was the most important depot (landing site) for sea turtles. During the period of data collection, Carenage peaked in handling 11,563 lb in 1969 and maintained an annual yield of several thousand pounds per year throughout the next decade (1969-1980).

A legal fishery for marine turtles continues to operate in Trinidad and Tobago during a five-month open season established in 1975. The extent of the fishery is unknown, as there are no records of marine turtle landings since 1980, the last year that the Fisheries Division collected these data. At the time of their writing, James and Fournillier (1993) estimated the legal take to be well over 1,000 hard-shelled turtles per year. While there are no formal data on species or numbers landed, size, repro-

ductive condition, seasonal or geographic distribution, or economic value, informed observers agree that available information represents a conservative estimate of take, the primary impetus for the take is turtle meat (which is both shared informally and sold), sales are made primarily through fishers, and the primary consumers are rural residents (Bräutigam and Eckert, 2006).

In 1975, the Fisheries Act of 1916 (Chapter 67:51 of the Laws of Trinidad and Tobago) was amended to include “Turtle and Turtle Eggs Regulations.” The regulations imposed a seven-month closed season (1 March - 30 September). About ten years earlier, some groups (e.g., FNC) pioneered research into the status and distribution of sea turtles, and the extent to which they were exploited, and alerted the public to a general downward trend in sea turtle numbers. Investigations by foreign researchers (e.g., A. F. Carr, P. C. H. Pritchard) further emphasised the endangered status of sea turtles, and the significance of remaining populations both regionally and internationally. In this way the impetus was imparted for the conservation of turtle populations and by the early 1980s, a cooperative approach had been adopted by Fisheries and Forestry authorities. The Fisheries Division had primary responsibility for enforcing the closed season, but the Forestry Division was better equipped to respond with enforcement personnel and resources. The partnership produced tangible results, including the declaration of some of the nation’s most important nesting grounds – Fishing Pond and Matura in 1990 and Grande Riviere in 1997 – as Prohibited Areas under the Forests Act (Chapter 66:01 Laws of Trinidad and Tobago).

The years preceding declaration of these nesting beaches as Prohibited Areas were dangerous years for sea turtles in Trinidad and Tobago. Thousands of pounds of meat (mostly hawksbill and green turtles) were traded annually from beaches and fishing depots throughout the country, but it was the killing of the giant leatherback turtles that caused the most concern. The leatherback harvest was (and is) wholly illegal, focusing on egg-bearing females at nesting beaches. As awareness of the turtles’ plight grew in the 1970s, so did pleas for conservation action. There was rising alarm that an unsustainable number of turtles, and especially gravid females, were being killed each year. Bacon (1973a) estimated that 30% of turtles nesting at Matura Beach and 100% of turtles nesting near villages on the north coast were killed. Despite persistent efforts by local conservation groups and Forestry officials, it was not possible to provide complete surveillance of prominent nesting beaches along the remote east and north coasts. A decade passed and the killing continued. James (1983) wrote, “Every year scores of rotting carcasses could be observed along beaches of Trinidad as a result of illicit slaughter by poachers who are unable to cart away all of the meat, and the major portion is left to rot.” In Tobago, similar scenes unfolded on a smaller scale.

Formal law enforcement alone was insufficient to curb this trend. A more effective and innovative approach was needed. In the 1980s, the Wildlife Section of the Forestry Division (hereafter, the Wildlife Section) turned away from traditional “top-down” natural resource management in Trinidad and made a commitment to what has since become known as “community co-management” (section 4.26). This growing trend in wildlife management emphasises a partnership with rural communities, whereby communities are trained and sensitised to a locally occurring and threatened natural resource and, as a result, actively participate in resource protection. Workshops, seminars and field projects were organised at communities near major leatherback nesting beaches along the northeast coast of Trinidad. Empowering these communities has resulted in the formation of groups that provide suitable services and facilities to a situation that previously lacked organisation and infrastructure.

Today groups such as Nature Seekers, Fishing Pond Turtle Conservation Group, Grande Riviere Nature Tour Guide Association (GRNTGA), Toco Foundation (TF), PAWI Sports, Culture and Eco-Club (PAWI), Nariva Environmental Trust (NET), Blanchisseuse Environment and Art Trust, San Souci

Wildlife Tours, Manzanilla Wildlife and Environmental Project, and the Manatee Conservation Trust in Trinidad are active and informed partners in natural resource conservation, providing beach surveillance, population monitoring, essential biological data, interpretation programmes (including tour guiding services), threat mitigation, and habitat maintenance.

These pioneering efforts in co-management must now serve as models for conservation throughout the Republic. In particular, the situation in Tobago remains dire. The determined efforts of conservation-minded residents and NGOs (e.g., SOS Tobago, Environment Tobago) have been a leading force in curbing the illegal slaughter of nesting sea turtles on the smaller island. Until recently these efforts were conducted largely in isolation, without the serious support of either the professional non-government community or the regulatory offices of Government. Today there is sincere and growing activism on the part of citizens, hoteliers, and Government. This activism cannot reach its full potential, however, without the realisation of a formal, mutually beneficial relationship between Government and community-based groups. Such a partnership not only functions to the benefit of sea turtles, but provides a vital service to a Government legally bound but under-equipped to protect the sea turtle resource. Egg-bearing females continue to be killed on their nesting beaches in Tobago, presenting a persistent challenge to resource managers, and the killing also has negative consequences for the development of ecotourism which could provide much-needed income to local communities, as has been demonstrated in Trinidad.

Although there are relatively few individuals directly involved in turtle hunting, legally and illegally, in Tobago, the number of turtle meat and turtle egg consumers would appear to be significant. Cultural pride is attached to enjoying wild meat, and poaching is always most severe in the weeks leading up to the major 'Harvest Festivals' and 'Fisherman's Fetes' that occur annually in each village, many during the sea turtle nesting season. Therefore, despite the lack of baseline or contemporary data on the status of current stocks and what level of exploitation might be defined as sustainable, turtle meat and eggs continue to be exploited during open and closed seasons alike.

In addition to the continued take of turtles at sea during the closed season and illegal hunting on the nesting beaches, more than 3,000 egg-bearing leatherbacks are estimated to have been caught in coastal gill (*fillette*) nets in 2000 (Lee Lum, 2003, 2006). In the past, many have been clubbed and/or dismembered to minimise damage to a costly net. The accidental entanglement of turtles in nets set for fish is the most serious contemporary threat to leatherbacks in Trinidad, killing far more than all other sources of mortality combined. If a solution to the bycatch problem cannot be found, the turtles will surely be extinguished despite dedicated, ongoing conservation efforts on the nesting beaches. In 2005, a national consultation hosted by the Ministry and WIDECAST brought together fishers, community conservation groups, natural resource management agencies, and bycatch experts to "review the problem of sea turtle bycatch in coastal gillnet fisheries [and devise] a series of potential solutions suitable for field-testing" (Eckert and Eckert, 2005). Recommendations from this meeting have already led to promising field trials. In a recent legislative review, Plater (2010) recommended an offshore prohibited area where net fishing is seasonally banned off nesting beaches to protect egg-bearing females.

Trinidad supports the largest known leatherback nesting population in the insular Caribbean, and perhaps the third largest in the world (Troëng et al., 2004). Notwithstanding, by all accounts, published and otherwise, nesting populations (all species) declined in size over the course of the 20th century. The precise status of remnant populations as we enter the 21st century is unclear, but after nearly two decades of focused conservation effort there is some evidence of slightly increasing numbers of seasonally present adult leatherbacks. Other species remain dangerously depleted.

There is much to be done, and this *Sea Turtle Recovery Action Plan for Trinidad and Tobago* emphasises an integrated approach. Recommendations for specific conservation action on a wide variety of fronts are provided, including strengthening conservation legislation, expanding the system of actively managed and protected habitats, improving coastal zone management policies, promoting public awareness, strengthening community involvement in conservation and management, requiring stiffer penalties for infractions against environmental laws, identifying critical habitats at sea, and building capacity for population monitoring, including quantifying the distribution, abundance and trend of the annual nesting effort and quantifying residency and trends among foraging stocks. The Recovery Action Plan endorses Government's pledge, as yet unfulfilled, to "introduce legislation to prevent the harvesting of sea turtles and sea turtle eggs throughout the year, and introduce public awareness and education programmes to promote sea turtle conservation" (GOTT, 1994). Moreover, expanded and more consistent surveys of nesting and foraging habitats are needed to verify important areas and to evaluate their intersection with fishing grounds and recreational areas (cf. Lee Lum, 2006).

This Recovery Action Plan is in keeping with the National Biodiversity Strategy and Action Plan (NBSAP) and national obligations under other regional and global treaties that promote conservation of threatened species and their habitats. The document has been widely reviewed in-country by Governmental and non-governmental stakeholders, as well as by international experts. It projects a balanced, scientifically sound agenda for achieving important goals over the short- and long-term.

We in Trinidad and Tobago are proud of our history and hopeful of our future. We realise that we cannot advance alone, we need our natural resources to support us. Our future must include populations of sea turtles, both to pass on to the next generation as part of our natural heritage and to assist at the present time in financially sustaining (e.g., through ecotourism and tour guiding) some of our rural communities. We must also recognise and appreciate the ecological benefits that sea turtles provide, including their roles in maintaining the health of coral reefs and seagrasses (which are important habitats for commercial fishes) and the role of leatherbacks in controlling jellyfish populations.

Under the NBSAP, the Environmental Management Authority (EMA) is a focal point for biodiversity planning and is committed to developing partnerships with stakeholders (Government, communities, NGOs) with an aim to promoting co-management of resources, information sharing and implementation of initiatives, and preparation of plans and projects (EMA, 2001). We recommend that EMA, which has a mandate to "develop and establish national environmental standards and criteria", adopt this Recovery Action Plan as the basis for sea turtle management and conservation action nation-wide, recognising that existing sea turtle conservation programmes implemented by the Wildlife Section, Turtle Village Trust, Fisheries Division, IMA, DNRE and DMRF (THA), and several community-based groups all need to be taken into account in coordinating this initiative.

Should our sea turtles be exterminated, they will not return in our lifetimes ... or in the lifetimes of our grandchildren. Maybe they will never return. The Caribbean region is replete with examples of Governments and communities that have come too late to the realisation that sea turtles are not an infinite resource. They are finite in number and must be managed with care and intelligence. As we evaluate our successes and failures with regard to our sea turtle conservation and management initiatives, the eyes of the world are upon us. Trinidad and Tobago supports the largest nesting assemblage of endangered leatherback turtles in the insular Caribbean. What we do here is singularly important for the very survival of this prehistoric creature on Earth. Similarly, the green and hawksbill turtles killed in our waters (including juveniles drawn from distant range States) will never return to their natal beaches to nest; thus, we are actively undermining the conservation efforts of our Caribbean neighbors.

Speaking of our own leatherback turtles, James (1983) wrote, “This remarkable creature, which has apparently not changed much from its ancient ancestors, is a unique part of our natural heritage and inspires wonder, reverence and a feeling for beauty in all who witness the sight of nesting turtles. This magnificent phenomenon cannot be duplicated, and Trinidadians who care are very fortunate to witness this beautiful episode of one of Nature’s bounteous surprises almost nightly for at least five months of every year.”

Let us hope that we in Trinidad and Tobago have the good sense not to sacrifice these “remarkable creatures” on the altars of indifferent politics, outdated customs, and short-term profit. If we miss our chance to act positively, we may not be granted another.

II. STATUS AND DISTRIBUTION OF SEA TURTLES

Several dedicated investigators have contributed substantively to our knowledge of the status and distribution of sea turtles, especially leatherbacks, in Trinidad and Tobago over a period of more than five decades. Research and investigative results have been published by colleagues both local and foreign; since 1982, the Forestry Division (coordinated by its Wildlife Section) and various community-based organisations have taken the lead in assessing the status of the nation’s sea turtles. Their efforts have largely taken the form of community awareness, fundraising, advocacy, and countless bone-wearying hours of mainly voluntary beach patrol.

The leatherback turtle (*Dermochelys coriacea*) is the dominant nesting species. Nesting by hawksbill turtles (*Eretmochelys imbricata*) places a distant second and, in order of abundance, nesting by green turtles (*Chelonia mydas*), olive ridleys (*Lepidochelys olivacea*), and loggerheads (*Caretta caretta*) ranges from occasional to rare (Dow et al., 2007).

The most frequented nesting beaches are found on the eastern and northern coasts of Trinidad, with the highest concentrations of leatherbacks at Grande Riviere, Matura, and Fishing Pond; other important nesting beaches on the north coast (Madamas, Tacaribe) (Figure 3a) are less accessible and data collection is sporadic. Nesting by other species follows the same general pattern, with beaches on the northern and eastern coasts being the most frequented. Exceptions are isolated nesting locations at southeastern (Mayaro Bay) and southwestern (Cedros-Granville Beach) sites for green and olive ridley turtles, respectively (Figure 3a).

The more popular nesting beaches in Tobago for leatherbacks are located on the southwest coast – Rocky Point (Mt. Irvine Back Bay), Grafton Beach (Stone Haven Bay), Turtle Beach (Great Courland Bay) – although nesting is broadly distributed throughout the island (Figure 3b). Hawksbill and green turtle nesting is less common, with the former being somewhat more abundant and especially on the northeast coast (L’Anse Fourmi Beach, Hermitage, Cambleton) (Figure 3b).

Green and hawksbill turtles of all sizes are present in seagrass and hard bottom habitat, respectively, off both islands. Both are hunted (mainly using nets) during a five-month open season, and are killed clandestinely at other times of the year. Hunting pressure on the leatherback in Trinidad eased considerably with the advent of community-based conservation efforts in the late 1980s to early 1990s. More recently, poaching in Tobago has declined significantly in the greater Black Rock area through the efforts of SOS Tobago, Game Wardens and the Honourary Game Wardens, but it remains rampant in the northeast of the island.

2.1 Caretta caretta, Loggerhead Sea Turtle

The local common name for this species is “loggerhead”. The loggerhead can usually be recognised by its large head, thick, somewhat tapered carapace (with typically five pair of non-overlapping lateral carapace scutes, see Figure 2), 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. Nesting females in Florida (USA) average 92 cm (36 inches) in shell length (straight-line, nuchal notch to posterior tip) (range 81-110 cm; n=194) and 116 kg (255 lb) (range 71.7-180.7 kg; n=261) (Ehrhart and Yoder, 1978). Adults weigh up to 200 kg (440 lb) (Pritchard et al., 1983). Colour is red-brown to brown; hatchlings are sometimes gray.

Loggerhead turtles are found as far north as Newfoundland (Squires, 1954) and northern Europe (Brongersma, 1972) and as far south as Argentina (Frazier, 1984), but they have a predominately temperate nesting distribution. As summarized by NMFS and USFWS (2008), (i) only two locations (South Florida, USA; Masirah Island, Oman) have more than 10,000 females nesting each year; (ii) those nesting aggregations with 1,000 to 9,999 females arriving each year are Georgia through North Carolina (USA), Quintana Roo and Yucatán (Mexico), Brazil, Cape Verde Islands, and Western Australia; and (iii) smaller nesting aggregations with 100 to 999 nesting females annually occur in the Northern Gulf of Mexico and Dry Tortugas (USA), Cay Sal Bank (The Bahamas), Tongaland (South Africa), Mozambique, Arabian Sea Coast (Oman), Halaniyat Islands (Oman), Cyprus, Peloponnesus (Greece), Island of Zakynthos (Greece), Turkey, Queensland (Australia), and Japan

According to the existing paradigm, hatchlings leave their natal beaches and are carried passively on the North Atlantic subtropical gyre in Sargassum seaweed rafts to areas of the eastern North Atlantic, including the Azores. After several years of pelagic (=open ocean) existence, juveniles, typically 50-65 cm (20-25 inches) in shell length, return or are returned by currents to the western North Atlantic to become resident benthic (=bottom) feeders on the continental shelf (Bolten, 2003). Early studies of Florida loggerheads suggest that individuals reach sexual maturity at 12-30 years old, more likely at ages closer to 30 years than 12 (Frazer and Ehrhart, 1985). More recent estimates suggest that sexual maturity occurs at 32-35 years of age (NMFS and USFWS, 2008).

The loggerhead is “the rarest of the marine turtles found in Trinidad and Tobago” (Nathai-Gyan et al., 1987). The first documented nesting record is that of a female tagged at Las Cuevas on the north coast of Trinidad on 11 July 1970 (Bacon and Maliphant, 1971). Some investigators have suggested that the south coast may also support loggerhead nesting (Bacon, 1973a), but adequate surveys have not been done. The most recent information on nesting was recorded on film at Grande Riviere on 16 July 1989 (Bro. Robert Fanovich F. P. M., in litt. to the Wildlife Section). The north coast of Trinidad, as well as Chachachacare Island in the “Bocas”, appear to support foraging. Interviews with fishermen confirm that the species is still occasionally encountered off the north coast; records of capture between Blanchisseuse and Matelot villages date back to 1990/91 (Wildlife Section, unpubl. data). Two loggerhead shells were discovered in 1987 at an inland river at D'Abadie in eastern Trinidad; indications were that fishermen had captured the turtles at sea and cooked the meat at the river camp (Nathai-Gyan et al., 1987). On the whole, research efforts have not been intensive for this species and behavioural patterns are unclear.

With respect to Tobago, there are a couple of anecdotal reports of loggerheads sighted offshore and one recorded nesting on Great Courland Bay in the mid-1990s (H. Macmillan, pers obs., 1999).

2.2 Chelonia mydas, Green Sea Turtle

Local common names for the species include “green turtle” and “greenback”. Green turtles are recognised by a round, blunt beak with serrated cutting edges, one pair of enlarged scales between the eyes, and four pairs of non-overlapping lateral carapace scutes (Figure 2). 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. 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 (37-47 inches) in straight carapace length; a mean size of 100.2 cm (n=2107) is reported from the Caribbean nesting beach at Tortuguero, Costa Rica (Bjorndal and Carr, 1989). For details on current conservation status worldwide, see Seminoff (2002).

Green turtle nesting in Trinidad and Tobago is considered to be occasional (Carr et al., 1982; Bacon, 1981) and less common than that of the hawksbill (Pritchard, 1984). The species is reported to nest along the north and east coasts of Trinidad; specifically, at Manzanilla Bay (Bacon, 1981), Mayaro, Matura, Matelot, and Big Bay at Sans Souci (Bacon, 1973a), and Grande Riviere (fewer than 10 nests per year: S. Ruiz, pers. comm., 1995). Nathai-Gyan et al. (1987) reported occasional nesting at Paria, Moruga and the islands off the northwestern coast. There are unconfirmed reports by villagers of nesting at Salybia and Sans Souci (see Figure 3a). The NSTDTT database records indicate that 14 nesting green turtles were tagged on Matura Beach during the period 1999-2005. In 2008, the NSTDTT database shows five green turtle activities (not necessarily confirmed nestings) at Matura and none in 2009; no other green turtle nesting was documented in 2008 or 2009 in Trinidad (NSTDTT, unpubl. data).

In Tobago, Bacon (1981) reports nesting at Batteaux Bay and Grafton Estate, generally known now as Grafton Beach or Stone Haven Bay. Since starting patrols in 2000, SOS Tobago has only recorded the occasional green during regular patrols on Turtle Beach (Great Courland Bay), Grafton Beach (Stone Haven Bay) and Mt. Irvine Back Bay (Rocky Point); however, there is evidence of more regular nesting in the north, especially at Goldsborough (W. Trim, pers. obs.) and L’Anse Fourmi Beach (T. Clovis, H. Pepe-Yeates pers. obs. 2004), and to a lesser extent in the southwest, especially at Arnos Vale (R. Daniel, pers. obs.), Pigeon Point and Kilgwyn Bay (R. Jacob, pers. comm.) (Figure 3b). No green turtle nesting was reported in Tobago in 2008 or 2009 (Lalsingh, 2008, 2009).

Nesting is believed to occur between February and August (Bacon, 1973a; Wildlife Section, unpubl. data) and, at least at Matura Beach, continues into September and October (D. Sammy, pers. observ.). Clutch size and frequency are unknown, but at Tortuguero, Costa Rica, 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. As is the case with all sea turtle species, cooler regimes favour male offspring; warmer regimes, female offspring (e.g., Morreale et al., 1982). In general, 2-6 clutches of eggs are laid per female every 2-3 years. This frequency is expected to characterise nesting in Trinidad and Tobago, as well.

Juveniles of varying sizes forage in the waters of Trinidad and Tobago throughout the year, primarily in areas of seagrass. Sightings indicate that the species is not confined to any particular area, having been reported at Saut D’eau, Matelot, Grande Riviere, Toco, Matura, Mayaro, Soldado Rock and Chacachacare. The Matelot and Toco areas are clearly important. Interviews with fishermen along the southern coast of Trinidad indicate that green turtles were occasionally captured by shrimp nets until the advent of mandatory turtle excluder devices (TEDs) (see section 4.23). In Tobago, green turtles are

caught extensively along the Atlantic coast from Kilgwyn to Speyside, in Charlotteville, and in the Buccoo Reef Marine Park, with all popular capture sites corresponding to seagrass meadows. Juveniles, sub-adults and adults have also been spotted at several popular dive sites around the island that correspond to coral reef habitat (Arnos Vale, Cove, Store Bay and offshore Kilgwyn) and juveniles are regularly spotted at reef dive sites in Mt. Irvine Bay in particular where they were observed more frequently than hawksbills (M. Cazabon-Mannette, in prep.).

Green turtles would not be expected to remain in local waters throughout their lives. The post-hatchling stage, in particular, is known to be pelagic (=open sea). 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. Sargassum seaweed rafts sometimes shelter hatchling green turtles and also harbour a diverse, specialised 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 returning to coastal waters and 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 seagrass 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 seagrass meadow to forage each day (Ogden et al., 1980, 1983). These scars, or grazing plots, are maintained by regular cropping for several months or more, and the more digestible newer growth (higher in protein, lower in lignin) is preferred (Bjorndal, 1980). When the cropped grasses show signs of stress (e.g., blade thinning, increased inter-nodal distance), the evidence suggests that the turtle abandons the area and moves on to an ungrazed area to establish another grazing plot.

Green turtles travel extensively during the first decades of their lives and in the years preceding reproductive maturity they may take up temporary residence in many locations (Carr et al., 1978). They most likely travel thousands of kilometers in the Caribbean Sea before the urge to reproduce impels them to migrate to mating and nesting grounds, the latter presumed to be their natal (=birth) beach. Caribbean green turtles reach sexual maturity at an estimated 18-36 years of age (reviewed by Frazer and Ladner, 1986). After reproducing, there is some evidence that turtles return to resident foraging grounds. Therefore, the movements of adult turtles are likely to be less extensive than those of juveniles, since adults move seasonally between relatively fixed feeding and breeding areas.

The green turtle is one of two species (with the hawksbill) usually caught by turtle nets in Trinidad and Tobago during the five month open season (see section 4.211). Nathai-Gyan et al. (1987) concluded, based on reports that the "green turtle is frequently caught by fishermen in waters of Trinidad and Tobago", that the species was "moderately common" in offshore waters. There are no official landing statistics, but James and Fournillier (1993) estimated that the fishery claimed more than 1,000 turtles per year (see section 3.3). More green turtles are caught than hawksbills in Tobago (E. Caesar, pers. comm., 1995); in November 2000, 3-5 mature green turtles were being landed weekly at one south-western site and the meat was sold openly in Bon Accord for TT\$14/lb (G. Alkins, pers. observ.).

In 2009, the open season price for green turtle meat stood at TT\$25/lb, increasing to TT\$40/lb in the closed season. There are also reports of whole turtles being sold for up to TT\$900 during open season (R. Daniel, pers. obs.).

The apparent focus on green turtle take may have resulted in declining numbers of this species in fishery waters. Hailey and Cazabon-Mannette (2011) reported survey results from interviews conducted in 2007 with 215 fishers in Tobago; of 22 fishers who reported fishing turtles, 10 reported that they catch mostly hawksbills and only five reported that they catch mostly greens (seven fishers did not elaborate).

2.3 Dermochelys coriacea, Leatherback Sea Turtle

Local common names for the species include “caldon”, “leatherback”, “torti a’cles”, and “coffin-back”. In addition, the name “batali” (used in Trinidad to refer to olive ridleys, see section 2.6) is sometimes used in Tobago to refer to leatherbacks (R. Sandy, pers. comm., 1995). Leatherbacks are the largest of the turtles. Females weighed on the nesting beach at Matura average 329 kg (n=269, range 143-498.5 kg) (Scott A. Eckert, unpubl. data). The largest leatherback on record is a male that drowned in a fishing net and stranded on the coast of Wales in 1988, the turtle 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 (Figure 2). The smooth, black skin is spotted with pale yellow or white. The tapered carapace is raised into seven prominent ridges. The average size of females nesting at Matura Beach, Trinidad, has remained relatively constant for nearly four decades: 158 cm (n= 20, range 125-185) between 1968-1970 (Bacon, 1971a); 157.6 cm (n=104, range 139.7-210.0) between 1981-1983 (Chu Cheong, 1990); 157.8 cm (n=131, range 142-171; Orosco sector only) in 1994 and 154.3 cm (n=2,267, range 115-188) in 2005 (NSTDTT, unpubl. data). 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. Reliable at-sea sightings confirm a range that extends from ~71°N (Carriol and Vader 2002) to 47°S (Eggleston 1971), meaning that this species has the most extensive range of any reptile. Adult females are seasonal visitors to Trinidad and Tobago, arriving as early as January and laying eggs mainly through August (April-June peak). In 1987, hatchlings were seen in February (Nathai-Gyan et al., 1987) in Trinidad and, in January 1996, hatchlings were seen on Great Courland Bay in Tobago (D. Rooks, pers. observ.), suggesting at least some egg-laying in November. Females arrive from north temperate foraging and residence areas and return to these latitudes after egg-laying is complete (Eckert and Eckert, 1988; James et al., 2005; Eckert, 2006). The paths taken by hatchlings leaving their natal beaches unknown, but young juveniles remain in tropical latitudes (Eckert, 2002). Two juveniles were recently released in the Charlotteville area: one from a net in 2003 and one from a fishing boat in 2004 (P. Turpin, pers. observ.). Age at maturity in Dermochelys was recently estimated by Avens et al. (2009) to be 24.5 to 29 years.

Based on limited tagging studies (Table 1) and other information available at the time, Nathai-Gyan et al. (1987) estimated that 500-900 turtles nested in Trinidad each year between 1984 and 1987. Today these numbers are widely viewed as significantly underestimating the population at that time. In 1999, Nature Seekers initiated a large-scale leatherback tagging programme at the Matura Beach Prohibited Area with an aim to census the population by marking each nesting turtle with flipper and Passive Integrated Transponder (PIT) microchip tags. Tagging data, combined with more recent early morning nesting surveys, indicate that an estimated 52,797 and 48,240 nests were laid at the nation’s three largest nesting beaches (Grande Riviere, Matura, Fishing Pond) in 2007 and 2008, respectively, and the population is stable or slightly increasing. In addition, nesting is now observed at sites along Trinidad’s north coast (e.g., Manzanilla, Big Bay, San Souci) where nesting has not occurred in recent memory. Quantifying the precise status of the island’s leatherback population has proved elusive, mainly due to an estimated 40% encounter rate (at patrolled beaches), inconsistent and/or unquantified beach patrol effort, and gaps in coverage (not all nesting beaches are patrolled).

In Tobago, the nesting colony is depleted and, despite the efforts of concerned citizens, is under persistent threat from poachers. Bacon (1971) reported that the Tobago population numbered in the “dozens” and Nathai-Gyan et al. (1987) endorsed this estimate; however, local unpublished reports from that time by Forestry Division personnel in the THA suggest that the numbers were actually much higher. Until recently there was little quantitative information, as no formal programme for data collection was implemented prior to 1993. It is clear from the personal experience of concerned citizens who have been patrolling beaches near their homes for many years (often directly confronting poachers and vying for a turtle’s life), that the population declined precipitously in the 1980s. As recently as 1987, multiple turtles could be seen on the beach at Black Rock (Courland Bay), to the point where they were “passing each other to and from nesting sites” (W. Herron, pers. observ.). By 1990, those days were gone. In 1994, a total of 64 leatherback nests were reported by NGOs, hoteliers, and government agencies in collaboration with the Forestry Division. In 1995, Forestry patrols observed 55 nests, representing perhaps fewer than 10 turtles.

Since 2000, consistent patrols by SOS Tobago on Turtle Beach (Great Courland Bay), Grafton Beach (Stone Haven Bay) and Mt. Irvine Back Bay (Rocky Point) have gradually reduced poaching at these sites to 1 or 2 opportunistic incidents per season, at most. These three beaches now host an average of 250 nests per season, with approximately 70% laid on Great Courland Bay (SOS Tobago, unpubl. data). In 2005, with assistance from Nature Seekers and the Barbados Sea Turtle Project, SOS began flipper-tagging on these three beaches and tagged 81 individuals between May and July of that year. PIT-tagging of leatherbacks started in 2008 with funding from Turtle Village Trust, and a total of 97 individuals were recorded in that year. SOS has also encountered leatherbacks previously tagged in Grenada and in Trinidad, illustrating the shared nature of the resource. King Peters Back Bay (Cotton Bay) in Moriah appears to host a comparable number of leatherbacks to Mt. Irvine Back Bay, but it is only sporadically patrolled due to its inaccessibility. Poaching is rampant there, with more than 10 confirmed slaughters in 2005, and concerned villagers feel that the overall nesting population has declined significantly as a result (B. Taylor, pers. comm.). Honourary Game Wardens and dedicated residents also monitor beaches on the Atlantic coast where nesting is occasional and poaching is still a threat.

The number of leatherback turtles arriving to nest fluctuates from year to year. This is the case with all sea turtle species, and results from the fact that a varying proportion of the population at large is reproductively active in any particular year. Individual females nest on 2-5+ year schedules, and these schedules coincide with each other in complex ways that determine what proportion of the population is encountered on the nesting beach each year. These year-to-year fluctuations do not normally reflect changes in the size of the population; however, when a persistently downward (or upward) trend in the data becomes apparent over the course of a decade or more, these long-term trends do reflect corresponding changes, for better or worse, in the population at large and should be taken seriously by managers and policy-makers.

The most important nesting sites in Trinidad are Matura Bay, Fishing Pond, and Grande Riviere, and these beaches are considered especially sensitive as easy accessibility makes them vulnerable to human disturbance. To promote protection, legal and other mechanisms have been implemented (see section 4.121). Other prominent nesting beaches on the north and east coasts of Trinidad include Paria Bay, Murphy Bay, Petite and Grande Tacarib, Madamas/Patience Bay, Cachipa, Manzanilla and Mayaro. Bacon (1971) reported nests at Valentines Bay, Las Cuevas, Blanchisseuse, Cumana Bay, Ortoire River Mouth, Maracas, Big Bay Toco, and Salibia, and sporadic nesting is recorded at these beaches today. James (1983) cited nesting at Salibia, Madamas, Paria, and Blanchisseuse and commented that “as recently as 10 years ago nesting turtles were also frequently seen at Las Cuevas and even at Maracas

Beach.” On the south coast, nesting has been recorded at Guayaguayare and Moruga. Other nesting areas include Big Bay at San Souci and, in 1994, nesting was reported at Palo Seco (see Figure 3a).

In Tobago, low density nesting occurs on most beaches and has been reported from both the Caribbean and Atlantic coasts. The most important beaches (those with the most nesting females) are Turtle Beach (Great Courland Bay), Grafton Beach (Stone Haven Bay) and Mt. Irvine Back Bay (Rocky Point) in the southwest and King Peters Back Bay (Cotton Bay), L’Anse Fourmi and Dead Bay (Erasmus Cove) in the northeast. Other occasional to frequent nesting sites include Sotre Bay, Grange Bay, Turtle Bay, Englishman’s Bay, Bloody Bay, Man-O-War Bay, Pirates Bay, Batteaux Bay (Speyside), Roxborough Beach (Argyle), Goldsborough Beach, John Dial Beach (Hope), Fort Granby and Minister Bay (Bacolet) (see Figure 3b). In past years, most records of nesting in Tobago have been associated with the illegal killing of egg-bearing females on shore (section 3.3).

Data collected at the well-studied nesting ground at Sandy Point National Wildlife Refuge (St. Croix, U.S. Virgin Islands) indicate that females deposit an average of 6-7 clutches of eggs at 9-10 day intervals during the nesting season and most return to nest every 2-3 years. Individuals rarely nest in consecutive years but sometimes return after intervals longer than three years. Clutch size is typically 60-100 yolked eggs, averaging 85 (Basford et al., 1990), in addition to a variable number of small, yolkless eggs. Bacon (1970) reported that clutch size varied at Matura from 65-130 eggs, including the yolkless eggs. Godley et al. (1991) reported an average of 80-90 yolked eggs at Matura and Grande Riviere. The eggs incubate in the sand at a depth of 60-70 cm. Incubation lasts about two months and hatchlings usually emerge in the early evening. Daylight emergence has been observed. On at least two occasions in recent years, nesting has been observed during daylight hours (“around noon”): at Matura by Game Warden (North East patrol) Urban Whittier and at Fishing Pond by Community Patrol member Thakorrie Boodoo. Daytime nesting seems slightly more common in Tobago, with 2-5 daytime nesting events each season on Great Courland Bay (SOS Tobago, unpubl. data)

With regard to the offshore behaviour of leatherbacks in Trinidad and Tobago, satellite telemetry studies of post-nesting females in Grande Riviere and Matura beaches shows that gravid females spend “much of their time directly off the nesting beaches and up to 30 km offshore”, with Galera Point defined as a particularly significant destination, perhaps because “two long-shore currents intersect at Galera and this confluence may serve to concentrate jellyfish prey” (Eckert, 2006) (Figure 4). James et al. (2005) reported that an adult male leatherback satellite-tracked from Nova Scotia, Canada navigated to Galera Point early in the nesting season in 2004 and again in 2005, suggesting that Galera Point may represent an area for mating, as well as foraging. Upon departing Trinidad, post-nesting adult females return to foraging grounds in Canadian and west African waters (Eckert, 1997a; Eckert et al., 1998; Eckert and Lien, 1999; Eckert, 2006) (Figure 5).

There has long been speculation that the arrival of leatherbacks, as well as their local movements and distribution, corresponds with a seasonal influx of jellyfish. Bacon (1971) mentions observations of leatherbacks “eating the jellyfishes, *Physalia* and *Stomolophus*, in coastal waters.” Fishermen along the north coast report that the turtles are often found in proximity with jellyfish. Some feeding may occur during the reproductive season, but the extent to which foraging occurs in local waters has not been studied. Based on studies of offshore 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. Stomach contents of animals killed in other parts of the world indicate the diet is mostly cnidarians (jellyfish, siphonophores) and tunicates (salps, pyrosomas) (Brongersma, 1969; Den Hartog and Van Nierop, 1984; Davenport and Balazs, 1991).

Fishermen describe activities which may represent mating off Galera Point (Trinidad) and the northeast coast of Tobago. James et al. (2005) document the movement of an adult male into Trinidadian waters from Canadian foraging grounds; the journey was repeated in both 2004 and 2005. Significantly, the male arrives prior to nesting (February). The two incidents of reported mating most familiar to the authors occurred off Blanchisseuse in April (“late 1970s”) and again in “about 1983” (C. Rooks, *in litt.* 5 July 1997). In both cases, the pair consisted of a larger male mounted atop a female at the sea surface. His fore flippers grasped her shoulders, ‘piggyback’ style. The pairs were easily approached by boat, but showed signs of distress and panicked when the boat got too close and they were unable to flee or dive. There are similar reports from fishermen in north-eastern Tobago, in most cases focusing on the deep waters surrounding St. Giles and Sisters Rocks (H. Pepe-Yeates, pers. observ) and near the natural gas rigs off the coast of Castara (R. Daniel, pers. comm.).

2.4 Eretmochelys imbricata, Hawksbill Sea Turtle

The common name for this species is “hawksbill” (or “oxbill”); “chicken turtle” is also used. One young fisherman interviewed in Tobago referred to this turtle as a “curve-back”. The species 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 lateral carapace scutes overlap, like shingles on a roof (Figure 2). There are two pairs of prefrontal scales between the eyes. Adults rarely exceed 90 kg (198 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. For details on current conservation status worldwide, see Mortimer and Donnelly (2007).

This rare turtle is challenging to study. Hawksbills are migratory (as are all Caribbean sea turtles) and high-density nesting is rare (Dow et al., 2007). Gravid females often nest on isolated beaches (including those flanked by exposed coral and rock) that are difficult to monitor on a consistent basis. Data collected from a long-term study of this species while nesting at Jumby Bay, Antigua, indicate that, over the course of the main nesting season (mid-June to mid-November), egg-bearing females will successfully nest an average of five times, separated by intervals of 13-18 days, and that clutch size averages 157 eggs (Corliss et al., 1989; Richardson, 1993). The female often lays her eggs in the shelter of beach vegetation, such as sea grape (Coccoloba uvifera) which is common along the coasts of Trinidad and Tobago. Little evidence of the visit exists aside from an asymmetrical (=flippers alternating) crawl 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 predictably return to the same area to renest on intervals of 2-3 (or more) years, again based on data collected in Antigua (Fuller et al., 1992; Hoyle and Richardson, 1993).

In Trinidad, nesting occurs mainly from July to November; a bit earlier in Tobago (April to November). Most nesting is reported from the offshore islands of Boca del Dragon (Bacon, 1973a; Pritchard, 1984). Females have been observed coming ashore on pebble beaches where there is no overlying sand and excavating nests under beach vegetation (Chu Cheong, 1990); e.g., crawls have been observed at pebble beaches at Chacachacare (Wildlife Section, unpubl. data 1991-1993). In addition, diffuse nesting occurs on the sandy beaches of the north and east coasts of Trinidad: Maracas, Blanchisseuse, Las Cuevas, Paria, Tacarib, Madamas, Cachipa, Grande Riviere, Matura, Fishing Pond, and Manzanilla. Bacon (1973a) adds Mayaro, Big Bay, Sans Souci and Matelot beaches and reports a “hatchling on Balandra Beach in July 1972” (see Figure 3a). Ms. M. Gaskin (Pointe-à-Pierre Wild Fowl Trust, pers. comm., 1994) reported nesting at Matura, Balandra, Manzanilla, Mayaro, and Chacachacare and Monos islands, and foraging around the islands of Monos, Huevos and Chacachacare in the “Bocas”.

Comprehensive tagging of nesting females began at Matura in 1999, and 84 nesting females were tagged between 1999 and 2005 (NSTDTT, unpubl. data). In 2008, there was one hawksbill nesting activity at Fishing Pond and seven at Matura; similarly, in 2008 there was one hawksbill nesting activity at Fishing Pond and three at Matura (NSTDTT, unpubl. data).

A maximum of six nests have been counted during a single year at Grande Riviere; most females are killed at this beach and the meat sells within the village for TT\$2/lb (S. Ruiz, pers. comm., 1995). By 2005, local consumption was still occurring but there was no evidence of retail sale (L. Peters, pers. comm.). Recent surveys (October 2009-February 2010) by the Wildlife Section at selected fishing depots and markets along the northeast coast revealed the following: at Sangre Grande and Tunapuna markets, hawksbill meat was available every Saturday at a cost of TT\$20/lb; at the Salybia and Manzanilla Fishing Depots, a whole hawksbill was selling at TT\$15/lb, and was also available weekly. Shells, cleaned and varnished, were selling for TT\$100-\$200 and ranged in size from 30-60 cm curved carapace length (Wildlife Section, unpubl. data).

Foraging is regularly observed offshore the northern and eastern coastlines. During a north coast habitat survey in July 1993, Wildlife Section personnel documented 12 hawksbills foraging in the near-shore waters of Paria Bay. In September 1994, another north coast survey documented two hawksbills foraging off Morne Poui. There are occasional sightings of foraging around Soldado rock off the south coast. 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 and other hard bottom habitat in Trinidad and Tobago, especially that supporting sponge growth. Fishermen confirm that juveniles of all size classes are captured in hard bottom habitat, such as the Manzanilla Bank, Trinidad, which is a favoured netting site during the open season.

In Tobago, Carr et al. (1982) reported nesting but gave no details. There is evidence of nesting (i.e. tracks, hatchlings or poaching) at almost all the small sandy/pebbly coves in Tobago on both the Caribbean and Atlantic coasts with regular activity being observed at Swallows Bay, Pigeon Point, Buccoo Bay, Mt. Irvine Back Bay (Rocky Point), Grafton (Stone Haven Bay), Great Courland Bay Arnos Vale, Gordon’s Bay, Celery Bay, King Peters Bay, Emerald Bay (Castara), Englishman’s and Little Englishman’s Bay, Dead Bay (Erasmus Cove), L’Anse Fourmi, Hermitage, Campbellton, Pirates Bay, Batteaux Bay, Barbados Bay, Little Rockley Bay, Petit Trou, Kilgwyn, Sandy Point and Milford Bay (Figure 3b). Most contemporary surveys of hawksbill nesting activity “involve track counts rather than actual encounters with turtles on the nesting beach”, and deficiencies in surveillance are noted (Lalsingh, 2009). Lalsingh (2008) reports eight nests and two false crawls, combined, at Turtle Beach, Grafton Beach, and Back Bay in Tobago in 2008, increasing to 21 activities in 2009 (Lalsingh, 2009).

The extent of potential foraging habitat is probably greater in Tobago than in Trinidad, but the distribution and abundance of foraging hawksbills is only beginning to be studied (in Tobago) with UWI Master’s student Michelle Cazabon-Mannette reporting their presence at dive sites around the island, including on reefs between Cove and Crown Point on the south-west of the island, along the north coast including Mt. Irvine, Arnos Vale, Plymouth, Castara, Sisters Rocks and Charlotteville, and throughout Speyside. The frequency of sightings varied across sites, with a maximum of 8.6 turtles per hour observed at Divers Dream (The Shallows) off Crown Point, while no more than two hawksbills per hour were observed at any of the other sites (mean = 0.8/hr across all reef sites) (M. Cazabon-Mannette, unpubl.

data). Consistent at-sea sightings records have not been kept, but the general consensus of residents interviewed for this Recovery Action Plan was that hawksbills are fewer and smaller than in recent memory, and that they are frequently caught during the closed season, mostly by spear fishermen and nets set parallel to the shoreline in reef habitat. The unregulated harvest has taken its toll. At Arnos Vale and Buccoo Reef, for example, hawksbills were “common” as recently as the mid- and late-1980s; today there are only a few resident juveniles.

Sporadic monitoring of smaller rural beaches in Charlotteville, L’Anse Fourmi, Castara and Parlatuvier reveal consistent nesting and poaching activity. In 2007, SOS Tobago recorded a combined total of 55 nesting events during an intensive patrol effort in June-July on the beaches of Campbelton, Hermitage, L’Anse Fourmi and Dead Bay (Erasmus Cove) and was able to tag 21 individual females on Campbelton which was the most regularly monitored nesting site and the most active for hawksbill nesting of the four beaches (G. Alkins, H. Pepe-Yeates: SOS, unpubl. data)

2.5 Lepidochelys kempii, Kemp's Ridley Sea Turtle

Although this species has not been documented in Trinidad and Tobago (and is not expected to occur), we have included this brief description to aid in its identification should the opportunity arise. In surveys conducted during the development of this Recovery Action Plan, a few interviewees identified the Kemp’s ridley (from photographs) as being present in past years. However, it is likely that these were olive ridleys (see section 2.6), as kempii is largely confined to the Gulf of Mexico and North Atlantic. Notwithstanding, all ridley specimens should be carefully photographed for identification by experts.

The species is similar in appearance to the olive ridley (Figure 2), being gray in colour when 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, section 2.4). At 27-41 kg (60-90 lb) (Ross et al., 1989), Kemp’s ridley is the smallest sea turtle. The species is carnivorous and eats mostly crabs, but will also prey on other crustaceans, shellfish, jellyfish, sea urchins, starfish and fish. Nesting occurs mainly in Mexico, with secondary sites located in the USA (Dow et al., 2007).

2.6 Lepidochelys olivacea, Olive Ridley Sea Turtle

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. Each front flipper bears a single claw, the horny beak may be finely serrated, and carapace scutes do not overlap one another. The turtle rarely exceeds 45 kg (100 lb) (Pritchard et al., 1983). Olive ridleys nesting at Eilanti, Suriname, range in size from 63-75 cm (25-29 inches) shell length and can be distinguished from the other sea turtles by a relatively high and often asymmetrical number of lateral carapace scutes, mostly six or seven on each side and sometimes eight or nine (Schulz, 1975) (Figure 2). Carapace scutes do not overlap one another (cf. hawksbill turtle, section 2.4).

The olive ridley sea turtle is also called “batali” by some fishermen, especially in Trinidad (Carr, 1956, 1967; Wildlife Section interviews 1994, 1995). [Note: Confusingly, the leatherback is referred to as “batali” in Tobago.] Nesting in the western Atlantic is reported from Brazil to Venezuela. Olive ridleys nesting in Suriname have declined considerably in recent years, from about 3,000 nests per year in the late 1960s to fewer than 500 nests per year in the early 1990s (Reichart and Fretey, 1993). Incidental catch and drowning in shrimp trawls has been implicated in their demise. While the species remains depleted in Suriname, recent population increases are reported in French Guiana (Kelle et al., 2009).

Though rare, this species is known to nest and feed in Trinidad and Tobago (the first reference to this was by Carr, 1956). Of the olive ridleys tagged while nesting in Suriname in the 1960s and early 1970s (see Pritchard, 1973, 1976), “a fair proportion” were later caught by trawlers plying the waters of Trinidad and western Venezuela (Pritchard, 1984).

Nesting records include individuals identified by Bacon (1981) at Matura, Manzanilla and Cedros, and another found by Chu Cheong (1984). According to M. R. Gaskin, “olive ridleys nested in western Trinidad in 1984”, an occurrence which she characterised as “surprising and noteworthy”; nest locations were given as “one nest near Orange valley and twenty or more at Otaheite” (cited *in* Pritchard, 1984). Nathai-Gyan et al. (1987) report an olive ridley carcass at Fishing Pond in 1986; they assumed the turtle had come ashore to nest and become entangled in beach debris. There was a confirmed nesting at Grande Riviere in July 1995 (S. Ruiz, pers. observ.). Livingstone (2005) reported olive ridley nesting on Madamas Beach on the north coast of Trinidad in June 2003 (see Figure 3a).

In Tobago, the shell of an adult olive ridley was found at Celery Bay with fresh cutlass marks; the flesh was gone and it could not be determined whether the animal was killed nesting or at sea (A. Blade, pers. comm., 1995). A 34-year old fisherman interviewed in Tobago indicated to the authors that ridleys are “rarely” seen; he could not remember the last sighting. There was an unconfirmed nesting in Tobago at Studley Park in 2004 (A. Ramsey, THA, pers. comm.), and a stranding at Little Rockley Bay in 2007 (T. Clovis, SOS, pers. observ.)

III. STRESSES ON SEA TURTLES IN TRINIDAD AND TOBAGO

3.1 Destruction or Modification of Habitat

Degradation of important habitat is an enduring problem. Several challenges are noteworthy: beach sand mining; beach erosion (natural and man-induced); pollution; and the consequences of increasing rural and commercial beachfront development, including seawalls (e.g., from Manzanilla to Point Radix on Trinidad’s east coast), artificial lighting (which disorients hatchlings and may dissuade or confuse nesting females), increased vehicle and pedestrian traffic, and litter.

Beach sand mining has been extensive at Matura Bay and Blanchisseuse in Trinidad. While in the past there has been extensive mining at Kilgwyn, Great Courland Bay, Studley Park, King Peter’s Bay, and Goldsborough Beach in Tobago, the introduction of affordable, higher quality sand in the construction sector has reduced the levels of beach sand mining in recent years. Nathai-Gyan’s (1984) report that mining at Matura Beach had resulted in the “drastic erosion of the turtle nesting area [as] illustrated by the presence of huge craters on the beach and numerous fallen coconut trees on the shoreline” contributed to the government’s halting of mining operations there in 1985, but in other cases entire beaches have been lost. For example, hawksbills no longer nest at Gordon Bay (Blanchisseuse), which has been reduced to a rocky shore by the persistent efforts of sand miners.

Annual cycles of erosion are especially prevalent on the beaches of Trinidad’s east and northeast coasts, and at Mt. Irvine Back Bay and Great Courland Bay in Tobago. These beaches, many of which are very important as nesting grounds for the leatherback turtle, are characterised by high energy wave action which can result in heavy nest loss. In 2008, extreme rough seas at the start of the nesting season (March) resulted in Mt. Irvine Back Bay (Rocky Point) and parts of Stone Haven Bay (Grafton) being completely underwater at high tide until well into May. At some sites (e.g., Fishing Pond, Matura, Grande

Riviere, Great Courland Bay), rivers emerging on nesting beaches annually burst their banks and incite considerable bouts of erosion during the nesting season (Godley et al., 1993; Lee Lum, 2005), precipitating nest loss. Bacon and Maliphant (1971) estimated that “about one third” of nests were lost to erosion at Matura in 1970. Similarly, an estimated 35% of nests were lost to erosion at Matura in 1994 (S. Lakhan, Nature Seekers, pers. comm.). On a related note, a gravid leatherback ashore at Matura Beach in 1994 died after it fell down an embankment created by heavy surf.

In addition to threats posed by erosion, litter and debris often characterise high energy (as well as high use) beaches. Coastal and inland littering (some of which is swept into rivers and ultimately reaches the sea) is a problem throughout the Republic. The east and north coasts of Trinidad are particularly prone to ocean-borne debris. Recreational activities and poor habits by both residents and tourists result in extensive littering on Tobago’s beaches; hillside and river dumping is also a major problem. To promote cleanliness at important nesting sites, annual beach clean-ups have been undertaken in Trinidad since 1992 (see section 4.134) at the initiative of community-based organisations and with the participation of clubs (e.g., University of the West Indies Biological Society), government agencies (e.g., Wildlife Section-Forestry Division), corporate entities (e.g., bhp Billiton), and the interested public. Government-assisted labour/training schemes, such as the Community Environmental Protection and Enhancement Programme (CEPEP), have also been helpful at providing maintenance on the beaches of Tobago and in Grande Riviere, but their habit of burning garbage and cutting coastal vegetation poses other dangers to incubating eggs and shoreline stability.

In Tobago, SOS Tobago has collaborated with Environment Tobago, youth groups, schools, visiting volunteers and the general public since 2003 to host regular beach clean-ups, prior to the nesting season, in the greater Black Rock area (Rocky Point/Mt. Irvine Back Bay, Grafton/Stone Haven Bay, and Turtle/Great Courland Bay). Under the THA, workers have also been employed to maintain the beaches on a daily basis. These efforts produce visible results and raise public consciousness not just about waste management, but also about threats to nesting turtles. In Trinidad, the most significant threat to date was a plan submitted to the Town and Country Planning Division in 1995 to develop several hotels and a golf course behind Matura Beach. The plan was never implemented and, with the exception of Grande Riviere (see section 4.132), the most important nesting beaches in Trinidad remain largely free of commercial development at this time.

In contrast, several Tobago beaches are densely developed for commercial tourism, including hotels, recreational centers, snack bars and restaurants. The result has been reduced sea turtle access to potential nesting sites due to built facilities, umbrellas, and other recreational equipment. One of the most significant challenges to conservation in Tobago is the apparent abandon with which coastal development proceeds. Plans for large hotels continue to emerge, despite the fact that existing hotels are rarely filled to capacity and smaller scale construction of things like beach facilities and sea walls continue with seemingly little consideration for beachfront lighting and beach stabilisation. Many residents interviewed for this Recovery Action Plan complained that too many hoteliers and villa owners act with impunity, ignoring limits set on the number of hotel rooms to be constructed, sewage standards, etc. Some prominent hotels have chronic sewage problems, releasing untreated or under-treated effluent offshore of nesting beaches (see section 4.146).

In terms of the marine habitat, there are isolated problems with anchor and other seabed damage in areas potentially important to sea turtles. Tobago’s shallow reef systems in near shore waters and within the Buccoo Reef Marine Park are subject to damage from reef-walking and breakage by snorkelers. However, most of the reefs are in deeper water and the many popular SCUBA sites are, therefore, less

prone to direct human damage. Unregulated anchoring is a recognised problem in Tobago and a well-maintained island-wide system of regularly monitored markers and moorings is needed, expanding upon the reef demarcation buoys implemented by Buccoo Reef Trust (BRT) and the Department of Marine Resources and Fisheries (with co-funding from the Travel Foundation) in Store Bay, Mt. Irvine and Charlotteville in 2004. Seagrass meadows must also be monitored and protected as valuable habitat.

In Trinidad, rough seas offshore most nesting beaches are less conducive to marine recreation or anchorage. The major commercial activity offshore Trinidad's nesting beaches relate to the petroleum industry, but to our knowledge there have been no injuries or other harm to sea turtles associated with these activities (see section 4.145).

Recommendations on preventing or mitigating degradation to nesting beaches and foraging grounds are provided in sections 4.13 and 4.14, respectively.

3.2 Disease or Predation

The extent to which disease negatively influences the survival prospects of sea turtles in Trinidad and Tobago has not been quantified.

Fishermen should be alert to fibropapilloma disease, a herpesvirus-like infection characterised by tumors. The disease affects mainly green turtles and can cause blindness, starvation and death. Tumors appear as whitish or gray growths, similar to warts, which can be 10 cm or more in diameter. Internal tumors can be associated with the lungs, intestinal surface, and kidneys (Jacobson, 1990). The cause of this potentially fatal disease is not known. In the southern regions of the Caribbean the disease has been reported in Barbados (Horrocks, 1992), Curaçao (Sybesma, 1989), Panama (Jacobson, 1990), and Venezuela (Guada et al., 1991), among others.

In Trinidad there have been unconfirmed reports of green turtles afflicted with fibropapillomas in the area of Chaguaramas dating back nearly 30 years (e.g., L. Lee Lum, IMA, pers. observ., 1983). In February 1991, a green turtle heavy with tumors was observed struggling in a weakened condition off the west coast (Goodwill Bay) of Gaspar Grande Island, northwestern Trinidad; the following day it was dead (G. Ramsewak, pers. comm., 1995). Similarly afflicted green turtles have been encountered in Paria Bay on the central north coast of Trinidad. Members of the community group GREAT observed three green turtles coming ashore to nest at Grande Riviere in 1993 with tumors resembling fibropapillomas (diagnosis was based on information provided by the Wildlife Section) and, in 1995, a green turtle exhibiting tumors washed ashore at Matelot entangled in a net (L. Peters, pers. observ.).

In 2008, J.E. Cooper, Professor of Veterinary Pathology, UWI, Mount Hope reported (*in litt.*, 8 April 2008) that “a dead green turtle (*Chelonia mydas*) was sent by the Wildlife Section for post-mortem examination at the School of Veterinary Medicine, UWI, Mount Hope. This turtle was found to have a disease called fibropapillomatosis and this is possibly the first documented report of this condition from Trinidad waters.” There are, to date, no confirmed reports of this disease in Tobago, although SOS has received unconfirmed reports from tourists of green turtles with “wool-like” growths on their heads. (Sores or abscesses, such as those sometimes reported on leatherbacks, should not be confused with fibropapilloma disease.) Health risk(s) to humans are poorly known, but it is logical to advise that diseased turtles never be eaten or offered for sale.

Major predators on sea turtle eggs and hatchlings include indigenous species of ants, crabs, birds and mammals, as well as exotic or feral species, such as dogs. Many people interviewed for this Recovery Action Plan consider feral dogs to be the nation's most serious threat to incubating eggs, even above poaching and coastal erosion. For a quarter-century or more, dogs have been the primary predators on leatherback eggs laid at Fishing Pond and Grande Riviere beaches in Trinidad, and on Great Courland Bay and Stone Haven Bay in Tobago. The problem may be just as severe at other beaches, but data are unavailable. In the case of Tobago, the proximity of hotel kitchens and friendly tourists also attracts a large number of strays that quickly become resident "beach dogs". Some tourists take them into their room at night, and/or pay for them to be spayed or neutered and then released back to the beach. Periodic relocations carried out by the hotel and SOS Tobago provide no long term relief as new dogs quickly move in once the hierarchy has been disturbed.

Members of the community group GREAT estimate that upwards of 40% of annual productivity (=eggs) was lost to dogs at Grande Riviere beach between 1991 and 1995. This is a problem of long standing. Two decades ago, Pritchard (1984) wrote, "Probably few nests in northeastern Trinidad survive predation by these dogs if what we saw at Grande Riviere in 1984 was typical." On 16 July 1989, an accurate count revealed that "53 old nests" were dug up by dogs at Grande Riviere (Fanovich F.P.M, in litt. to the Wildlife Section). The dogs are not wild, but belong to village communities adjacent to the beaches (see section 4.242 for recommendations).

Ghost crabs (Ocypode quadratus) are common but not worrisome predators of eggs and hatchlings; no practical action can be taken to mitigate this natural loss. The black vulture (corbeaux, Coragyps atratus) is common throughout Trinidad (but absent in Tobago) and has been observed to prey on emerging hatchlings; the same is true for sea gulls (Larus sp.) and frigate birds (Frigata magnificiens) (Nathai-Gyan et al., 1987). The common black hawk (Buteogallus anthracinus) is also observed, especially in the vicinity of Matura (Orosco area) and Fishing Pond beaches, and almost certainly preys upon emerging hatchlings. Godley et al. (1989, 1991) report opossums (manicou, Didelphis marsupialis), digging into emerging nests at Matura Beach, Trinidad. Matte (Tupinambis negropunctatus) and iguanas (Iguana iguana) forage on the beaches at night, but it is not known whether they scavenge eggs.

Mongoose (Herpestes auropunctatus) are a serious threat to sea turtles throughout the Wider Caribbean Region. Mongooses have been implicated in the destruction of more than half of all eggs laid at some hawksbill nesting beaches (e.g., in the U. S. Virgin Islands: Boulon, 1984). Mongooses in Trinidad (they are absent in Tobago) appear to be mainly concentrated in inland agricultural areas, especially poultry farms. They are also occasionally seen on the beaches of the east and north coast of Trinidad (e.g., Salybia: K. Eckert, pers. observ.), but turtle egg predation has not been reported. Mongooses are considered vermin and the Mongoose Act, Chapter 67:55 of the Laws of Trinidad and Tobago, makes it an offence to import or possess any live mongoose; penalties include a fine of TT\$ 1,000.

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. Beach monitoring personnel occasionally see turtles with missing or partially missing flippers, a condition likely attributable to a shark encounter. Leatherback remains are reported from the stomachs of killer whales captured in St. Vincent (Caldwell and Caldwell, 1969). In addition, losses (especially of hawksbills) to tiger sharks (Galeocerdo cuvieri) are relatively common in the Eastern Caribbean (e.g., Joseph et al., 1984; Young, 1992; Fuller et al., 1992). Residents report that during the nesting season there are "many sharks" just offshore the nesting beaches in Trinidad, but attacks on turtles have not been documented and this type of natural loss should not constitute a management concern.

3.3 Over-utilisation

Sea turtles have long played a role in the subsistence economy of fishing villages in Trinidad and Tobago, and they featured in the domestic and export markets of the colonial era, as well. The earliest record is a commentary in 1637 by the Secretary of the Dutch West Indies Company (Ouseil, British and Venezuela Boundary Dispute, US Commission Vol. II Doc. No. 25) who reported nesting turtles on the Bocas Islands of Chacachacare and Huevos. In correspondence to the Governor of Trinidad, William Tucker referred to turtles coming ashore at Guayaguayare Bay (Public Records Office, 7 June 1804). Commercial exploitation was noted as early as 1729 when Captain Davies of the *HMS Dolphin* observed turtling in Tobago (Public Records Office, State Papers Colonial C.O. 28/21). Also during the eighteenth century, French settlers indulged in turtling in Tobago (“The Right of France to Tobago. Presented in Paris.” – presented 12 April 1749, Trustees of the British Museum). In 1785, 405 lb of tortoiseshell (= hawksbill sea turtle shell) was exported to Britain (Parliamentary Papers Vol. XXVI 1789).

Popular legends have characterised the fishery since its earliest days. For example, “There is a well-known legend, popular among the fishing villages, that says: ‘it is only when you see the Turtle Star, that the leatherback turtle will come on the beach to nest, that the turtle follows the Star.’ The Turtle Star is often identified as the brightest and/or most ‘twinkly or colourful’ star in the sky during nesting season and like all legends, this interpretation is loosely based on natural events. “[Since] stars run two hours earlier each month ... several bright stars are looked upon as ‘The Turtle Star’, depending on the time, hour, and month. From March to April, *Sirius*, the brightest star in the Heaven, is overhead at 7:00 pm, setting at 1:00 am. Other bright stars clearly visible in the turtle nesting months from March to July are *Spica* in Virgo, *Arcturus* in Bootes, *Antares* in Scorpio and *Vega* in Lyra.” (Gaskin, 1994; see also Bacon, 1976).

Turtles have traditionally been captured both in nets and on nesting beaches. The flesh, fins, carapace (=shell), plastron, and eggs were (and are) all items of value. Even carcass scraps and entrails were used, and hatchlings were used as bait in the local shark fishery. No part of the turtle was wasted. Turtle meat, especially of the green turtle, has always been favoured for consumption. The texture of the flesh is often compared with mutton, and it can be prepared in a variety of ways. With the advent of foreign tourism in the twentieth century, the versatility of turtle meat made it a favourite among restaurateurs catering to a growing tourist market that favoured exotic dishes. In rural communities, meat, plastron (stewed), and eggs are savoured even today. Some preference is observed toward certain internal organs; for example, the stomach and intestines.

The turtles have long been associated with virility, and as a consequence the genital organs of male turtles are used to make drinks and powders which are considered to be aphrodisiacs. On 7 June 1987, it was reported in the *Sunday Punch* that a 24-year old Port of Spain man was the “sex stimulant king” of Trinidad and Tobago. The young man had a thriving business selling turtle penis, which had been dried, grated, and mixed into a drink with reputed aphrodisiac qualities. The product was marketed in three sizes (soft drink, flask, and rum bottle sizes) and “sometimes served in brandy or punches, peanut, soursop, carrot, whatever.” Such concoctions are also sold openly in Tobago, even during the nesting season, particularly at Mt. Irvine Bay (T. Clovis, pers. observ.) with ‘Tobago turtle egg punches’ now being exported to Trinidad (R. Daniel, pers. observ.). The misguided belief that sea turtle parts and products can enhance virility has also been the impetus for a considerable level of egg poaching in recent decades (Wildlife Section, unpublished reports), all of which has been conducted in contravention of legislation protecting turtle eggs at all times of the year (see section 4.211 for details), and Nathai-Gyan (1984) reported that “eggs are greatly exploited for this reason.” Informed observers confirm that egg poaching remains a very serious threat on unprotected beaches throughout the country.

Apart from consumptive uses, the income of artisanal fishermen has been supplemented over the years by the sale of turtle products. Stuffed juveniles, tortoiseshell jewelry and trinkets, and polished whole shells fetched good prices in both local and export markets throughout the 20th century. Tortoiseshell, treated properly, reveals a high gloss that makes it a prized material for jewelry and ornaments. Pritchard (1984) reported that “a considerable portion of the shell of the hawksbills caught in Trinidad waters is purchased, currently for TT\$15-20/lb, by Hashim Mohamed of Toco, who then sells it to Mr. Charles Fritz of St. Lucia who visits Trinidad (and other islands as far away as the Bahamas) approximately every three months, purchasing shell for export to Japan.” In a 1982-1983 survey of 15 fishing depots in Trinidad revealed that turtle carapace was selling for TT\$5-18/lb at five of the depots; some were exported to Tobago and as far away as England (Chu Cheong, 1984). In the case of hawksbill turtles, young juveniles are favoured for their shells and for taxidermy; larger specimens are exploited for meat, as well as carapace scutes.

What makes this aspect of utilisation attractive is its ability to earn foreign exchange (see also section 4.311). Fishermen are either paid by middlemen who later export the product, or by vendors who sell items to tourists at beaches, airports and retail outlets. During the 1970s, Tobago's Handicraft Section (Ministry of Community Development) “purchased shells for use in their village programmes as the raw material for making bracelets, earrings, brooches, pendants and hair clips” (Nathai-Gyan, 1984). Moreover, before the Government ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1984, tortoiseshell was commercially exported from Trinidad and Tobago to Japan. Japanese Customs data indicate that Trinidad and Tobago supplied Japan with more than 1000 kg of hawksbill shell between 1983-1985 (Milliken and Tokunaga, 1987). Based on an average weight of tortoiseshell per animal imported into Japan from the Caribbean region (1.34 kg; Milliken and Tokunaga, 1987), Japanese import statistics indicate that a minimum of 746 hawksbills were killed to sustain this brief period of commercial export.

To obtain raw tortoiseshell (the colourful hawksbill shell scutes from which trinkets are made), the shell has traditionally been heated over an open fire and the scutes peeled away. By the early 1990s, scutes were selling for TT\$60-75/lb; they were used locally as well as shipped to buyers in Tobago. Finished items were sold primarily to tourists and primarily in Tobago, with an apparently much lower level of commerce in Trinidad (e.g., in Port of Spain and by roadside vendors). Tortoiseshell jewelry is still occasionally found for sale in Tobago at beachside craft shops at Store Bay, Buccoo and Englishman's Bay in particular (T. Clovis, pers. observ.). No data are available on the number of turtles killed for the shell trade.

In 1995, a local artisan began selling tortoiseshell rings to Grande Riviere tourists, but the enterprise was discontinued after pressure was exerted by GREAT, a local conservation group. The authors observed two pairs of earrings (TT\$30 each) included in the inventory of a roadside vendor at Salybia Beach, Trinidad, in May-June 1996 (notably during the closed season); the vendor indicated that they sold poorly and he would not buy them again. From October 2008 to February 2009, the Wildlife Section conducted follow-up surveys at fishing depots along the northeast coast and found hawksbill shells for sale at the depot at Manzanilla Beach. The shells were cleaned and varnished; a shell 30 cm CCL was priced at TT\$100 and another at 60 cm CCL was priced at TT\$200. The survey also found jewelry fashioned from hawksbill shell for sale at Las Cuevas Beach, which is a popular tourist destination for local and foreign tourists alike.

The hard-shelled turtle fishery: Hawksbill and green turtles are the most frequently exploited turtles, both for meat and shell. Green turtles are herbivores and can grow to exceed 200 lb (440 kg),

qualities that make them ideal sources of protein, and they are generally considered the preferred eating turtle. Olive ridleys and loggerheads also contribute in a minor way to the annual harvest of turtle meat, although they are not as popular or as prevalent as the green turtle. In addition to a traditional at-sea fishery, green turtles, hawksbills, olive ridleys, and loggerheads are also killed on their nesting beaches. According to coastal residents interviewed for this Recovery Action Plan, nesting by these species, especially the hawksbill and green, is noticeably reduced from historical levels.

There are few data that document the take of hard-shelled sea turtles, but all indications are that large numbers are involved. Bacon (1971) concluded, "All turtles seen nesting on the north coast beaches [Trinidad] are killed by local villagers and a large number of immature ones are taken in beach seines." Generally, the hard shelled species are considered by the public to be 'less protected' than the leatherback; moreover, they are smaller and more easily removed from the nesting beach. Even in Grande Riviere where there is a strong community conservation effort on a legally protected nesting beach, nesting hawksbills are still occasionally taken "behind the back" of the patrollers. (L. Peters, GRNTGA, pers. comm. 2008), this also occurs on Great Courland Bay in Tobago (T. Clovis, SOS, pers. comm., 2007, 2008). Small, rural beaches throughout the island are littered with shells of hawksbills and greens throughout the nesting season, such as at Dead Bay and L'Anse Fourmi (H. Pepe-Yeates, SOS, 2007, pers. observ.). In Tobago, it has also become common practice for tourists to 'buy' the freedom of otherwise ill-fated hawksbills brought ashore in seines at Stone Haven Bay and Great Courland Bay. These turtles, mainly juveniles, are returned to the sea, often to be caught and 'sold' again and again.

Prior to 1975, the hard shell fishery was a legal year-round activity and some of the earliest published catch statistics can be found in Rebel (1974), who noted that "one man in a boat caught 10,000 pounds" of green turtles off Matelot in 1946. Formal records were not kept prior to 1969, "but a partial volume of the trade is given by the weight of turtles sold in the Port of Spain market. In 1947 this amount was 60,000 pounds [27,273 kg]" (Rebel, 1974). In the nearly quarter century between 1947 and 1969, catch weight declined precipitously. Fisheries statistics record 11,746 lb of turtle meat landed in 1969 in Trinidad (Table 2), a mere 19% of the 60,000 lb sold in the Port of Spain market alone in 1947. Whether this is evidence of an equally dramatic decline in local turtle populations or simply a reflection of inadequate fisheries statistical data, cannot be known.

Fisheries Division records indicate that between 1969 and 1980, the total weight of turtle meat sold at seven depots in Trinidad and three in Tobago was 58,598.50 kg (range 2567.8-7251.2 kg/yr) and 786.7 kg (range 18.1-249.4 kg/yr), respectively (Table 2). The annual average weight in Trinidad was 4,883.2 kg (valued at TT\$111,471); in Tobago, 131.10 kg (valued at \$1,294). Prices per pound [1 lb = about 0.45 kg] varied considerably, ranging from TT\$0.30 (Orange Valley) to TT\$1.52 (Carenage) in 1977, for example; the price generally rose as the years advanced. Carenage was the most consistent and highest yielding depot; Speyside was the most prominent depot in Tobago. The information necessary to convert the total weight of meat sold to the number of turtles landed is not available. With regard to these data, Bacon (1973a) cautions, "These figures must be treated with great caution; their value as fishery statistics is negligible. They represent only a small percentage of the turtle meat actually sold in the country as most of this does not pass through any formal market. Furthermore, turtle meat is sold on many more beaches than those listed. The market values stated are [also] unrealistic as the marked differences in price indicate – during 1970 turtle meat was sold at 60, 35 and 26 cents per pound at three centres. The figure of 26 cents at San Fernando is obviously fictitious."

Bacon (1973a) goes on to report, "Other information [besides the Fisheries statistics] on the exploitation rate consists of scattered observations, verbal reports and articles in the press and cannot

form a reliable basis for any resource management planning. However, three pieces of this information are enlightening. First; turtles caught by fishing boats at Cedros, or even as far south as Icos, are taken frequently to markets in Port of Spain. The *Trinidad Guardian* reports (No. 17295, 25.1.73) that some sea turtles were abandoned to die on Cedros beach because the truck carrying them to market was overloaded. Finally, the author was allowed to examine some turtles held at the St. David Fishing Cooperative in April 1972. There were 15 turtles that had been caught during one week waiting to be slaughtered for the Sunday morning market. Ridelys, Greens, Loggerhead and Hawksbills were present and it was estimated that they would yield at least 1500 lb of meat. If this was sold for 60 cents per pound, and prices at Toco are frequently higher, their value would be TT\$900. These estimated weights and market values are probably too low, but give some indication of the commercial value of this resource.

“The carapace and bones are normally discarded, although in some areas the outer shell covering of green and hawksbill turtles is collected. This shell (the ‘tortoiseshell’ of commerce) is sold to merchants from Port of Spain for about [TT] \$1.00 per pound for green and \$1.50 per pound for hawksbill shell. In addition, the carapaces of juvenile hawksbills are sold to tourists for \$30.00 or more, the smaller ones gaining the higher prices. ... The sale of meat and eggs of all species and of shell from the green and hawksbill supplement the income of many fishermen for short periods of the year. Most of the turtle fishing takes place, legally, between March and the end of May. At this time ordinary fishing may be neglected with consequent loss of income from that source. Green, Hawksbill, Loggerhead and Ridley turtles are caught at sea, especially off the north coast and the meat is sold locally, being very popular in the coastal villages. The leatherback is hardly ever caught at sea, mainly because it is too large to handle in the water but also because its meat is less popular. In Trinidad and Tobago few, if any, people are entirely dependent on the turtle fishery for their subsistence, partly because of its seasonal nature.” (Bacon, 1973a).

Rebel (1974) concluded, “Today the turtle industry in Trinidad and Tobago is a small one, a part-time enterprise for the persons involved. About half the turtles (green, loggerhead, and leatherback) are caught with nets, about one-quarter with harpoons, and the rest by turtle turning or as incidental catches in other fishing.” A decade later, in preparation for the Western Atlantic Turtle Symposium, Chu Cheong (1984) conducted a survey from October 1982 to February 1983 of 15 fishing depots in Trinidad. She reported that fishermen from six of the 15 depots were still involved in turtle catching: Matelot, Toco, Grande Riviere, Mayaro, La Lune, and Carenage. The number of men gaining part time earnings from turtle fishing ranged from 1-4 per depot; the fishery was described as a “supplemental activity” and a “declining industry” with only 12 men from six depots still fishing turtles (cited in Chu Cheong, 1995).

Then (1982-1983), as now, the most common method of capture was a tangle net set in an area known to be frequented by turtles. Chu Cheong (1984) reported that nets as long as 30.5 m (mesh size 30 x 30 cm extending vertically to an “eight mesh” depth, or 2.4 m) were deployed across bays or near reefs and could be linked together to increase the area covered. The braided nylon from which nets are made is undetected by the turtle until it becomes ensnared, whereupon it often drowns. Nets were set in known feeding areas and checked morning and evening; most turtles were caught at night. Harpoons were also used at Grande Riviere, Toco and Carenage. In the 1982-1983 survey, weekly catches ranged from 4-10 turtles at each of the turtle catching depots. Green turtles were captured most often, followed by hawksbills. The data indicate that with few exceptions, green turtles were netted and hawksbills harpooned.

During Chu Cheong’s five month survey during the open season, data were collected from 42 turtles. The average weight of 10 green turtles caught at Toco was 41.5 kg, with a mean carapace length of 63.7 cm; the average weight of 11 green turtles caught at Matelot was 47.5 kg, with a mean carapace

length of 77.7 cm. In contrast, 19 hawksbills from Toco reportedly averaged 86.3 kg (range: 72.5-111.5 kg), with an average carapace length of 74.8 cm. [*Note:* Either hawksbills were consistently misidentified, or the weights were exaggerated. Adult hawksbills very rarely exceed 90 kg (see section 2.4) and the fishery most likely consisted mainly of juveniles speared by handheld harpoons.] One loggerhead from Toco measured 101.6 cm (carapace length) and weighed 117.9 kg. Also according to Chu Cheong (1984), wholesale prices for turtle meat ranged from TT\$1-2/lb, while retail prices ranged between TT\$3-5/lb at the fishing depots and climbed as high as TT\$8/lb at inland markets.

Despite the conclusions of some investigators that the sea turtle fishery was dying out (e.g., Chu Cheong, 1994), James and Fournillier (1993) estimated that the legal harvest remained well over 1,000 hard-shelled turtles per year. In 1995, a fisherman (“Samuels”) in Tobago reported setting two nets near Kilgwyn Reef off the southwestern coast and catching 26 [green] turtles; he had trouble selling all the meat (W. Herron, pers. comm.). During the open season it is a common sight to see turtles overturned in villager’s backyards, in boat engine locker rooms, or on the shoulders of fishermen going to market. An open season market survey (Saturday, 11 November 1995) in Sangre Grande, Trinidad, revealed only one sea turtle meat vendor; he offered hawksbill meat for TT\$6/lb, slightly higher than is typical for fish. The vendor indicated that six turtles had been brought to him by a fisher, and that he had paid the fisher TT\$ 4/lb. The turtles had been netted the week before at Manzanilla, they had been brought to market on Friday, and by 10:00 am Saturday morning the meat was virtually gone (K. Eckert, pers. observ.). The shell had been sold separately to an artisan for fashioning into ‘trinkets’ (see discussion above).

Green turtle meat is also traded in produce markets during the open season, although reportedly in lesser amounts than hawksbill meat. Both species are captured on the northeast coast of Trinidad by nets, and the number of turtle fishermen is described as “plenty” by coastal community residents interviewed for this Recovery Action Plan in Trinidad. Turtles of all sizes are brought to the market, including “very small ones”. Members of the Matura-based Nature Seekers report that nets are commonly ca. 100 m from shore where turtles find good forage in rocky seabed habitats (e.g., Manzanilla Bank, Salybia, Galera Point, Matelot). Casual observation of nearshore waters to the north of Matura Bay can result in the sightings of 10-12 turtles “right away” (S. Lakhan-Baptiste, pers. comm.). In addition to the Sangre Grande market, the meat is offered for sale in Princess Town, Port of Spain, Arima (where the meat comes from Matelot), Carenage, and Chaguanas. Reports that fishermen active in Fishing Pond and Matura were using sea turtle hatchlings as bait were received by Wildlife Section personnel in 1991 and 1992; similar reports surfaced in Grande Riviere in 1993.

Updating a survey she conducted in 1981-1983, documenting a total of 12 fishermen landing turtles at six landing sites (out of 15 sites surveyed), Lee Lum (2003) surveyed 27 depots in 2001-2002 and reported turtle fishing in eight (four of these were also reported in the earlier study). The most recent information for Trinidad is that, during the 2004 open season, 250 green and hawksbill turtles (an estimated 70% of them green turtles) were caught, primarily at sea, and the meat sold for TT\$6/lb wholesale or TT\$10/lb after processing (R. Roberts, pers. comm., 2005). The price was higher (TT\$14-20) to secondary buyers in Toco, Tobago and other areas outside of Matelot.

In Tobago in 2000, mature green turtles were sold openly on the roadside for TT\$14/lb (G. Alkins, pers. observ.) and increased to TT\$12-30/lb in 2008 (M. Cazabon-Mannette, pers. observ.). Reports of turtles landed and slaughtered at popular fish landing sites continue to be numerous during open season, particularly in Scarborough, Speyside, Buccoo and Lambeau. Most of these turtles are caught in nets set intentionally or by spear fishermen; on more than one occasion, lifeguards have been implicated in spearfishing mortalities (T. Clovis, SOS, pers. observ.). Turtles are also captured opportunistically in

nets set for fish. Juvenile turtles are sometimes found at near shore reefs like Mt. Irvine with carapace wounds consistent with speargun encounters (M. Cazabon and T. Clovis, SOS, pers. observ. 2008). Nets are active year-round and, in 2003, SOS Tobago responded to a report of a leatherback entanglement in a turtle net off Canoe Bay. While the leatherback was eventually freed, a small juvenile green was also found dead in the net.

In a 2007 survey of 215 fishermen in Tobago, 22 fishers confirmed that they targeted sea turtles and 14 considered turtles to be an important source of income. The 22 fishers were interviewed at landing sites around the island, including Pigeon Pt., Speyside, Parlatuvier, Castara, Studley Park, Little Rockly Bay, Hermitage, Delaford, Charlotteville, Scarborough, Buccoo and Bon Accord, confirming that turtle fishing is broadly distributed. Ten fishermen reported catching mostly hawksbills, and five mostly green turtles; 12 fished for turtle year-round, and six fished daily for turtles. The fishers did not report an annual turtle catch, but one who fished regularly during the five-month open season reported catching 150 turtles per year. The smallest turtles reported captured ranged from 7 to 22 kg and the largest from 40 to 225 kg; the average weight reported ranged from 18-90 (mean 37) kg. Price per pound of meat varied from TT\$12-30, most often \$25-30. Twelve of the 22 admitted to fishing turtles year-round (four more did not answer); nine of those fishing year-round (and three others) demonstrated no knowledge of local regulations (Cazabon-Mannette, unpubl. data; Hailey and Cazabon-Mannette, 2011).

In summary, in the face of inadequate legislation and ineffective law enforcement, an unmanaged take continues in and out of season for hard-shelled sea turtles, especially hawksbills and green turtles. Meat, shell and eggs are marketed formally and informally. Prices are comparable to, and often lower than, prices paid for fish. The number of sea turtles landed per year is unknown; Fisheries personnel ceased the necessary record-keeping in 1980. The total number of turtle fishermen is unknown, as is the extent to which sea turtles contribute to their livelihoods, although some research has been conducted (e.g., Trinidad: Lee Lum, 2003, 2006; Tobago: Hailey and Cazabon-Mannette, 2011). All indications (albeit largely anecdotal) are that nesting has declined (both in terms of the number of beaches visited and the number of nests laid per year) and turtles caught at sea are, on average, smaller than they once were, a common indication of an over-exploited resource.

The leatherback fishery: In contrast to the at-sea fishery for hard shelled turtles, most purposeful harvesting of leatherbacks occurs on land; the harvest consists solely of reproductively active females. The harvest is clandestine, but relatively well documented. Bacon (1970) reported that at least 23 females were killed, “mainly by local villagers”, in Matura in 1968 – nine on the northern section and “fourteen in one week” on the southern section. In 1969, 13 were slaughtered on the northern section alone, a figure which was likely to be an underestimate since “poachers frequently hide the remains of the carcasses” (Bacon, 1970). Taking all the data into account, Bacon (1971, 1973a) estimated that in 1970, 30% of the females nesting at Matura Beach were killed and fully 100% of those nesting near villages along the north coast were killed. He concluded, “In addition to considerable natural losses, due to injury and beach erosion, human predation is taking a heavy toll. This situation is aggravated by inadequate laws and law enforcement ...” (Bacon, 1970).

James and Fournillier (1993) estimated that prior to 1990, as many as 50-70 leatherbacks were slaughtered annually. “Every year scores of rotting [leatherback] carcasses could be observed along beaches of Trinidad as a result of illicit slaughter by poachers who are unable to cart away all of the meat and the major portion is left to rot. ... Disregard for the life of these creatures has been so great that some fishermen do not consider it an immoral act to hack off a flipper for use as bait to catch sharks and leave the remainder of the carcass to rot.” (James, 1983). Controlling the poaching proved extremely difficult

for law enforcement agencies. Referring to attempts by the Wildlife Section to control poaching at Fishing Pond by scheduling beach patrols by Game Wardens beginning in 1983, James (1987) reports, "Threats against their lives were stepped up by determined poachers driven by the high profit motive (leatherback turtle meat is sold as beef roti [an Indian delicacy] -- it is cooked with beef fat to disguise the taste and smell). Tyres on patrol jeeps have been slashed and cutlass threats have been made to unarmed wildlife research staff."

By the end of 1984, 22 carcasses had been documented by patrollers at Matura (8), Fishing Pond (11) and Manzanilla (3) (Nathai-Gyan, 1984). Three years later, the killing seemed only to have increased; 16 carcasses were found at Fishing Pond before the 1987 nesting season had even reached its peak (James, 1987). Pritchard (1984) wrote, "The Fishing Pond Beach is particularly visited by poachers and large numbers of carcasses were seen there . . . It is urgent that a high enforcement presence be maintained on this beach." Godley et al. (1989) describe encounters with poachers during routine beach patrols between 4-23 July 1989 at Matura Beach. "On two Saturday nights, unaccompanied by Wildlife Wardens, we encountered large bands of men on the beach. Although intoxicated, and carrying cutlasses, they were friendly enough and open about their intention to kill turtles. All were gainfully employed . . . this was clearly not a subsistence activity for them. We had been advised not to challenge poachers in the absence of our Wardens, and withdrew. Following one of these incidents, next day we found a fresh turtle carcass: the throat had been cut without severing the trachea; all the flippers had been removed; the plastron had been separated from the carapace to remove the eggs."

The situation did not improve until Matura and Fishing Pond beaches were declared Prohibited Areas in 1990 and comprehensive community-based patrol programmes were initiated. By 1993, the killing of leatherbacks at Matura Beach had been reduced to zero. As the popularity of Turtle Watch programmes increased, however, attention once devoted to all-night patrol was diverted to controlling visitors. Gaps in the patrol schedule were quickly noticed by poachers, who slaughtered one turtle on the nesting beach in 1995, four in 1996, and one in 1997 (Nature Seekers, unpubl. data). A low level of illegal killing also continued at Fishing Pond, and as recently as 2010, four leatherbacks were poached there (T. Boodoo, pers. comm.). Similarly, "2-3 leatherbacks" were killed annually by villagers at Grande Riviere a decade ago (S. Ruiz, pers. comm., 1995) but, since 1996, the kill rate has been zero (L. Peters, pers. comm.). Poaching of egg-bearing leatherbacks continues at other important nesting beaches without regular surveillance; for example, Manzanilla Beach (Wildlife Section, unpubl. data).

In the case of Tobago, where there is no formal protection of important sea turtle nesting beaches, the killing of leatherbacks continued well into the eighties and nineties, and continues today on the rural beaches where volunteer patrols are less active. Beach patrols in 1982 by the conservation group "Club Crusoe" revealed high levels of poaching. By 7 June 1984 (peak season), seven carcasses had already been reported from Grafton Beach (Stone Haven Bay) and five from Great Courland Bay (Nathai-Gyan, 1984). Protection efforts were intermittent during the 1980s, and it was not until 1990 that community patrols were informally organised once again. Volunteer patrollers documented five carcasses at King Peter's Back Bay in 1990 (W. Herron, pers. comm.). In 1995, patrols were undertaken by Forestry personnel who reported 55 nesting crawls and four carcasses (clearly an underestimate, since community patrollers found seven carcasses at King Peter's Back Bay alone). Since not every crawl results in the laying of eggs (thus 55 crawls represents an unknown but fewer number of nests), and females average 6-7 nests per year, those 55 crawls might be attributed to fewer than 10 turtles.

With this in mind, mortality (minimum: 7 turtles) would appear to have approached 100% in 1995 at the hands of man.

The situation did not improve in 1996, despite repeated requests by activists that police and Forestry officials intervene. By mid-June 1997, a staggering 16 leatherback carcasses had been identified on various beaches in Tobago: seven at Rocky Point (Mt. Irvine Back Bay), four near Castara (Celery Bay), three at Turtle Beach (Great Courland Bay), and two at Grafton Beach (Stone Haven Bay) (W. Herron, pers. comm.). Again, repeated requests for formal intervention were ignored. At Mt. Irvine Back Bay, a relatively small and isolated nesting ground, 13 nests were probed and possibly poached. Much of the meat obtained during 1997 later appeared at community celebrations typical of the season, such as “Fishermen Fetes” held on St. Peter’s Day. The fetes often emphasise ‘wild meat’ and openly offer a selection of illegally obtained meats. Turtle meat and “Turtle ‘n Dumplings” were served at various fetes during the months of June and July. It is not unusual for several men to participate in the killing. A witness to the slaughter at Plymouth (Great Courland Bay), where one turtle was killed on 28 May and two more on 29 May, reported that “a group of 15-17 men were involved” (pers. comm. to W. Herron).

Regular SOS-organised beach patrols, starting in 2000, have significantly reduced the poaching on Mt. Irvine Back Bay, Stone Haven Bay, and Great Courland Bay, with one unconfirmed kill in 2004, two in 2005, one in 2006, none in 2007 and one in 2008. An average of 200 leatherback nests was recorded per year on these beaches, collectively, between 2000 and 2005. The killing is now largely confined to relatively remote beaches, but there are regular exceptions. SOS Tobago documented 6-12 carcasses per year on King Peters Back Bay (Cotton Bay) from 2003 to 2005, and a carcass was found in front of the Parlatuvier School in 2004 (SOS Tobago, unpubl. data). Eggs are sometimes collected by poachers, but the most common predators are dogs. The turtle is the main poaching target; she is flipped and her throat slit. As the 1990s progressed, there was an observed increase in maiming (“slice off a fin and run”), as poachers attempted to avoid confrontation with community activists; these incidents may also have been indicative of younger, smaller and less experienced poaching groups. The meat sold for TT\$7-10/lb, depending on availability, in the 1990s and for TT\$25/lb in 2009 in the open season and more in the closed season (M. Cazabon-Manette, unpubl. data).

In view of the extensive slaughter of leatherbacks over the years, it is interesting that some local legends discourage the eating of leatherback meat. Bacon and Maliphant (1971) quoted a local fisherman who explained that the “caldon is really the doctor for all the other turtles. When a turtle gets sick the leatherback takes all its disease out of him. So that is why caldon is covered with spots and his meat is not good to eat.”

Concluding remarks: It is unfortunate that the passage of the 1958 Conservation of Wild Life Act, which some have interpreted as fully protecting sea turtles, went largely unnoticed by both users and law enforcement agencies. It was not until the 1975 enactment of the “Protection of Turtle and Turtle Eggs Regulations” (promulgated under Section 4 of the Fisheries Act, Chap. 67:51), a legislative action which provided for a seven-month closed season on sea turtles, that the public began to take notice. With the advent of the well-publicised closed season, a steady decrease in the harvest and an accompanying rise in price occurred. Formal data collection became awkward, since much of the harvest continued clandestinely and vendors and fishermen alike became apprehensive about divulging information, even during the open season.

Today the sea turtle fishery is an unmonitored industry. Unquantified legal and illegal take by an unknown number of fishers, open access, and lack of population monitoring are obvious hinderances to management and sustainable use. Furthermore, incidental capture of sea turtles, especially leatherbacks, in coastal gillnets is now the nation’s largest single source of mortality to the giant turtles and constitutes an immediate management crisis (Eckert and Eckert, 2005).

Government has long articulated the need to introduce a moratorium on sea turtle harvest (see section 4.213). As part of its commitment to retaining access to the U. S. shrimp market, the Government pledged to “introduce legislation to prevent the harvesting of sea turtles and sea turtle eggs throughout the year, and introduce public awareness and education programmes to promote sea turtle conservation” (GOTT, 1994). A moratorium, coupled with an effective public awareness campaign focusing on the plight of the sea turtles, both locally and throughout the Caribbean region, is supported by this Recovery Action Plan and is in keeping with treaties negotiated and signed by Caribbean governments, including Trinidad and Tobago, that call for increased protection for endangered sea turtles throughout the region (see section 4.32).

3.4 Inadequate Regulatory Mechanisms

Relevant legislation for the conservation of sea turtles is embodied in the Conservation of Wild Life Act (Chapter 67:01) and the more recent Fisheries Act (Chapter 67:51). The Conservation of Wild Life Act includes sea turtles under a general umbrella of protected species and thus prohibits all hunting, but the Fisheries Act views sea turtles as a fisheries resource harvestable under certain circumstances during an annual open season. Overlapping and conflicting jurisdiction between regulatory agencies (and even, at certain times, between Ministries; cf. 1987-1991) with regards to the administration of the Conservation of Wild Life Act and the Fisheries Act has contributed to long-standing paralysis on the subject of amending the Fisheries Act to eliminate the open season for turtles.

Conflicts, inconsistencies, and outdated management approaches (e.g., minimum size limits) embodied in the regulatory framework are compounded by financial and human resource constraints within Government agencies mandated to manage sea turtles. This is clearly seen in the area of law enforcement, and exacerbated by confusion over legal jurisdiction and issues such as which agency has the mobility to successfully enforce relevant legislation. The Wildlife Section took the lead in resolving the dilemma in 1983 by making sea turtle issues a priority; at that time there was virtually no law enforcement effort being put forth, although a few non-governmental organisations were actively (but intermittently) monitoring populations.

It was during this era that some of the more threatening encounters resulted between Research Officers, Wildlife Section Game Wardens, and poachers. As a result of the Wildlife Section’s increasing role in patrolling and intervention, the vulnerable communities felt their claim on the resource was under severe threat and retaliated by direct confrontation with Wildlife Section staff. Efforts of the Wildlife Section were directed to developing community awareness and establishing community management groups. Today community co-management projects have matured and are successful in supporting the Government in its obligation to manage sea turtles. Community groups assist with patrolling nesting beaches, collecting data, and deterring poaching (see section 4.26).

Significant progress in both consolidating and modernising the legal framework was achieved with the passage of the Environmental Management Act (No. 3 of 2000), which was enacted “to provide for management of the environment within Trinidad and Tobago through the establishment and operation of an Environmental Management Authority (EMA), an Environmental Trust Fund and an Environmental Commission, to define the powers and duties thereof, and for related matters.” The Act is holistic, defining environment as “all land, area beneath the land surface, atmosphere, climate, surface water, ground-water, sea, marine and coastal areas, sea bed, wetlands and natural resources within the jurisdiction of Trinidad and Tobago”, and recognising the need for an integrated and committed approach to sustainable development.

The power and responsibilities of the EMA are broad; with the necessary political will, the results could be momentous. The Act provides for assessment of environmental impacts, protection of natural resources, control of pollution and hazardous substances, appointment of inspectors and other enforcement personnel, and the establishment, through user and licence fees, of an Environmental Trust Fund. As a result, the Act requires that any number of activities potentially harmful to sea turtles (e.g., coastal construction, visitation and recreational activities, artificial beachfront lighting, nearshore dredging, anchoring) follow prescribed conservation guidelines and the EMA requires EIAs before Certificates of Environmental Clearance are issued for developments containing activities mentioned in the Certificate of Environmental Clearance (Designated Activities) Order.

The EMA also has the authority to designate rare or endangered species as “Environmentally Sensitive Species”, making them eligible for special considerations. The first series of Environmentally Sensitive Species (manatee, Trinidad piping-guan, sabre-wing hummingbird) was designated in 2005. The second series selected by the EMA included five species of sea turtle, but their designation was rejected in Cabinet, apparently due to pressure from members from Tobago concerned about closure of the turtle fishery (Hailey and Cazabon-Mannette, in prep.). Such designation is important for sea turtles, which at present are subject to a regulated but unmanaged fishery that has long been out of sync with international standards regarding sustainable use (see section 4.213). **It is a recommendation of this Recovery Action Plan that, as a matter of priority, the EMA continue to advocate for sea turtles to be included as “Environmentally Sensitive Species” under the Act.**

3.5 Other Natural or Man-made Factors

As noted above (see section 3.3), drowning in gillnets is the nation’s most significant cause of sea turtle mortality. But entanglement in lost or abandoned fishing gear (primarily nets) can also pose a risk. According to a brochure (“Plastics in the Coastal and Marine Environment”) developed in March 1995 by the Fisheries Division with support from FAO/UNDP (Integrated Coastal Fisheries Management Project INT/91/007), “Fishing nets have been made more efficient by the use of transparent plastics. Lost or discarded fishing nets are known to entangle many marine species. Some of these entanglements have been attributed to the animal’s inability to see transparent fishing gear. Plastic is strong. Once a marine animal becomes entangled in a plastic strapping band, net or other plastic item there is very little the animal can do to break free.”

General harassment, often unintentional, was a serious problem on high density leatherback nesting beaches until the advent of nightly conservation patrols by community-based organisations at Matura and Fishing Pond. However, even nightly conservation patrols by Wildlife Section staff and community-based organisations at Grande Riviere were ineffective at curbing serious and chronic harassment until 1997 when Prohibited Area status was granted to the nesting beach there, thereby conferring a degree of order to the pattern of visitation (see also section 4.121). Nathai-Gyan et al. (1987) reported that nesting turtles are subject to lights (torches, cameras), noise, and other disturbances from “large, sometimes unruly crowds who flock to the beaches to observe nesting.”

Riding turtles and other acute harassment was not uncommon prior to 1990 when Matura Beach and Fishing Pond were declared Prohibited Areas, thereby requiring that nocturnal visitation be supervised by trained guides or authorised agents of the Government (see also Section 4.271). In Trinidad, harassment is still common on nesting beaches throughout the island that are neither protected nor monitored. In 2008, national media reported that a nesting leatherback had been “ridden to death” in Manzanilla by persistent villagers who took turns on her throughout the day.

In Tobago, SOS patrols Turtle Beach (Great Courland Bay), Grafton Beach (Stone Haven Bay), and Rocky Point (Mt. Irvine Back Bay). The group's public awareness efforts in the surrounding villages of Black Rock, in particular, have reduced incidences of harassment but it still occurs, particularly in the form of people wanting to use flash photography and to stand upon and/or "ride" the turtles, especially if they have children with them (J. Ayres, SOS, pers. observ. 2008). Occasionally, in the past, hatchlings were retained by resort managers in Tobago in a well-intentioned but misguided attempt to protect them from predators by delaying their release to the sea until they had increased in size. Fortunately this is no longer practised and whenever it is brought to light, WIDECAST Country Coordinators have successfully initiated a dialogue with the persons involved in order to bring about the release of the little turtles (which are not helped in any way by being kept from their natural cycle).

A host of other comparatively minor factors potentially reduce reproductive success. Soil erosion is prevalent at the southern end of Matura, Fishing Pond and Manzanilla beaches; mud and silt are sometimes deposited in nesting areas. During the rainy season, the periodic advancement of mangrove and marsh frontiers can reduce the space available for nesting on adjoining beaches. Vehicles periodically drive on some important nesting beaches, such as Turtle (Great Courland Bay) and Grafton (Stone Haven Bay) in Tobago, and Grande Riviere and Matura in Trinidad. No vehicles are allowed on Prohibited Area beaches during the turtle nesting season (Forests Act Legal Notice 28 of 1990), so drivers leave the site immediately upon being made aware that turtle eggs are incubating. But such restrictions are unenforceable in Tobago (there being no Prohibited Area beaches in Tobago), so SOS Tobago continues to debate with drivers and has introduced strategically placed signage to try and curb this practice. Potentially threatening nearshore recreational activities (e.g., 'jet-skiing', surfing) have not as yet caused known harm or mortality to sea turtles in Trinidad or Tobago. The potential effects of the offshore oil industry on sea turtles and/or their habitats have not been systematically studied.

IV. SOLUTIONS TO STRESSES ON SEA TURTLES

4.1 Manage and Protect Habitat

The first step in the effective management of turtle habitats 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, seagrass beds and sandy beaches are important not only to the survival of sea turtles, but also to the sustainability of large sectors of the national economy, including subsistence, commercial and recreational fisheries, coastal and marine tourism, etc.

Bräutigam and Eckert (2006) offer the following recommendations to enhance habitat protection and management in Trinidad and Tobago: (i) increase the number of protected nesting beaches; (ii) restrict/regulate tourism and other activities (e.g., sand mining, waste disposal) near nesting beaches during the egg-laying season and improve enforcement of such measures; (iii) improve coastal zone management (and monitoring) capacity, including through environmental impact assessment, particularly in relation to tourism and other beachfront development; (iv) expand the system of protected areas; and (v) strengthen the management framework for protected areas to ensure that these areas fulfill their stated objectives. 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.

4.11 Identify essential habitat

Nesting beaches are fairly well known and are located primarily on the north and east coasts of Trinidad (Figure 3a), and on the southwest and northeast coasts of Tobago (Figure 3b), due to the efforts of Dow et al. (2007). In 1990, two of the nation's most important leatherback nesting beaches (Matura and Fishing Pond) were declared as Prohibited Areas under the authority of the Forests Act, and a similar declaration for Grande Riviere in 1997 (see section 4.121). **It is a recommendation of this Recovery Action Plan that similar protection be afforded to the primary nesting beaches in Tobago, under both the Forest Act and the Environmental Management Act, as well as to nesting beaches important to other sea turtle species.** Both hawksbill and leatherback sea turtles are classified as Critically Endangered by the World Conservation Union (IUCN) *Red List of Threatened Species*, meaning that their reproductive age classes having been reduced, worldwide, by more than 80% in the most recent three generations (IUCN, 2004). Green sea turtles are classified as Endangered by IUCN and, by all accounts, their numbers are in significant decline in the Republic, especially in Tobago.

Assembled data (Dow et al. 2007) identify Tobago's main nesting beaches – including Great Courland Bay (leatherbacks), Stone Haven Bay (leatherbacks) Mt. Irvine Back Bay (leatherbacks, hawksbills), King Peters Back Bay (King Peters Back Bay (leatherbacks, hawksbills), L'Anse Fourmi Beach (leatherbacks, hawksbills, green turtles), Dead Bay-Parlatuvier (leatherbacks, hawksbills, greens), and Campbellton Beach (hawksbills) – and these are urgently in need of protection. Identifying important additional hawksbill and green nesting grounds, in particular, should be a high national priority.

In addition to nesting areas, important feeding grounds must be identified and adequately safeguarded. Sea turtles forage predominantly on seagrass and algae, as well as on invertebrates (e.g., sponges, crabs) associated with coral reef, hard bottom, and estuary habitats. In addition to feeding areas (e.g., Petit Trou Lagoon, Kilgwyn Bay, Cove, Buccoo Bay and Kings Bay among others, in Tobago), there may be important refuge sites or migratory corridors in the waters of Trinidad and Tobago. The present thrust for coastal tourism and industrial development makes it all the more imperative that nearshore marine communities be surveyed with an aim to identify and appropriately manage fragile near-shore ecosystems, many of which are important to the survival of the nation's sea turtles. **It is, therefore, a recommendation of this Recovery Action Plan that foraging grounds be identified and critical areas incorporated into any future national network of marine preserves.** Particularly relevant in this regard is the Marine Areas (Preservation and Enhancement) Act of 1970, as amended.

4.111 Survey foraging areas

No quantitative surveys of marine habitat use by sea turtles have been carried out. **It is, therefore, a recommendation of this Recovery Action Plan that all available means be utilised to improve our understanding of the status and distribution of sea turtle foraging grounds in Trinidad and Tobago, and that marine reserves sufficient to protect critical areas be defined and gazetted.** To this end, standard sightings data forms should be developed, a database maintained by the Fisheries Division or other appropriate entity, a Sightings Data Coordinator be identified, a network of volunteer data collectors and collaborators be assembled, and a means of communication among collaborators established. The network should include Coast Guard and other marine patrol officers, fishermen, cruisers/yachters, dive operators, and Marine Park personnel. The support of collaborating agencies, such as Trinidad and Tobago National Security (which donated air time to a sea turtle survey sponsored by FAO in 1984), should be solicited. As sightings accumulate and an organised database takes shape, the distribution and seasonality of sea turtles will become increasingly clear.

Healthy seagrass meadows, coral reefs, hard bottom habitats and estuaries should be considered potential foraging areas. Coral reefs and seagrass are preferred by the two species most commonly found in the nation's waters; i.e., hawksbill and green turtles. Coral reef formations have been poorly mapped in Trinidad, but more detailed information is available for Tobago (e.g., Laydoo, 1991; Hoetjes et al., 2002; Burke and Maidens, 2004). Coral reefs off Tobago are most well developed along the entire Caribbean coast and at Speyside and are primarily characterised as fringing reefs (Laydoo, 1991). Seagrass meadows are concentrated around the southwest sector of the island (e.g., Canoe Bay, Petit Trou) and the Buccoo Reef area but also at Kings Bay. In Trinidad there is a well-developed fringing reef off the northeastern point at Salybia. Hard bottom habitat (with sponge growth suitable to support hawksbills) extends eastward along the north coast from the islands in the northwest peninsula, and then south along the east coast as far as Matura Beach and the Manzanilla Bank; important feeding areas are also found in the vicinity of Soldado Rock (southwest peninsula). Seagrass rims the Gulf of Paria in the northwest peninsula, extending eastward to Point Cumana.

Despite the fact that a national survey of sea turtle foraging areas has not yet been undertaken, sightings of foraging turtles have been (and continue to be) reported on an *ad hoc* basis. Loggerhead, green, olive ridley and hawksbill turtles forage off the north coast and east coasts of Trinidad, and green and hawksbill turtles also forage off Soldado Rock on the southwest peninsula. Bacon (1981) reported that olive ridley, green and leatherback turtles were seen foraging in the Gulf of Paria. From 1982 to 1994, the Wildlife Section conducted annual boat and aerial surveys, surveyed all north coast beaches on foot at least once per year, and made occasional observations from high points (cliffs) above known foraging areas. There were no confirmed at-sea sightings of olive ridley or loggerhead turtles during these 12 years, only hawksbill and green turtles were recorded. Sea turtles have also been observed foraging by fishermen off Galera Point, northeast Trinidad, around the rock island off Saline Bay and islands of the northwest peninsula (Lori Lee Lum, IMA, pers. comm., 2002).

In Tobago, green turtles are occasionally sighted at popular dive sites around the island, particularly around Buccoo Reef and Charlotteville and sites (e.g., Arnos Vale, Store Bay, Flying Reef [Kilgwyn], Cove, south of Little Tobago in Speyside) associated with coral reefs. Juveniles are regularly spotted at dive sites in Mt. Irvine Bay, in particular (M. Cazabon-Mannette, in prep.). Hawksbill turtles are much more common and their presence is documented at dive sites all around the island, including on reefs between Cove and Crown Point on the southwest coast, along the north coast (including Mt. Irvine, Arnos Vale, Plymouth, Castara, Sisters Rocks and Charlotteville), and throughout Speyside. The frequency of sightings varies across sites, with a maximum of 8.57 turtles per hour observed at Diver's Dream (The Shallows), south of Crown Point, while no more than two hawksbills per hour were observed at any of the other sites (M. Cazabon-Mannette, in prep.). Early summaries of the distribution of juvenile hawksbills included popular snorkeling sites, as well, and both species were recorded at Man-O-War Bay, Buccoo Reef and Bon Accord Lagoon (summarised in Groombridge and Luxmoore, 1989). Finally, most turtle nets are set in the vicinity of Buccoo Reef, Bon Accord Lagoon, Kilgwyn Reef (southwest coast, off Crown Point Airport), and Studley Park (north of Scarborough), suggesting that these areas are important, or at least predictable, foraging grounds. For additional detail, see sections 2.2 and 2.4.

It is a recommendation of this Recovery Action Plan that all historical sightings documentation be assembled into a national database, geo-referenced, and serve as a launch point for modernising and continuing a national Sea Turtle Sightings Database. Data use agreements are needed to ensure that data providers and data users abide by mutually agreed protocols related to information access, data ownership, publication privileges, and so on.

4.112 Survey nesting habitat

It is self-evident that all aspects of effective management of nesting habitat depend on reliable knowledge of which beaches are central to the reproductive success of sea turtles in the Republic. **With this in mind, it is a recommendation of this Recovery Action Plan that the Government commit to a three-year, comprehensive survey of nesting habitat, including allocating the necessary resources and dedicating such staff as may be required.** It is a further recommendation that the Government reinforce its ties, and extend its technical and logistical support, to a variety of community-based organisations and other partners who are well positioned to conduct consistent habitat surveys and to provide the Government with data required for sound management decisions (see also section 4.26, “Co-management”). Some community-based partners, (see discussion below) may also be able to provide survey personnel to remote coastal areas for the purpose of the national habitat survey.

The goal of the three-year, comprehensive national survey should be to identify conclusively those beaches that support the most sea turtle nesting, updating, as needed, existing maps (Dow et al. 2007). From this information, it is a **recommendation of this Recovery Action Plan that seven Index Beaches**¹ (4 in Trinidad, 3 in Tobago) be identified for long -term monitoring and study (see section 4.25). During the survey, all potential nesting habitat (i.e., the nation’s entire sandy coastline) should be foot-patrolled at least weekly from 1 March to 30 November, which encompasses the peak nesting season for the five species of sea turtle known to nest in Trinidad and Tobago. Surveys should be conducted at a consistent time of day, preferably early in the morning. All new crawls should be tallied and then “crossed out” (by incising an ‘X’ over them) to avoid double- counting. Crawls should be identified to species (see Figures 2a, 2b and section 4.251 for diagnosis).

From information already in-hand (see Figures 3a, 3b), it would appear that, at a minimum, Matura, Fishing Pond, and Grande Riviere beaches be designated as “Index Beaches” for long term population monitoring in Trinidad. In Tobago, low density nesting occurs on most beaches and has been reported from both the Caribbean and Atlantic coasts, with the most nesting reported at Turtle Beach (Great Courland Bay), Grafton Beach (Stone Haven Bay), and Mt. Irvine Back Bay (Rocky Point) in the southwest and King Peters Back Bay (Cotton Bay), L’Anse Fourmi and Dead Bay (Erasmus Cove) in the northeast. Since 2000, SOS has monitored the three southwest beaches as index sites for leatherbacks.

The authors recognise that a national survey, which has never been done, will not be an easy task. A network of coastal partners, the organisational skills of a National Coordinator, and a cadre of dedicated volunteers will be essential for success. The effort must be made, however, and soon. Without some minimum level of comparative, baseline data, the Government cannot hope to fulfill its mandate to safeguard the nation’s sea turtle resource, advocate for standard guidelines and criteria, or develop effective management plans for habitats critical to their survival.

So that we might know where we have been, and thus be better prepared to plan for next steps, a brief history of past survey efforts follows.

¹ Characterising a nesting or foraging ground as an 'Index' site implies the consistent and long-term application of standardised population monitoring protocols to ensure the data are suitable for trend analysis. Survey boundaries are established and, ideally, adhered to from year to year, keeping in mind that the precise boundaries of leatherback nesting beaches, in particular, may shift over time. The survey area should attempt to represent a range of threat and protection levels, a variety of turtle life stages, and a range of turtle population densities. The emphasis of this protocol is on establishing index methods for measuring trends in relative abundance at fixed locations; therefore, the sampling strategies at each Index site should ideally be structured in a manner that allows inference to a larger area of interest.

Trinidad: Habitat surveys have been periodically undertaken by resident and foreign scientists, as well as by local and national community and conservation groups, since the 1940s. Several nesting areas along the northwest, north and east coasts and in the Gulf of Paria have been identified (see section II, "Status and Distribution of Sea Turtles"). Some surveys have been highly quantified, as in Chu Cheong (1990) who categorised Trinidad beaches according to the number of nesting tracks seen during aerial surveys in June - September 1982 and in March - August 1983. The study reported six high density beaches with greater than 20 nesting tracks, four medium density beaches with between 5-20 tracks, and seven low density beaches with fewer than five tracks (Figure 6). Others have been largely anecdotal, as when fishermen and residents have been interviewed to provide insight on historical and contemporary nesting trends, or when patrols have not been consistent over long periods of time.

In the early 1940s, the FNC of Trinidad and Tobago became involved in occasional nighttime beach surveys, which later included applying identification tags to nesting females. Continuing efforts by the Club resulted in several publications during the 1960s and 1970s (e.g., Bacon, 1967, 1969, 1970, 1971a, 1971b, 1973a, 1973b, 1973c, 1975, 1976, 1978; Bacon and Maliphant, 1971). In 1982, the Wildlife Section initiated patrols at major nesting beaches as part of a strategy to ensure that leatherback turtles were protected. During the 1983 nesting season (March - August), the Wildlife Section was joined by the North East conservancy of the Forestry Division in patrolling Matura and Fishing Pond beaches; nests, as well as carcasses, were documented. Poaching was widespread, and poachers responded to the patrols by "camping round-the-clock to observe any breaks in human activity". Survey and protection efforts at Fishing Pond were especially difficult because poaching was entrenched at this remote site, and threats against the lives of the Game Wardens were commonplace (James, 1987).

By 1984 the situation had come under some measure of control, and monitoring at Matura, Fishing Pond and Manzanilla involved several groups (e.g., Wildlife Section, North East conservancy, FNC), as well as interested individuals (e.g., a watchman from Fishing Pond). Pritchard (1984) reported the results of a brief (three-week) survey in 1984 of potential nesting beaches between Blanchisseuse and Manzanilla Bay, and as far south as Moruga Bay. The survey was undertaken at the request of UNDP/FAO, and the final report also made recommendations concerning legislation and law enforcement, incidental catch, and sand mining. Surveillance sponsored by the Wildlife Section continued into the 1990's. Data collected between 1983 and 1992 are summarised in Table 3.

On 9-10 September 1994, as part of ongoing efforts by the Wildlife Section to monitor nesting activity, a foot survey of the north coast (Blanchisseuse to Madamas) was undertaken by Wildlife Section personnel and officers of the Trinidad and Tobago Regiment. The aim was to evaluate the potential for a Beach Monitoring Project to be sponsored by the Civilian Conservation Corps (CCC). Foraging areas (e.g., hawksbills feeding at Morne Poui) and evidence of nesting was recorded. Weathered leatherback tracks were encountered on several beaches, including Murphy Bay, Petit and Grand Tacarib, and Madamas; hatched nests were excavated to confirm species and residual hatchlings were released to the sea. It was concluded that the assistance of CCC in monitoring this coastline could provide, for the first time, accurate data for this region; further, the three-month CCC project cycle would yield data throughout the peak breeding season (as opposed to once per annum, as had been the case with Wildlife Section patrols in the past).

The Beach Monitoring Project with CCC did not materialize because CCC was disbanded. Due to limited resources, the Wildlife Section has maintained its annual foot survey of remote north coast nesting beaches, but the information provides only a "snap shot" of nesting (and mortality) at the time of the survey (typically once per year). Creative partnerships will, of necessity, form the basis of any

consistent data-gathering along this roadless coast. It is noteworthy that the north coast not only supports leatherback nesting, but is likely to support some of the nation's best remaining hawksbill nesting habitat.

The highlight of survey efforts in the 1990s has been the dedicated work of community groups that survey Trinidad's most important leatherback nesting areas (Grande Riviere, Matura Beach, and Fishing Pond) at least several times per week during peak nesting season (April - July). These groups act as community partners in fulfilling Government's mandate to manage and protect its sea turtle populations. Data are tallied with regard to the number of turtles, crawls and confirmed nests, turtle size and diagnostic marking(s), nest location, sources of mortality (e.g., poaching, strandings, predator interactions), etc. In return, these groups have organised themselves into tour guiding organisations that profit from permission granted by the Government to guide visitors into Prohibited Areas to view nesting.

Tobago: Surveys and beach patrol initiatives planned by the Fisheries Division in the mid-1970s were aborted as a result of financial shortfalls and transportation problems. These and other setbacks -- including physical threats and harassment from turtle poachers -- contributed to long delays in establishing estimates of annual nesting density. The senior author (KF) conducted interviews with natural resource agencies and hoteliers in the 1980s. The first surveys of nesting beaches in Tobago were undertaken in 1982 by Club Crusoe, headed by Mr. S. Beard. By and large, it has been the persistent efforts of coastal residents, and more recent efforts by the Forestry Division, which have provided information on the distribution and relative importance of sea turtle nesting habitat in Tobago.

The Department of Natural Resources and the Environment (DNRE) of the Tobago House of Assembly has the responsibility for wildlife management activities including the conservation of marine turtles during their nesting period. Wildlife management activities generally include habitat management and the enforcement of wildlife conservation laws. In 1992-1993, Mr. Raye Sandy (then with A.C.F. Tobago) began a turtle watch group supervised by S. Davis (Forester I). The Forestry Division Tobago became formally involved in 1994 in response to a recommendation by the Tobago House of Assembly that "relevant authorities" conduct patrols, monitoring and surveillance to avert further killing of sea turtles in Tobago. In 1997, with the hope that beach coverage and data collection would be enhanced, and poaching reduced, data sheets were installed with the security guards at the Turtle Beach and Grafton hotels for recording nesting events, estimated size of turtle and egg count, and evidence of slaughter; training was also provided to security personnel in regards to tourist etiquette during turtle watching (Wendy Herron, *in litt.* 24 January 1998).

SOS Tobago was born of the need to protect turtles from poachers, particularly on beaches within the greater Black Rock area. SOS Tobago's mission is to conserve local sea turtle populations and their coastal and marine habitats through community-based initiatives in research, education and eco-tourism. A volunteer beach patrol monitors turtle nesting activity nightly (March-July) on Turtle Beach (Great Courland Bay), Grafton (Stone Haven Bay), and Mt. Irvine Back Bay, which are the most active leatherback nesting beaches in Tobago and have been identified as unofficial 'index beaches' for this species. SOS also assists residents with monitoring nesting and counteracting poaching on the northeastern end of the island, particularly Charlotteville, L'Anse Fourmi, Dead Bay (Erasmus Cove) and King Peters Back Bay, conducting sporadic nest counts by day and occasionally camping overnight during nesting season.

In 2007, SOS initiated a hawksbill tagging programme in Charlotteville which is now carried out by residents of that community as part of their monitoring effort. SOS Tobago also conducts interactive lectures and field trips for village councils and schools, produces educational displays at a variety of events and venues throughout the year, hosts international university volunteers, facilitates Turtle Watch

training for registered tour guides, and hosts presentations for beachfront hotel staff, management and guests about appropriate conduct on turtle nesting beaches (see Clovis, 2005). The DNRE supports the initiatives of SOS and provides technical and tactical support for their turtle conservation activities. Officers of the DNRE also complement the SOS effort through the provision of law enforcing authority. Direct financial support for patrols has not yet been forthcoming from the THA; however, the advent of the National Monitoring Programme with Turtle Village Trust in 2008 has helped to ease that burden significantly.

Based on information collected to date, the most important nesting beaches (for leatherback turtles) in Tobago are Turtle Beach (Great Courland Bay), Mt. Irvine Back Bay (Rocky Point) and Grafton Beach (Stone Haven Bay, in that order. Judging from the distribution of carcasses, King Peters Back Bay (Cotton Bay) and other less accessible beaches, such as L'Anse Fourmi and Dead Bay, may also provide important nesting habitat to the beleaguered colony of leatherback turtles in Tobago. Increasing reports from Minister Bay (Bacoleet) suggest that it may also be an important site. Nesting by loggerhead and olive ridleys is likely to be extremely rare.

To measurably increase the effectiveness of relevant community groups with regard to long-term data collection, it is a recommendation of this Recovery Action Plan that they engage the expertise of WIDECASST and/or other technical organisations in the development of five-year plans specifying research and conservation objectives, fund-raising targets, training needs, and organisational stability and sustainability; the design of procedures manuals for harmonised field techniques and data collection; and a mechanism for national training and evaluation.

4.12 Develop area-specific management plans

It is intuitive that in order to conserve the marine resources of Trinidad and Tobago, including sea turtles, the habitats upon which these species depend must be properly managed and protected. Having identified areas critical to the survival of sea turtles (see sections 4.111, 4.112), area-specific management planning, taking into account recommendations put forth in this Recovery Action Plan and developed within the framework of existing planning legislation or resource/habitat management protocol, should be undertaken. As a priority, management plans should be developed for the Prohibited Areas associated with the nation's most important nesting beaches (and adjoining waters) and most important foraging grounds. In Trinidad, a management plan for Grande Riviere, which faces more potential management challenges than either Matura or Fishing Pond, might serve as the most comprehensive model.

SOS Tobago has long advocated for Prohibited Area status for all three index beaches in the Black Rock area and two nesting beaches (King Peters Back Bay and L'Anse Fourmi) on the northeast coast that are used by leatherback, hawksbill and green turtles. In response, the DNRE (THA) has recently announced an interest in declaring Great Courland Bay a Prohibited Area (A. Ramsey, THA, in litt.), surely an excellent first step toward managing critical habitat in Tobago. Prohibited Area status would not only facilitate sea turtle conservation, but also promote more environmentally sound coastal tourism. Given the large number of users of this beach, a comprehensive management plan with full stakeholder involvement would need to be developed as part of the process of prohibition. This could be worked on concurrently with the Grande Riviere model, as many of the issues are similar.

Mt. Irvine Back Bay, the only completely undeveloped beach in southwestern Tobago, provides important nesting habitat for hawksbills and leatherbacks, while the adjacent land is government-held property that has long been considered for tourist development. By legislatively protecting the beach, its

permanent status as a “green space” could be secured, creating a welcome respite for turtles, tourists and locals from the heavily developed coastline. A management plan for this bay, including the nesting beach there, could serve as a model for management of the other as yet undeveloped beaches along the northeast coast.

Area-specific plans for Prohibited Areas should *inter alia* specify guidelines not explicit on the entrance permit; for example, lighting and drainage. Lighting guidelines are enforced by conservation groups (during beach patrols) and by tour guides, but they cannot be enforced. Similarly, storm drains and greywater outflows from the land behind the beach often directly affect nesting habitat, fouling sand and cutting directly into the beach during heavy rains encouraging erosion and nest loss.

Management plans should be peer-reviewed and regularly updated, should provide for compliance and reporting, and should be explicit in supporting best practices in everything from tour guiding to coastal setbacks. Specific management recommendations are offered in the sections that follow, including a summary of minimum standards and restrictions. Management plans are also needed for important foraging grounds, and a potential model is that developed for the nation’s first marine park – Buccoo Reef (<http://www.buccooreeftrust.org/>).

4.121 Review existing legislation

In the paragraphs that follow, we briefly describe the status of existing planning legislation and illustrate how critical habitat may be protected under the provisions of the Town and Country Planning Act, the Forests Act, the Marine Areas (Preservation and Enhancement) Act and, more recently, the Environmental Management Act. **Once legislative authority has been brought to bear on the protection of habitat, clearing the way for certain restrictions regarding its use, it is a recommendation of this Recovery Action Plan that site-specific management planning involve local coastal zone authorities (section 4.122), specify pertinent restrictions (section 4.123), provide for the enforcement of restrictions and other guidelines (section 4.124), and encourage public awareness (section 4.125).**

Town and Country Planning Act: “The existing legislation, the Town and Country Planning Act, has as its main aim the orderly and progressive development of land and the preservation and improvement of the amenity of land. The legislation provides for the preparation of development plans to indicate the use to which land is to be put and the control of development of all land. Through such control permission must be granted for development, which includes engineering, building, mining operations, change in the use of land or buildings, and the subdivision of land before development is commenced. The National Physical Development Plan (NPDP) for Trinidad and Tobago, prepared under the authority of the Town and Country Planning Act (Chap. 35:01 of the laws of Trinidad and Tobago) and approved by Parliament, sets out the land use planning and physical development framework for a 20-year period ending in 2004. A review of the NPDP is due and is expected to commence in 2011 (Shelley Sultanti-Maharaj, Town and Country Planning Division, Ministry of Planning, Economic and Social Restructuring, and Gender Affairs, *in litt.* 23 November 2010).

Matura is identified by the 1984-2004 NPDP as an area of “natural-scientific interest to be preserved and protected.” **It is a strong recommendation of this Recovery Action Plan that Matura/ Fishing Pond and Grande Riviere beaches, which together support the largest known leatherback nesting colony in the insular Caribbean, be afforded the strongest measure of protection under existing and future planning legislation.** It is a further recommendation that the full strength of planning legislation be brought to bear on behalf of other important nesting beaches, including two of the

most important leatherback nesting grounds in Tobago: Turtle Beach (Great Courland Bay) and Grafton Beach (Stone Haven Bay). Restrictions on coastal development and visitation (see section 4.123), which are necessary to provide for the long term breeding success of endangered sea turtles, should receive the uncompromised support of the Government at all levels.

Forests Act: In Trinidad, two important beaches were declared Prohibited Areas in 1990 under Section 2 of the Forests Act (Chapter 66:01 of the Laws of Trinidad and Tobago). Legal Notice 28/90 states, “2. The Matura Beach and the Fishing Pond Beach described in the Schedule hereto are hereby declared prohibited areas every year during the period 1st March to 31st August inclusive.” Grande Riviere was similarly declared in 1997. Permits must be obtained from the Forestry Division in order to enter these areas. Carrying capacity is established at 200 persons at the 8.85 km Matura Beach (100 persons through the Orosco entrance, 100 through the Rincon entrance), 100 at the 10.46 km Fishing Pond Beach, and 100 at the 1.6km of beach at Grande Riviere. In each case, carrying capacity is reduced by 50% during July and August, the period of peak hatchling emergence. These restrictions are unofficial, however, and not consistently enforced. Other restrictions also apply.

Prohibited Area designation has been vitally important to Trinidad’s national conservation strategy, as Matura/Fishing Pond and Grande Riviere beaches support some of the highest density nesting by endangered leatherback turtles in the world. Prior to Prohibited Area designation at Grande Riviere, for example, 500 or more unrestrained visitors per night converged on this short (1.6 km) stretch of beach. Visitors stressed gravid females with crowding, noise and lights, placed newborn hatchlings in harm’s way, and forced the patience of dedicated conservation guides to the breaking point. Visitors were often appalled at the experience, which reflected poorly on ecotourism in Trinidad. Conservation measures, including rules that govern carry capacity, are made possible by the Forests Act. **It is a recommendation of this Recovery Action Plan that Prohibited Area status be afforded to other critical habitats, especially in Tobago.**

Marine Areas (Preservation and Enhancement) Act: The multiple benefits of marine protected areas are under-realised in Trinidad and Tobago; it appears that their use as a tool for marine resource management and ecotourism is not well understood by the Government or the citizenry. The Laws of Trinidad and Tobago protect only one area, Buccoo Reef, under the Marine Areas (Preservation and Enhancement) Act Chap. 37:02 (No. 1 of 1970, as amended in 1973). The reef is a no fishing zone, where “fish” are defined to include corals, crabs, lobsters, shrimps, turtles, turtle eggs and any species of marine fauna. Entry into this restricted area is prohibited except with written permission by persons acting on the Minister's behalf. Permission may be subjected to conditions and anchoring sites may only be designated upon notification by the Minister.

It is a recommendation of this Recovery Action Plan that specific attention be focussed on developing criteria for a national system of marine protected areas to serve as the centerpiece of fisheries enhancement and marine resource conservation in the 21st century, and that resources be allocated to adequately manage both new and existing (Buccoo Reef Marine Park) areas. At a minimum, harmful activities, including indiscriminate anchoring and other unnecessary physical damage to the seabed (especially degradation of coral reefs and seagrass), should be prohibited. As important foraging grounds are identified, they should be considered for marine protected area designation.

The Environmental Management Act, 2000: This Act does not repeal any of the aforementioned laws and its objectives include: develop and effectively implement written laws, policies and other programmes for and in relation to the conservation and wise use of the environment to provide adequately

for meeting the needs of present and future generations and enhancing the quality of life; and enhance the legal regulatory and institutional framework for environmental management. The Act's Environmentally Sensitive Areas and Species Rules of 2001 are of particular note. The Rules outline criteria in three schedules for designation of Environmentally Sensitive Species. Schedule I provides justification for the designation under international conventions to which Trinidad and Tobago is signatory, including the SPAW Protocol, CBD, and CITES (see section 4.3). Schedule II outlines categories and objectives that must be met for designation, including maintenance of species abundance and diversity, sustainable economic and human development, uniqueness or significant taxonomic importance, indigenous species or those that spend part of their life cycle in Trinidad and Tobago. Animals and plants referred to in other laws are also included in criteria for designation.

Under the Environmentally Sensitive Areas Rules (2001), areas may be protected if they meet the following requirements, including: providing habitat for Environmentally Sensitive Species, fulfilling international obligations (such as to the Ramsar Convention or the SPAW Protocol), contributing to the appreciation of wider ecological aspects and intrinsic values, enhancing the conservation of biological diversity, facilitating research and education, or maintaining ecosystem functioning or cultural values. **It is a recommendation of this Recovery Action Plan that full use be made of these provisions in the safeguarding of sea turtle habitat, that the EMA legislation be strengthened to create powers under the designation of Environmentally Sensitive Species and Environmentally Sensitive Areas to protect the environment in a comprehensive way, and that at nesting beaches (or offshore areas) where formal protected area status is not feasible, regulatory guidelines and/or zoning ordinances be enacted and enforced to restrict potentially harmful activities** (cf. see section 4.123).

Other: Trinidad and Tobago lacks a coastal lighting ordinance to define and enforce “sea turtle friendly” beachfront lighting on new or existing structures. Such an ordinance could be developed under the aegis of the Town and Country Planning Act or the Environmental Management Act, the latter requires environmental impact assessments (EIA) before Certificates of Environmental Clearance are issued to developments above a certain size and could require that conditions be placed on lighting. A lighting ordinance can be a useful conservation tool if fairly constructed and consistently enforced. Witherington and Martin (2003) suggest a basic framework that includes descriptions of activities prohibited because of their disruption to sea turtle nesting, standards for new lighting, standards for mitigating existing lighting, and proposals for enforcement and monitoring. Lake and Eckert (2009) adopt these ideas to the Caribbean and make recommendations. See also section 4.132.

Noteworthy is a proposal to replace the Forestry Division by a Forestry and Protected Area Management Authority to assume the roles currently played by other government agencies (e.g., Chaguaramas Development Authority; Fisheries Division, Ministry of Agriculture, Land and Marine Resources) involved in managing protected areas (PA) (GOTT, 2010). As presently described, the Forestry and Protected areas Management Authority will –

- Develop and implement policies and programmes for the efficient management of terrestrial, coastal and marine PAs, including recommendations for revising and updating the National Forest and Protected Areas Policies;
- Implement national laws and regulations on forests and PAs;
- Make recommendations for the rationalisation of policies, laws regulations and administrative arrangements for the management of forests and PAs in Trinidad and Tobago;
- Develop mechanism for the sharing of information and resources and the development and implementation of collaborative programmes;

- Establish and implement appropriate management arrangements for each PA (including forested areas) that may include arrangements for management of private land, and management of state and/or private land by communities, civil society organizations, or the private sector; and
- Establish multi-stakeholder management committees as required to coordinate and facilitate the management of particular terrestrial, coastal and marine PAs. These would represent all of the Government agencies responsible for management, as well as other key stakeholders from civil society and the private sector.

According to GOTT (2010), an Executive Board (comprised of government, community and non-profit organisations, academic institutions, and private sector disciplines such as environmental and wildlife management, ecology, land use planning, tourism, fisheries, forestry, social and community development, and law and business) will be appointed to guide operations of the Authority.

4.122 Involve local coastal zone authorities

It is a recommendation of this Recovery Action Plan that the appropriate local authorities, governing councils and community groups be intimately involved when area-specific management plans are developed. In Trinidad and Tobago there is no single coastal zone authority, and use of the coastal zone is under the authority of at least three ministries with separate interests. The Ministry of Planning and Development (Town and Country Planning Division) oversees the development of beachfront property on both islands. The Ministry of Works, Settlement and Infrastructure (Drainage Division) (Division of Infrastructure and Public Utilities, Works Department in Tobago) has authority concerning coastal protection structures. The Ministry of Energy and Energy Industries (Division of Infrastructure and Public Utilities, Works Department, in collaboration with DNRE in Tobago) oversees the quarrying of beach sand. General policies on the conservation of coastal habitats have been formulated through the development of the National Biodiversity Strategy Action Plan (approved by Cabinet in 2001), which concluded that “an integrated multi-sectoral approach is needed for coastal and fisheries management, both within Trinidad and Tobago as well as regionally” (EMA, 2001).

4.123 Develop regulatory guidelines

When areas are defined as especially critical to remaining sea turtle stocks, regulatory guidelines should seek to establish a framework within which appropriate visitation or land use (commercial, recreational, residential) can occur. There are a number of straightforward, standard recommendations that should be taken into account, and these are enumerated below.

It is noteworthy that conservation guidelines already apply to two nesting beaches – Matura Beach and Fishing Pond Beach – which were declared Prohibited Areas in 1990 under the authority of the Forests Act, and Grande Riviere which was similarly declared a Prohibited Area in 1997. Entry into these areas between 1 March and 30 August (peak nesting season) requires a permit specifying purpose of visit, period and duration of visit, etc. Rules are enforced regarding fishing, camping, picnicking, etc. One-time entry for an adult is TT\$5 [ca. US\$ 0.85]; \$50 for multiple entry throughout the prohibited period (these fees are \$2 and \$20, respectively, for children under 12). Tour guiding fees are charged separately (see section 4.271). Some believe that not all critical areas, especially on the well-developed beaches of tourist-oriented Tobago, can be declared Prohibited Areas, but the experiences of Grande Riviere, also a ‘hotel beach’, have shown that this is not the case.

The Environmental Management Act (No. 3 of 2000) has the potential to regulate any number of activities potentially harmful to sea turtles (e.g., coastal construction, visitation and recreational activities, beachfront lighting, nearshore dredging, anchoring) by mandating prescribed conservation guidelines, and the Environmental Management Authority requires EIAs before Certificates of Environmental Clearance are issued to developments above a certain size.

It is essential for the survival of depleted sea turtle populations that certain minimum and standard guidelines be adopted to safeguard nesting habitat. The most fundamental of these guidelines are summarised below and are discussed in further detail in sections 4.13 and 4.14. Any regulations, in order to be effective, must be enforceable.

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

2) *Artificial lighting*: The condition that artificial lighting not be visible from nesting beaches should be established as inviolate. Infringe on this principle and a fundamental change (for the worse) in the ability of the beach to support nesting will have occurred, thereafter diminishing the effectiveness of all other conservation initiatives. A “no-lighting” policy is comparatively easy to impose during the planning stages of development. For nesting beaches already characterised by residential or commercial beachfront development the task is more difficult, but not insurmountable. For details, see 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 (section 4.133). Because sandy beaches are naturally dynamic, there are numerous examples throughout the Caribbean region of beaches lost, rather than secured, as a result of armouring. The physical characteristics of the coastline should be taken into account prior to coastal construction so that adequate setbacks, rather than expensive and often counter-productive armouring, can be used to provide for the long-term conservation of the beach resource.

4) *Design setbacks*: If development of land adjoining a sandy beach is planned, setback limits should be defined that reflect the damage likely to be caused to the beach and backshore environment during a major storm, and that take into consideration beach and backshore characteristics. Setbacks not only help to protect coastal properties from storm damage, but also reduce over-crowding of the foreshore, 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. Setbacks of 30-40 m and 80-120 m from the line of permanent vegetation are reasonable minimum guidelines for upland and lowland coastal development, respectively (section 4.133). Issues of land ownership and use limitations should be examined with a view towards providing incentives to encourage owners to apply their land(s) to conservation purposes.

5) *Access*: With the exception of authorised patrol or emergency vehicles, the use of motorised vehicles should be prohibited on beaches at all times. 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). Tire ruts also present a hazard to hatchlings crossing the beach. Where vehicles are needed to transport heavy fishing, commercial, recreational, research or film equipment, a minimum number of access points should be provided; vehicles should park landward of the line of permanent vegetation. Pedestrian access to beaches for recreational, commercial or research or film purposes should be confined to specific locations and strictly regulated so as to minimise destruction of the beach or beach forest by trampling.

6) *Waste disposal*: The country-wide management plan for waste disposal should be improved. No dumping should be permitted inshore or within the nearshore, beach, dune, or wetland environment of the shore zone. Such dumping as has already occurred should be subject to immediate clean-up; clean-up should be accomplished using hand tools (section 4.134). The fouling of beaches runs counter to the economic interests of both residents and commercial landowners. Beach litter can obstruct hatchlings on their journey to the sea, discarded glass and metal can injure turtles, and larger objects can prevent females from finding a nest site. All beach users (fishing, commercial, recreational, research, film) should be required to take with them any garbage or other waste brought to or generated at the beach. Trash cans and regular pickup should be provided at all beaches and commercial, research or film users should ensure that adequate pickup is available for their waste (or provide for private removal).

7) *Vegetation cover and fires*: A reasonable vegetation buffer should be preserved above mean high tide. Creeping and standing vegetation stabilises the beach and offers protection against destructive erosion by wind and waves. The beach forest provides important nesting habitat for the hawksbill turtle and offers natural shielding for the beach from sources of artificial lighting (section 4.132). Fires, whether for recreation, disposal of vegetative waste or charcoal production, should be prohibited on sandy 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 and discharge of faecal matter 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 and other organic wastes, from land-based sources should be centrally treated before its discharge into the sea, or into watercourses which enter the sea and care should be taken in the positioning of outflow pipes or storm drains on to critical nesting beaches and into critical offshore habitat. See sections 4.143 to 4.146.

9) *Dredging and anchoring*: Sedimentation and anchoring are leading causes of destruction to seagrass meadows and coral reefs throughout the Wider Caribbean, and such damage is clearly visible in Tobago and the yachting centres of northwestern Trinidad. Anchoring should be restricted to designated sand bottom areas; vessels should tie in at approved moorings in coral reef areas. Alternatively, vessels should be required to remain offshore, beyond the zone of living coral and seagrass. Dredging activities should be planned to minimise damage (e.g., smothering by sedimentation) to down-current coral and seagrass. Severe disruption of the sea bed, especially in living seagrass and coral communities, can ruin foraging areas for sea turtles and nursery sites for commercial fishes, negatively affect the natural dynamics of the marine environment, and result in the loss of beach sand (section 4.147).

10) *Physical destruction of coral and seagrass*: In the absence of the sheltering influence of offshore reefs, shorelines are often severely altered, resulting in economic and environmental losses. Neither coral reefs nor algal ridges should be dynamited or dragged with chains to provide boat access, “improve” swimming areas, anchor film props etc. Anchoring should not occur in reef or seagrass areas (see above, and section 4.147). Divers should be thoroughly coached on diving etiquette so as to preclude trampling, collecting, or touching living coral. The practices of using chemicals or dynamite for the purpose of stunning fish should be disallowed under all circumstances (this is already the case, see sections 4.141, 4.142). The destruction of coral reefs resulting from these practices can be irreversible.

4.124 Provide for enforcement of guidelines

Institutional support for enforcement cannot be over-emphasised. In order to effect compliance with rules and regulations concerning the protection of habitat, law enforcement is crucial. **It is a recommendation of this Recovery Action Plan that the presence of authority (e.g., Forests Officers, Game Wardens, Estate Constables, Fisheries Officers, Coast Guard personnel) be visible at Prohibited Areas, Marine Parks, and other protected habitat.** Community-based Honorary Game Wardens should also be incorporated as enforcement partners, especially during the sea turtle nesting season. Officers should work collaboratively with community-based organisations conducting routine monitoring and tour guiding. On important nesting beaches not yet designated as protected, more community members should be empowered as Honorary Game Wardens to enforce conservation guidelines. Enforcement officers, in any capacity, should be duly trained to perform their job adequately.

With regard to conditions imposed on beachfront construction projects, such as setbacks and lighting restrictions, it is a recommendation of this Recovery Action Plan that a registered architect, professional engineer, or other authority designated by the Government conduct a site inspection, including a night survey with beachfront lights turned on. The purpose of this inspection would be to verify that beach illumination is minimised and is in accordance with regulations designed to protect nesting and hatching sea turtles. Regular site inspections should be undertaken to ensure compliance. Training in the conduct of a lighting assessment, following internationally accepted best practices, can be provided by WIDECAS.

4.125 Develop educational materials

It is a recommendation of this Recovery Action Plan that residents and visitors (and, when appropriate, developers and concessionaires) be made aware of regulations promulgated to safeguard habitat important to sea turtles. Educational materials should be readily available to the visiting public and should include clear descriptions of what types of activities are permitted and what types of activities are not permitted in the management area. Permanent signboards at nesting beach entrances are one way to educate visitors. A signboard may explain that access permits and/or licensed guides are required, beach fires and littering are prohibited, 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. A telephone number to report violations should be provided. Other options include the distribution of informative pamphlets, permanent signage in hotel rooms, and repeated information provided by the media. Signage, pamphlets and weekly hotel lectures have made a considerable impact in visitor behaviour on Turtle (Great Courland Bay) and Grafton (Stone Haven Bay) beaches.

At the Matura and Fishing Pond Prohibited Areas, signage is placed at key locations along the roadway. Informative signs regarding ‘beach etiquette’ and general information (information designed to

ensure that nesting turtles are not hindered or harassed) are placed at entry points to these nesting beaches, as well as at Grande Riviere. At Matura, brochures are distributed at the point of purchasing permits and also when tour guides are hired. At Fishing Pond, the potential exists for upgrading an available abandoned structure to develop a modest and very nice interpretive center at the entry to the Prohibited Area. These are all excellent examples of public awareness efforts in the management and protection of habitat critical to the survival of the nation's sea turtles, all of which should be further developed and recommended for replication by the National Sea Turtle Conservation Programme (section 4.6).

4.13 Prevent or mitigate degradation of nesting beaches

4.131 Sand mining

Permission to extract sand is given by the Ministry of Energy and Energy Industries. **It is a recommendation of this Recovery Action Plan that every effort be made to effectively prohibit the practice of beach sand mining throughout the Republic.** The chronic removal of sand from nesting beaches accelerates erosion and degrades or destroys beach vegetation by extraction or saltwater inundation. In severe cases, saline ponds are formed in unsightly pits left by mining operations, shoreline trees are lost to the sea, and entire beach habitats are eliminated. Transport trucks operating on the beach can also accelerate erosion, in addition to scarring the terrain.

The loss of sandy beaches not only reduces the reproductive success of sea turtles, but endangers beachfront investment (piers, hotels, houses) and has serious economic implications for the future of vital industries (e.g., fishing, coast-based tourism). For example, at Gordon Bay (Blanchisseuse, Trinidad) sand mining by villagers for home construction has reduced the beach to a rocky shore. Gordon Bay was once an important fishing port on the north coast, and also supported nesting by hawksbill turtles. Now neither the berthing of boats nor the nesting can occur.

Of one of the nation's most important nesting beaches, Pritchard (1984) wrote, "Sand mining is unquestionably an environmentally undesirable activity at Matura, contributing to beach erosion, destabilization of shorelines, and loss of nesting habitat for marine turtles." The turning point was a visit to the beach, hosted by Dr. C. James with the Quarries Advisory Committee and members of the petroleum industry (who were seeking further mining concessions). The turtle's plight in its labour of love to secure a next generation had a significant impact on its viewers that night, and no licence has since been granted for mining at beach locations on the north or east coasts of Trinidad. Since mining can also occur illegally in remote areas, grassroots awareness of the damage caused by beach sand mining is an important defence against clandestine action. For example at Grande Riviere, another important nesting site, periodic attempts to carry sand from the beach by truckload are invariably countered by concerned villagers; recent attempts have not been made.

Beach sand mining is also a serious problem on some beaches in Tobago and has been extensive at several sites, including Great Courland Bay where commercial operations between 1978-1983 resulted in the loss of a vertical meter of sand, exposing bedrock in some areas. The beach has never recovered. Other windward beaches have been similarly exploited. In addition to commercial operations, subsistence take is widespread. Individuals extract sand by hand (shovel), filling gunnysacks, and loading 20-30 bags on a truck for use in domestic construction or repair. Cumulative damage is evident at Great Courland Bay, Stone Haven Bay, and elsewhere, raising concern that egg-bearing females will be forced into marginal habitat when prime nesting areas become inaccessible due to exposed bedrock. According to EMA (1995), "The search for cheap sand and gravel to serve as aggregate in Tobago's booming con-

struction industry is placing at risk the very beaches that are one of the island's prime tourism attractions." The report concludes, "Sand mining has already destroyed beaches at Goldsborough and Richmond Bays, and other beaches are under threat at Friendship, Canoe Bay, Little Rockly Bay, King's Bay [and] Little Englishman's Bay." To that we can now add Kilgwyn.

Besides degrading tourism assets, beach sand mining can also lead to serious coastal erosion problems, destruction of sensitive marine habitat and degradation of water quality along the shores. The IMA has worked with THA, tourism operators, the construction industry, and others to find a workable solution that would protect the beaches while meeting industry's need for aggregate. In September 1995, the IMA sponsored a public forum in Tobago to present options and seek comment. A joint committee of the IMA and THA proposed that (i) as a general rule, no beaches in Tobago should be mined for aggregate, (ii) the THA review the adequacy of existing beach control regulations, and strengthen its capacity to enforce the regulations, (iii) a beach monitoring programme be established, and (iv) an adequate source and means of supply of construction aggregate at commercial rates be identified and utilised as soon as possible (EMA, 1995). These recommendations are fully endorsed by this Recovery Action Plan. Today, the Division of Infrastructure and Public Utilities must seek the permission of the DNRE before removing sand from any area, however, there is still limited enforcement and many people continue to remove beach sand for their own personal use.

4.132 Beachfront lighting

Sea turtles are profoundly influenced by light. Hatchlings, freshly emerged from the nest, depend largely on a visual response to natural seaward light to guide them to the ocean. Consequently, in zones of coastal development, sources of artificial light distract the little turtles so that they turn away from the sea and crawl landward. Having done so, they are eaten by crabs, birds and dogs, or die in the morning sun before reaching the sea. The same can be said for nesting females who are confused by or turn inland toward zones of bright lighting. Research demonstrates that low-pressure sodium vapor (LPS) luminaires, which emit light in the 590 nm range (yellow), do not attract hatchlings to the extent of full-spectrum white light, and thus LPS lighting should be considered by coastal developers whenever possible (e.g., Witherington, 1990). A comprehensive manual by Witherington and Martin (2003) focuses on assessing and resolving light-pollution problems on sea turtle nesting beaches. A discussion of lighting assessment techniques is also available in Knowles et al. (2009) and Lake and Eckert (2009).

There are presently no official regulations with regard to the lighting of beachfront properties. As coastal development inevitably proceeds along the east and north coasts of Trinidad, where sea turtle nesting is concentrated, *the condition that artificial lighting not be visible from a nesting beach should be established as inviolate. It is a recommendation of this Recovery Action Plan that a national Lighting Ordinance be adopted and that lighting restrictions be imposed as a condition for obtaining approval for coastal construction from Town and Country Planning.* This requirement is widely implemented in Florida (Witherington and Martin, 2003), as well as being a requirement in Belize (Smith et al., 1992), St. Kitts and Nevis (Eckert and Honebrink, 1992), and, more recently (since 2001), in Jamaica using the 1956 Beach Control Act (R. Bjorkland, *in litt.* 24 May 2010). Guidance on formulating a lighting ordinance can be found in Lake and Eckert (2009).

Lighting necessary for the illumination and security of beachfront development should be positioned so the source is not visible from the beach and does not directly illuminate areas of the beach. Low pressure sodium vapor lights emit wavelengths (560-620 nm, "yellow") which are less attractive to turtles and they should be used whenever possible. Low intensity, ground-level lighting should be encouraged.

Nighttime and security lighting should be mounted not more than 5 m above the ground and should be positioned or shielded so it does not directly illuminate areas seaward of the line of permanent vegetation. No lighting, regardless of wavelength, should be placed between turtle nests and the sea.

An *absence* of lighting is the best guarantee that hatchlings will safely find the ocean. Where this is not an option, “next best” solutions have long been available. For example, Witherington (1990) proposed: (1) 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), (2) alternative light sources (e.g., LPS lighting is known to be less attractive to hatchlings than full-spectrum white light), (3) time restrictions (lights extinguished during evening hours when hatching is most likely to occur; e.g., 1900-2300 hrs), (4) 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), and/or (5) 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 kilometers away can disrupt hatchling orientation).

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.

It is fortunate that in Trinidad the majority of high-density nesting beaches are in relatively unpopulated areas. Nevertheless, problems are apparent even when development occurs on a small scale. For example, lights associated with the Mt. Plaisir Estate Guesthouse built on the nesting beach at Grande Riviere (which supports the densest leatherback nesting in the Republic), once attracted both hatchling and adult leatherbacks. Bloodied walls once marked the point at which adults collided with the building. Estate management has taken steps to minimise the lighting hazard, including removing some light sources and turning others off after sunset. This has been highly effective, although hatchling disorientation still occurs on moonless nights. More recently, hatchlings are disoriented by the lights of newer hotel developments, including parking and security lights, and by a single brilliant light marking a fishing depot on the south end of the beach.

In Tobago, where coastal tourism constitutes a significant part of the economy, lighting is a widespread threat to sea turtles. SOS patrollers often relocate disoriented hatchlings to a darker part of the beach, only to find them reappearing at the hotel again having merely swam parallel to shore toward the bright lights. Nesting females also sometimes become disoriented when returning to the sea, and head inland towards hotel lighting instead. Surveillance and security staff on the grounds at night should be advised to watch for disoriented hatchlings, and to release them immediately and safely in dimly lit areas and to turn off troublesome lights whenever there are hatchlings and turtles on the beach. Some hotels promote the fact sea turtles nest at their doorsteps, and some (but not all) of these hotels have taken steps to introduce “turtle friendly” lighting and to engage security staff as guides and beach patrollers. The degree to which these efforts are maintained at private hotels is largely dependent on the management.

It is important that tourists are made aware by hotel staff of the importance of sea turtle conservation, and that they be asked to participate in conservation measures, such as maintaining a dark beach and enforcing proper etiquette during “turtle watching” by hotel guests (see section 4.271 for a discussion of turtle watching). Weekly hotel lectures sensitise guests regarding Turtle Watch etiquette and other issues; however, it can be difficult to organise training for staff. It is critical that hotel workers at properties on or adjacent to nesting sites be adequately trained in the basics of sea turtle conservation, and that contact information for local conservation groups be readily available. Turtle Beach Hotel set an example in 2004 by allowing SOS Tobago to conduct “midnight meetings” with security staff and periodically scheduling presentations at weekly Duty Manager meetings. Such efforts must be sustained throughout the nesting season, and, again, the level of commitment depends very much on management.

It is a recommendation of this Recovery Action Plan that direct communication be initiated and sustained between the appropriate agencies and the hotel community with regards to “turtle-safe” lighting alternatives and the enforcement of any imposed conditions. It is a further recommendation that Government provide conservation materials to beachfront hotels and secure a commitment from the Hotel Association that its members will participate actively in a national campaign to safeguard sea turtle nesting beaches. Beachfront hotels and restaurants should be asked to report incidents of sea turtle nesting; to remove, redirect or obscure (shade) any lights shining on the beach; and to check the grounds each morning in order to “rescue” misdirected hatchlings.

Beachfront (and surrounding) lighting is a problem easily addressed by current technologies, and mitigation is most effective when undertaken collaboratively by all coastal properties. To that end, a national meeting (cf. Eckert and Horrocks, 2002) should be organised in Trinidad and Tobago with the objective of reaching consensus on a *Sea Turtle Policy Statement* to be implemented as part of the environmental management systems of coastal hotels, particularly those located at major nesting sites. A formal statement embedded in hotel operating procedures is critical; otherwise, turnover within hotel management can result in inconsistent lighting policies and unpredictable implementation of other conservation measures. For more detail on developing a *Sea Turtle Policy Statement* and a Check-List for implementation, see Choi and Eckert (2009).

4.133 Beach stabilisation structures

Most beaches are naturally dynamic. To protect commercial investments such as beachfront 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. Moreover, 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. In addition, the armouring of beaches can limit access to nesting turtles. Fortunately, structures of this type have not been built on (or offshore) known nesting beaches. **It is a recommendation of this Recovery Action Plan that hard engineering options to beach protection be regarded only as a last resort.**

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 (see Choi and Eckert, 2009). **It is a recommendation of this Recovery Action Plan that national planning legislation adopt a strong stance regarding setbacks for beachfront development (private and commercial) and require mixed-species vegetated buffer zones between built facilities and sandy beach platforms.** 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 buffer zones, including beach forest, lawns and other landscaping. Setbacks not only help to protect coastal properties from storm damage, but also reduce overcrowding of the foreshore, 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. Setbacks of 30-40 m and 80-120 m from the line of permanent vegetation are reasonable minimum guidelines for upland and lowland coastal development, respectively.

4.134 Beach cleaning equipment and vehicular use of beaches

Beach debris can significantly reduce reproductive success by sea turtles. An accumulation of debris can prevent an egg-bearing female from finding a suitable nest site, and can trap emerging hatchlings. Nathai-Gyan et al. (1987) reported, "Solid waste is a serious problem affecting most turtle nesting beaches and usually consists of any item from logs, branches, dried coconuts, plastics, fishing nets and a host of other incidental items either brought in by tides or washed from inland [sources] by rivers. During certain months of the year, as much as 70% of beach surfaces may be covered by debris, resulting in drastic reductions of available nesting surfaces."

According to a brochure ("Plastics in the Coastal and Marine Environment") developed in March 1995 by the Fisheries Division with support from FAO/UNDP (Integrated Coastal Fisheries Management Project INT/91/007), "Plastics have become one of the most popular materials in use, particularly in the household, in Trinidad and Tobago . . . The period 1979 to 1992 has seen a 3.7 to 7 percent increase in the weight of domestic waste entering the Beetham, the major landfill in Trinidad." While the increase by weight is small, the increase in volume has been very substantial. The result is "an increase in uncollected plastics reaching coastal areas and the environment in general since only 85 percent of generated waste reaches . . . the landfill." The brochure urges that "greater efforts be made to educate the public of Trinidad and Tobago about the consequences of irresponsible disposal of garbage both on land and in the coastal areas" and that industry take an "active interest in the new technology for production of biodegradable plastic material and in the recycling process." These recommendations remain current and have the full support of this Recovery Action Plan.

Noteworthy is the fact that agencies, organizations and sponsors have been involved in litter surveys and beach clean-ups in Trinidad for more than two decades. Results of an early survey of 15 beaches in the northwest peninsula in 1984 by researchers from IMA showed a total litter load in excess of 1 tonne for the beaches sampled. Highest concentrations were found on the St. Peter's Bay, L'Anse Paoua and Turtle Bay. It was estimated that on five of the 15 beaches, prevailing water currents accounted for more than 40% of the litter load; however, material deposited by visitors constituted the greatest amount. Of the identifiable items, 42% consisted of metal soft drink cans, 4% glass bottles, and 30% plastic containers and disposable food utensils. A decade later, in 1993, a follow-up study (island-wide) concluded that 44% of shoreline litter was plastic and 30% was glass, and that beachgoers and inland sources were among the causal factors.

On 17 September 1994, the first "Clean Coast Day" was organised by the Fisheries Division and the results archived with what is now The Ocean Conservancy's International Coastal Clean-up database (www.oceanconservancy.org). Volunteers collected 4.4 tonnes of litter from 9 km along six beach areas at William's Bay, Chagville Beach, Hart's Cut, L'anse Paoua, Scotland Bay, Grand Fond Bay (Monos), and Chacachacare; plastics accounted for 50% of the debris collected. The trend is clearly toward an increase in the importance of plastic materials as a major and persistent source of litter on our beaches and in the coastal marine environment. The public should be aware of these trends and their implications for

the environment. **It is a recommendation of this Recovery Action Plan that beach clean-ups, such as that sponsored by Nature Seekers at Matura, be an annual event on turtle nesting beaches prior to the nesting season, that collection methods and analysis be standardized nationwide, and that results be collated and emphasised in the national media.**

Hotels have been built on some of the main nesting beaches in Tobago. Hotel staff frequently hand-rake these beaches, but pick-up trucks and other vehicles are sometimes driven onto the beach to remove rubbish piles. Because mechanised beach cleaning equipment can crush or puncture incubating eggs, effort should be made to provide alternatives to the grooming of sandy beaches. Furthermore, the swelling of seasonal rivers in the rainy season often leads to flooding of residential areas behind the beach and the subsequent dredging of a channel across the beach to the sea. This is always done with heavy equipment which drives along the beach to the site and then digs through the sand bank endangering nests enroute and at the site. **For routine cleaning and maintenance of the beach and bordering waterways, it is a recommendation of this Recovery Action Plan that manual labour be used and that sea turtle conservation groups in the area be consulted before bringing heavy equipment on to the beach so that high density nesting areas can be avoided.** Community-based sea turtle conservation groups are willing to quickly mobilise their volunteer resources to assist in clearing larger debris piles in order to reduce or eliminate the need for motorized vehicles on the beach and to collaborate in draining overflowing rivers (T. Clovis, SOS Tobago, pers. comm.).

Beach clean-up and river drainage should not include the removal of vegetative cover (see Choi and Eckert, 2009). Supralittoral trees and shrubbery provide hawksbills with nesting habitat and promote beach stabilisation. Even raking and removal of leaves and grasses above the high tide line can increase the probability of wind erosion, thus degrading both nesting habitat and vegetated buffer zones adjoining coastal development. The use of heavy equipment on the beach for the removal of large debris should be generally confined to non-nesting months (November to February), and all potential obstacles or hazards (e.g., logs) brought on by the rainy season should be cleared from the beach before nesting begins. Fire should never be used for disposing of vegetative waste.

With regard to the operation of motor vehicles, it is a recommendation of this Recovery Action Plan that, with the exception of authorised patrol or emergency vehicles, motorised vehicles not be allowed to drive on sandy beaches. Driving cars and trucks on the beach compacts the sand (crushing eggs), damages beach vegetation, and can cause or exacerbate erosion; erosion exposes eggs to wave action and reduces the amount of beach available for nesting; and vehicles can strike and kill hatchlings crawling to the sea, or frighten females away from nesting (Choi and Eckert, 2009). Hatchlings huddled just below the surface of the sand (waiting to emerge later in the evening, when the sun sets and the beach surface cools) are particularly vulnerable to being crushed by passing vehicles. Tire ruts left in the sand can also trap hatchlings and prevent them from reaching the sea (Hosier et al., 1981).

With the increasing popularity of vehicles with off-road capabilities, beach driving is becoming more of an issue, especially in Tobago. Prior to the declaration of Matura Beach, Trinidad, as a Prohibited Area in 1990, residents interviewed for this Recovery Action Plan recalled it being “common” to see vehicles driving on the beach while turtles were laying their eggs. As a result of community vigilance since 1990, beach driving no longer occurs. Vehicles occasionally still drive onto Grande Riviere nesting beach, but community groups there are quick to request that the vehicle turn back. In Tobago, where there is no “Prohibited Area” status, getting drivers off the beach can be more challenging and groups have taken to strategically placing signs and logs to act as deterrents at main entry points – illustrating the value of community groups as sea turtle stewards and co-managers (see section 4.26).

4.135 Beach rebuilding projects

The linkages between development and the persistence of sandy beaches are complex, and should be considered with care before construction proximal to sandy beaches is permitted. If dunes are leveled, vegetation removed and/or solid jetties or seawalls constructed, the likelihood of committing the owners to repetitive and increasingly expensive rebuilding is heightened and sometimes guaranteed. Rebuilding is generally accomplished by bringing sand to the beach from inland sites or adjoining beach segments, or by hydraulically pumping sand onshore from an offshore site. Beach rebuilding projects may enhance some nesting areas, but, in general, the effects are negative (Crain et al., 1995). Heavy equipment and activity can deter nesting and crush eggs, and the new overburden can prevent hatchlings from successfully digging out of the nest. In addition, the type of sand placed on the beach is often unsuitable for nest construction and proper incubation of eggs.

The decision to rebuild a natural beach is expensive and rarely effective in the long term. The forces precipitating the erosion are not and often cannot be allayed by the act of rebuilding, and thus in many cases the cycle inexorably begins anew. **If rebuilding is unavoidable, it is a recommendation of this Recovery Action Plan that replacement sand be similar (e.g., grain size, organic content) to that which was eroded, thereby making every effort to maintain the suitability of the beach for the incubation of sea turtle eggs.** Rebuilding should never be undertaken during nesting and hatching seasons when heavy equipment and activity can deter nesting and crush eggs, and the new overburden can prevent hatchlings from successfully digging out of the nest (see Choi and Eckert, 2009).

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 (see section 4.133). 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.

4.136 Other

Recreational activities on nesting beaches are known to negatively affect sea turtle nesting in various ways, ranging from nuisance noise to the obstruction of nesting habitat by sunbeds, vendors, etc. Nathai-Gyan et al. (1987) were among the first to draw attention to the fact that “increased recreational activities at Manzanilla, Mayaro and Guayaguayare beaches have seriously affected nesting at these beaches, where significant numbers of leatherback turtles continue to nest annually. Manzanilla and Mayaro may suffer a similar fate to north coast beaches, such as Maracas and Las Cuevas, where recreational activity has had negative impacts on turtle nesting.” Beach BBQs and campfires are a perennial concern on Tobago’s beaches, activities with the potential to kill developing embryos and significantly reduce the success of the annual breeding effort. **It is, therefore, a recommendation of this Recovery Action Plan that during the planning stages of large-scale public gatherings on nesting beaches, local sea turtle experts be invited to advise organisers concerning the timing and location of such gatherings and that permitting agencies pay heed to their advisements.**

Timing is critical when considering recreational activities at nesting beaches. In 2005, a major US production company set up to film on Great Courland Bay for six weeks in the middle of nesting season, with the prior blessings of relevant authorities. SOS Tobago, having monitored Great Courland Bay routinely since 2000, was consulted only after the film-set was in place, compromising the safety of

incubating eggs. Authorities downplayed the media outcry and the production company continued its activities, including placing a number of stakes along the beach for an obstacle-course race, threatening additional nests in the surrounding area.

This kind of international production is a welcome boost to tourism in Tobago, but the timing unnecessarily threatened the eggs and young of these endangered species and set a bad precedent for the kinds of activities that can occur on a turtle nesting beach during the active season. “It became impossible to explain to residents and tourists that *they* should not drive a truck or light a beach bonfire with this enormous, heavily used infrastructure allowed to persist in the middle of Tobago’s prime nesting area” (G. Alkins, SOS Tobago, pers. comm., 2006).

4.14 Prevent or mitigate degradation of marine habitat

According to the Reefs at Risk analysis (Burke and Maidens, 2004), “all the 40 km² of reefs around Trinidad and Tobago are threatened by human activities. The most pervasive threats are over-fishing and coastal development, each threatening nearly all reefs. ... Pollution from the land, which threatens over 85% of reefs, includes poorly treated sewage, domestic grey water, agricultural runoff, fertilizers, herbicides, pesticides, and chemicals. Marine-based pollution was not identified in the analysis as an important threat.” The analysis identifies Buccoo Reef, declared a restricted area in 1973 under the Marine Areas (Preservation) Act, as the nation’s only marine park and admonishes that the management plan formulated for Buccoo Reef Marine Park in 1995 has never been implemented (see also Hoetjes, 2002). **It is a recommendation of this Recovery Action Plan that specific threats to marine habitat, especially areas important to sea turtles, be identified and efforts taken to reduce these threats.**

4.141 Dynamiting reefs

The destruction of coral reefs by explosives not only destroys forage and refuge for sea turtles, but also permanently diminishes the capacity of the Republic’s waters to support local fishing and tourism industries. The Fisheries Act of 1916 (Chapter 67:51 of the Laws of Trinidad and Tobago) states, “7. Any person who uses poison of any description or any explosive with intent to stupefy, poison, take or kill fish is liable on summary conviction to a fine of one thousand dollars or to imprisonment for three months.” **It is a recommendation of this Recovery Action Plan that the provision be strictly enforced and that fines and other penalties (such as confiscation of equipment) be stiffened when the revised national Fisheries legislation is enacted.** Reef blasting is not known to occur in Trinidad and Tobago (A. Jobity, Fisheries Division, pers comm., 2002).

4.142 Chemical fishing

The destruction of coral reefs by chemicals not only destroys forage and refuge for sea turtles, but also permanently diminishes the capacity of the Republic’s waters to support local fishing and tourism industries. The Fisheries Act of 1916 (Chapter 67:51 of the Laws of Trinidad and Tobago) states, “7. Any person who uses poison of any description or any explosive with intent to stupefy, poison, take or kill fish is liable on summary conviction to a fine of one thousand dollars or to imprisonment for three months.” **It is a recommendation of this Recovery Action Plan that the provision be strictly enforced, and that fines and other penalties (such as confiscation of equipment) be stiffened when the revised national Fisheries legislation is enacted.** Chemical fishing is not known to occur in Trinidad and Tobago (A. Jobity, Fisheries Division, pers comm. 2002).

4.143 Industrial discharges

According to EMA (1995), “solid wastes and liquid effluents from many of the country’s major industries are discharged directly into watercourses and coastal areas untreated or without basic treatment.” Industrial sources of water pollution include oil production and refining (section 4.145), quarry operations, food processing, chemical plants and rum distilleries. These wastes may contain toxic chemicals, including organics and heavy metals, and can result in high water temperatures. Toxic and hazardous wastes consist of heavy metals such as lead, cadmium, mercury and synthetic organic chemicals, mostly used as raw materials in the manufacturing sector, and in agriculture, in the form of pesticides, fungicides and fertilizers (section 4.146). There are limited facilities in Trinidad and Tobago for the treatment of these wastes. Typically, industrial wastes are either stored on-site or discharged into rivers and streams with only partial, if any, treatment. Runoff from polluted streams also affects the coastal and marine environment.

More than 90% of Trinidad’s labour force is employed on the west coast (Glasgow, 1983), where the Gulf of Paria boasts two ports, various fishing depots, and boat and yacht marinas, all of which contribute to heavy boating traffic and associated wastes. Large industrial complexes (e.g., Point Lisas) produce a variety of industrial wastes. Legislation prohibiting pollution of coastal waters is embodied in the Harbours and Shipping Act of 1987, but enforcement is ineffective. The Archipelagic Waters and Exclusive Economic Zone Act of 1986 enables the President to make Regulations for the “32.(a) protection and preservation of the marine environment, and the prevention, reduction and control of pollution of that environment arising from – (i) land-based sources including rivers, estuaries, pipelines and outfall structures; (ii) sea-bed activities under the jurisdiction of Trinidad and Tobago and artificial islands installations and structures under its jurisdiction; (iii) dumping; (iv) vessels; and (v) the atmosphere.”

Foraging areas in the Gulf of Paria are particularly vulnerable to industrial discharges, including those released to inland waterways that ultimately lead to the sea. The same is true of the much less developed east coast, where principal nesting beaches occur. Major watersheds drain to the Atlantic Ocean, heightening the danger that industrial discharges from inland sources might affect nesting and inter-nesting (offshore) habitat. According to EMA (1995), the Caroni is one of the most severely affected rivers in Trinidad; others include the Couva, Guaracara and Cipero rivers, East Dry River, Diego Martin River, Morvant, Caura and Santa Cruz rivers.

It is a recommendation of this Recovery Action Plan that (1) existing pollution laws be reviewed for completeness and enforceability, providing Government with recommendations for changes where needed; specifically, water pollution rules drawn up by the EMA should be relaid in Parliament and, when passed, the necessary enforcement mechanisms be put in place; (2) industries be monitored to confirm that discharges are duly registered with Government and properly identified as to content; (3) watercourses and nearshore zones be regularly monitored for the presence of harmful chemicals and noxious substances; and (4) fish and other marine life in suspected polluted areas be tested for the presence of toxins.

4.144 At-sea dumping of garbage

The dumping of garbage at sea is recognised as a growing problem throughout the world. Death to marine organisms as a result of ingestion or entanglement is widespread (e.g., Balazs, 1985; O'Hara et al., 1986; Laist, 1987; CEE, 1987). Mrosovsky (1981) estimated that 44% of adult non-breeding leatherbacks had plastic in their stomachs, apparently having mistaken it for jellyfish. Debris continues to pose a

danger to turtles after it washes ashore. Sea turtles and their eggs can easily be harmed by encounters with tar, glass, and abandoned netting on nesting beaches.

In Trinidad and Tobago, 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 (pertinent legislation is summarised in section 4.143). Solid waste discharged from inland waterways accounts for a large portion of marine pollution in Trinidad, therefore concerted efforts in curtailing indiscriminate garbage disposed island-wide are needed. **It is a recommendation of this Recovery Action Plan that relevant legislation be fully enforced, and that a public awareness campaign be launched under the aegis of Government, cooperatives, NGOs, and the media to alert fishermen, recreational boaters and cruise ships of the need to properly dispose of garbage and unwanted fishing gear.** Announcements should be prepared for radio and newspaper. Regular beach clean-ups, such as those sponsored and carried out by the Nature Seekers at Matura Bay, should be recognised and encouraged, both locally and nationally (see section 4.134).

Although penalties for littering can be useful deterrents, the Litter Act is rarely enforced. Similarly, enforcement of statutes requiring the use of port reception facilities is needed to ensure compliance by the many hundreds of vessels using the northwest peninsula every year. Guidelines and regulations with respect to waste ships, yachts, and smaller crafts have been developed on a regional basis under the aegis of the UNEP Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, to which Trinidad and Tobago is a Party (see section 4.321). These guidelines should be given the full consideration of national authorities, and enforced throughout the country.

4.145 Oil exploration, production, refining, transport

An oil-contaminated environment can be lethal to sea turtles and incubating eggs. Behavioural experiments indicate that 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 loggerhead turtles are significantly affected by exposure to crude oil pre-weathered for 48 hours (Vargo et al., 1986). Hawksbill turtles may be particularly 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) later reported young hawksbills (to 20 cm) stranded in Florida “with tar smeared sargassum”; some individuals had ingested tar.

In 1990, oil and asphalt, including mining and refining, made up 30% of the GDP of Trinidad and Tobago (Central Statistical Office, 1991). In 1994, the petroleum industry contributed nearly 50% of the government’s foreign exchange earnings, and nearly 28% of government revenues (EMA, 1995). Today related industries and infrastructure continue to expand. There is no question but that caution is needed in the planning stages and beyond to ensure that marine resources, including sea turtles, are not harmed as petroleum and/or natural gas is pumped from sea-based wells off the east, south and west coasts of Trinidad and the northeast coast of Tobago to refineries and/or holding tanks along the west coast of both islands. EMA legislation (enacted in 2001) requires EIAs before Certificates of Environmental Clearance (CEC) are issued to developments above a certain size, and CEC rules are currently being applied to new exploration. **It is a recommendation of this Recovery Action Plan that exploration and extraction activities be accompanied by independent EIAs and acceptable environmental controls.**

Tar balls on east coast beaches have been documented since the late 18th century (Kulger, 1936) and there is evidence to suggest that they result from naturally-occurring seepage offshore (Amoco, undated). There is also evidence of petroleum-related pollution onshore from refineries, oil field tank farms, trunk pipelines, and the retail sector (e.g., EMA, 1995). Tar-fouling is a nuisance on major leatherback nesting beaches (e.g., Matura, Fishing Pond); tar balls are heaviest during the dry season, including the first three months of the egg-laying period (March-May). In May-June 2005, oil-fouled leatherbacks came ashore to nest at Matura and Grande Riviere (L. Peters, pers. observ.), and there is undocumented evidence of petroleum fouling ('green and sludgy' substance on the skin and carapace) on leatherbacks nesting at Mt. Irvine Back Bay, Tobago, in May 2001 (T. Clovis, SOS Tobago, pers. observ.). Oil deposits resembling melted tar have also been documented at hawksbill nesting beaches (e.g., Chacachacare) (K. Fournillier, pers. observ.).

Notable is the proactive stance taken by BHP Billiton International, which has taken the initiative to develop a human resources base on the northeast coast of Trinidad that includes training of 30 persons within each community in oil spill response techniques and leaders who will mobilize these individuals in case of an oil spill. **It is a recommendation of this Recovery Action Plan that such training be maintained, and that community groups also be trained (and equipped) to respond to oiled wildlife.**

Legislation to prohibit oil pollution is embodied in the 1980 Oil Pollution of Territorial Waters Act, Chapter 37:03 of the Laws of Trinidad and Tobago. Section 3 of the Act makes it an offence to discharge or allow oil to escape from any vessel into the territorial waters of Trinidad and Tobago. With few exceptions, such as when the discharge is due to collision, the owner or Master of any vessel from which oil is discharged, or allowed to escape into any waters to which the Act applies, is liable upon summary conviction to a fine of ten thousand dollars and to imprisonment for 12 months. The Harbour Master is empowered to appoint a discharge site for ballast water. The Petroleum Act, Chapter 62:01 of the Laws of Trinidad and Tobago, includes additional relevant provisions, including licensing the transport, discharging and landing of petroleum and petroleum products by aircraft, vessels, other vehicles and pipelines; imposing conditions to be observed by licensees, and preventing pollution of land, water or air.

Notwithstanding, it is generally agreed that the legislative framework in Trinidad and Tobago is insufficient to safeguard the Republic from the devastation of a catastrophic spill. The Oil Pollution of Territorial Waters Act speaks only to the deliberate discharge of oil by a vessel, not taking into consideration other ways by which oil may be spilled. The Act was "not intended to deal with problems or disasters of the magnitude that presently occur when oil is spilled into the marine environment" (Goodridge, 1987). Other legislation, including the Continental Shelf Act (Act No. 43 of 1969) and the Petroleum Regulations of 1970 (made pursuant to Part III of the Petroleum Act, Section 29(1)(j)), are also inadequate. The Continental Shelf Act addresses incidents of oil discharge from a pipeline (or otherwise than from a ship) as a result of any operations for the exploration of the seabed and subsoil or the exploitation of their natural resources. Penalties are meagre and, in general, an adequate defence is realised by asserting that the discharge was an accident and/or that, once discovered, "all reasonable steps were taken for stopping or reducing it."

In an attempt to design a strategy by which "all reasonable steps" might be taken to mitigate the effects of a spill or other discharge event, a National Oil Spill Contingency Plan was adopted in 1977, but never fully enacted. During this period, a bilateral agreement with Venezuela was also negotiated. In 1993, "Guidelines for the Cleanup of Oil Spills in Exploration and Production Operational Areas" was prepared by the Petroleum Company of Trinidad and Tobago (Safety, Environmental and Fire Services Department and Exploration and Production Division). Soon thereafter, the National Oil Spill Contingen-

cy Plan Committee, an inter-agency committee with industry representation, undertook to revise the national plan (after examining various international agreements for guidance on how to improve and strengthen it). The draft has undergone internal and international peer-review but, according to sources within the Ministry of Energy, finalising the Plan is stalled pending agreement on the financial aspects of implementation; specifically, a sustainable source of funds must be identified to sustain a National Oil Spill Contingency Fund (O. Adams, pers. comm., 2002).

In view of the high level of petroleum activity, both in Trinidad and Tobago and in neighboring Venezuela, it is a recommendation of this Recovery Action Plan that a comprehensive National Oil Spill Contingency Plan (including a funding mechanism) be adopted and implemented at the earliest opportunity. The present draft is a significant improvement over its predecessor, but it remains a framework document (e.g., no regulations, no penalties). The adopted Plan should ensure that, in the event of a disaster of modern-era proportions, Trinidad can meet its obligations both to its citizens and to its neighbours. The Plan should also make provision for a National Oil Spill Contingency Fund sufficient to meet the demands of a catastrophic spill. National legislation should be strengthened to confront all the complexities of modern technology and international law regarding oil exploration, production, refining and transport, and should provide for costs other than for clean-up (e.g., damage to property, damage to natural resources, loss of profits or earnings, restoration). Without the necessary internal legislation, Trinidad and Tobago could suffer considerable damage due to oil pollution without having any proper recourse to obtain the necessary compensation or redress for such damage (Goodridge, 1987).

Trinidad and Tobago is a signatory to the Cartagena Convention (section 4.32) and its Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region. Article 3 of the Protocol states:

- a. The contracting Parties shall, within their capabilities, cooperate in taking all necessary measures, both preventive and remedial, for the protection of the marine and coastal environment of the Wider Caribbean, particularly the coastal areas of the islands of the region, from oil spill incidents.
- b. The contracting Parties shall, within their capabilities, establish and maintain, or ensure the establishment and maintenance of, the means of responding to oil spill incidents and shall endeavor to reduce the risk thereof. Such means shall include the enactment, as necessary, of relevant legislation, the preparation of contingency plans, the identification and development of the capability to respond to an oil spill incident and the designation of an authority responsible for the implementation of this protocol.

4.146 Agricultural runoff and sewage

Agricultural chemicals are widely used in Trinidad and Tobago, 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 minimise negative impacts, and also to make careful choices about future agricultural investments. There is the additional problem on both islands of high levels of organic waste indiscriminately released into watersheds (which discharge to the sea) from agricultural husbandry, such as chicken farming and piggery operations. According to EMA (1995), "Livestock and poultry wastes are commonly disposed of by dumping into rivers. ... Moreover, most abattoirs, except for those at Port of Spain and Arima, are not connected to any sewerage system where such wastes can be treated."

With regard to sewage, the report goes on to say, “The discharge of untreated or partially treated sewage into the marine environment is another major source of pollution. In Trinidad and Tobago, there are two major sewage treatment plants and several smaller systems that discharge their effluents either directly or indirectly into inshore coastal waters. Most of the other inland package treatment plants, many poorly constructed pit latrines, and many farms discharge much of their wastes into rivers that eventually flow into the sea. Chronic pollution from industrial sources and domestic sewage discharges has resulted in unacceptably high levels of faecal coliform off a number of beaches in Trinidad.” (EMA, 1995). The tourism industry contributes to the problem. Specifically, there are frequent sewage treatment shortfalls at some Tobago hotels and a growing potential for nearshore pollution resulting from the unregulated release of yacht-generated sewage (see Section 4.144.)

The Water and Sewerage Act (Chapter 54:40 of the Laws of Trinidad and Tobago) empowers the Water and Sewerage Authority (WASA) to enact regulations to prevent water pollution, including both surface and ground (subterranean) waters. Section 62 of the Act makes WASA responsible for maintaining and developing the existing sewerage system, and for administering same. The Public Health Ordinance (Chapter 12:4 Section 70(1)j of the Laws of Trinidad and Tobago) also contains provisions to protect watercourses from pollution. There are no data to indicate the direct effects of agrochemicals and sewage on sea turtles utilising the beaches and waters of Trinidad and Tobago, but the cumulative effect of these poisons and high BOD (biological oxygen demand) wastes on the marine environment weakens the capacity of coral reefs and other affected benthic systems to support life, including endangered sea turtles and commercial fishes and invertebrates (e.g., lobster).

It is a recommendation of this Recovery Action Plan that Government give priority to a national sampling and monitoring programme in the country's major watersheds, especially, for the purposes of this Recovery Action Plan, those discharging at or near major nesting or foraging grounds. The sampling programme should be consistent and comprehensive, the data centrally compiled, and the information available to the public. It is a further recommendation that designated Index Sites be monitored consistently to serve as general indicators for the larger ecosystem. For example, a monitoring programme for the Buccoo Reef Marine Park provides management information with regard to pollutants along the southern Caribbean coast of Tobago and could serve as a model for other areas. At present, samples (e.g., chlorine, E. coli) are periodically collected in and out of the sewage lines at Tobago hotels by WASA and Public Health authorities.

In Stone Haven and Great Courland bays in Tobago, agricultural and ‘greywater’ runoff is released directly to the beaches through roadside drains, and from nearby farms, hotels and restaurants. The effluent saturates the sand at the point of entry, attracting flies, dogs and other creatures that could jeopardize sea turtle nests. Moreover, the smell renders the site unbearable for beach patrollers and Turtle Watch tours. **It is a recommendation of this Recovery Action Plan that sewage treatment facilities of sufficient capacity be developed, as a priority, in areas where tourism and urbanisation is compromising the human and ecological health of coastal areas.**

4.147 Anchoring, dredging and land reclamation

In Tobago, as elsewhere in the Caribbean, extensive damage has been caused to reefs by anchors and chains from moored yachts. This is particularly evident *inter alia* in Charlotteville and Mt. Irvine. The systematic demolition of coral by heavy anchors severely degrades potentially important sea turtle foraging and resting habitats. Healthy coral reef and seagrass ecosystems are central to the survival of endangered sea turtles, particularly hawksbill (section 2.4) and green turtles (section 2.2), as well as to the

sustainability of marine-based tourism. **It is a recommendation of this Recovery Action Plan that regulations be adopted under the authority of relevant legislation, a public awareness campaign be undertaken, and a national system of moorings be developed.**

Priority attention should be given to Tobago where yachts and other pleasure boats may anchor anywhere without restriction. Moorings should be developed within a larger context of yacht support, including facilities for sewage and waste disposal onshore. As a start, a pilot programme for reef demarcation buoys was successfully implemented in 2004-2005 by Buccoo Reef Trust and the Department of Marine Resources and Fisheries, with co-funding from the Travel Foundation (UK), in areas of exceptionally high anchorage, including Store Bay, Mt. Irvine, and Charlotteville.

Dredging and land reclamation activities affecting the coastline and nearshore waters can severely degrade sea turtle foraging and refuge areas. These activities should be conducted in such a way as to minimise damage to benthic communities resulting from turbidity. Turbidity (suspended sediment) degrades and smothers, sometimes fatally, surrounding coral reefs and seagrass beds. **Since dredging and land reclamation have serious environmental implications, it is a recommendation of this Recovery Action Plan that a thorough and independent environmental assessment be conducted, reviewed, and approved before dredging or reclamation is initiated.** In addition, a CEC is required for such activities as they are captured under activities 12 and 13 of the Certificate of Environmental Clearance (Designated Activities) Order.

Land reclamation and dredging activities at present are largely confined to the Gulf of Paria, so that nesting activities are not likely to be affected, but the threat of sedimentation to foraging areas should not be discounted. Also worth noting is that small-scale river operations on the east coast may negatively affect sea turtle nesting areas. For example, dredging in the estuary of the Mission River (Toco) uncovered a full-term leatherback nest several years ago; the hatchlings were released to the sea (D. Walcott, pers. observ.). River dredging and upstream development can also have significant effects on river flow and sediment loads, both of which can ultimately affect nesting habitat.

4.2 Manage and Protect All Life Stages

The Government of Trinidad and Tobago claims jurisdiction over an exclusive economic zone (extending 200 nautical miles seaward of the territorial sea), including “the protection and preservation of the marine environment”, and promises that “the Minister to whom responsibility for fisheries is assigned shall ensure, through proper conservation and management, that the living resources in the exclusive economic zone are not endangered by over-exploitation” (Archipelagic Waters and Exclusive Economic Zone Act, 1986). “Proper conservation and management” has not yet been achieved for the sea turtle resource. To achieve this goal, the national regulatory framework needs to be revised and improved. In the sections that follow, existing legislation is reviewed and changes are suggested where necessary.

4.21 Assess regulatory mechanisms

4.211 Review existing local laws and regulations

In 1975 the “Protection of Turtle and Turtle Eggs Regulations” were promulgated under Section 4 of the Fisheries Act of 1916 (Chapter 67:51 of the Laws of Trinidad and Tobago). The Regulations mandate that “2. No person shall -- (a) kill, harpoon, catch or otherwise take possession of any female turtle which is in the sea within any reef or within one thousand yards from the high water mark of the

foreshore where there is no reef; (b) take or remove or cause to be removed any turtle eggs after they have been laid and buried by a female turtle or after they have been buried by any person; (c) purchase, sell, offer or expose for sale or cause to be sold or offered or exposed for sale or be in possession of any turtle eggs. 3. No person shall, between 1st March and 30th September, kill, harpoon, catch or otherwise take possession of or purchase, sell, offer or expose for sale or cause to be sold or offered or exposed for sale any turtle or turtle meat.” Offenders are liable on summary conviction to a fine of two thousand dollars and to imprisonment for six months.

In practice, the rules of the open season are difficult to enforce. The provision that females not be ensnared by nets set within 1000 yards from the high water mark or in any reef requires vigorous at-sea enforcement efforts to ensure compliance. Furthermore, while the sex of an adult male is confirmed by the presence of a tail extending 20 cm (8 inches) or more beyond the shell, one cannot assume that a turtle is a female simply because the tail is not elongated. Such a turtle may be a sexually immature male. Most turtles are harvested as juveniles and are taken from reef or other nearshore hard bottom habitat where, according to law, only males can legally be landed. To determine the sex of a juvenile, the turtle must be killed to examine the reproductive organs – an obvious flaw in the legislation.

There is a well-documented history of correspondence among relevant Government offices articulating concern over inadequacies in the legislative framework that protects sea turtles, and urging that the “Protection of Turtle and Turtle Eggs Regulations” under the Fisheries Act be amended to ban the capture, possession and sale of the whole or any part thereof of a sea turtle (see Appendix II). **Based on documented evidence of the continued slaughter of sea turtles, both legal and illegal (see section 3.3), throughout Trinidad and Tobago, and a documented history of consensus among relevant agencies that existing Turtle and Turtle Eggs Regulations are inadequate to achieve sustainable use of the sea turtle resource, it is a recommendation of this Recovery Action Plan that the Regulations be amended to embrace a national moratorium until such time as data exist to support a coherent, science-based evaluation of a sustainable and governable level of exploitation that will not result in further population declines** (for more detail, see also section 4.213).

An additional benefit of a moratorium would be to eliminate any residual illegal trafficking in sea turtle products, and tortoiseshell trinkets in particular. Hawksbill turtles killed during the open season provide the raw material for jewelry and other ornaments fashioned from the animal’s shell. While there is “no evidence of significant international trade in marine turtle products involving Trinidad and Tobago in the past decade” (Bräutigam and Eckert, 2006), these items continue to be marketed informally to tourists (see section 4.311). Such sale is in contravention of CITES provisions (since tourists subsequently leave the country) and, when sold during the closed season, is a violation of national law.

The Conservation of Wild Life Act (Act 16 of 1958, amended by 14 of 1963), Chapter 67:01 of the Laws of Trinidad and Tobago, is a potentially powerful tool in offering sea turtles, their nests and young protection against wounding and killing, as well as acts of harassment at sea or on nesting beaches. The Act provides, among other things, for Game Sanctuaries, a Wild Life Conservation Committee, Game Wardens and Honorary Game Wardens, and penalties and fees for convicted offences. “Protected animal” is defined as any animal not specified or mentioned in the Second or Third Schedules to the Act. As sea turtles are not so mentioned, they were for many years considered by the Wildlife Section-Forestry Division to be protected *de facto* under this law and could not be hunted without a licence from the Chief Game Warden. This approach was successfully challenged in Court in 2004, based on the lack of specificity with regard to sea turtles and the issue of jurisdiction, and the open season (under the Fisheries Act) reportedly upheld.

Regulations passed in 1994 require shrimp vessels to use turtle excluder devices (TEDs) in their nets. The Fisheries (Conservation of Marine Turtles) Regulations, enacted under the authority of the Fisheries Act (Chapter 67:51 of the Laws of Trinidad and Tobago), “apply to all commercial trawlers that are registered in the Republic or that are permitted to fish in the territorial waters of the Republic” and stipulate that “every commercial shrimp trawler shall be fitted with a turtle excluder device by April 30, 1994 and such device shall be of the type and specifications authorised by the Minister”. The law was enacted in response to a U. S. law requiring that countries seeking to export shrimp into the U. S. take steps to ensure that shared stocks of endangered sea turtles are not adversely affected by shrimp trawling (see section 4.23 and Appendix I for details).

Noteworthy is the fact that institutional arrangements for the management of forestry and wildlife resources are currently being addressed, and in this regard it has been proposed that the Forestry Division be replaced by a Forestry and Protected Area Management Authority. The Authority will also assume the roles played by other government agencies (e.g., Chaguaramas Development Authority; Fisheries Division, Ministry of Agriculture, Land and Marine Resources) involved in the management of protected areas (GOTT, 2010; see also section 4.12).

4.212 Evaluate the effectiveness of law enforcement

The Fisheries Act of 1916 (Chapter 67:51) states that, “5. It is the duty of the Fisheries Officer and any person authorised in writing by him so to do, subject to any general or special directions given by the Minister, to carry out the provisions of this Act.” The Conservation of Wild Life Act of 1958 (Chapter 67:01; Section 23.(1)) authorises Game Wardens as enforcement officials. Largely because of ambiguity in existing legislation (see section 4.211), and limited numbers of Game Wardens (fewer than 20 for both islands), law enforcement has a weak profile. Other causal factors include insufficient material (vehicles, fuel) and human (staff time) resources within regulatory agencies and the well known challenges incumbent in enforcing rules and regulations in small communities where men are called upon to confront or arrest brothers and cousins. Finally, the widespread perception that the enforcement of wildlife law is not meaningful – or even necessary – hinders enforcement activity, and can even serve to shame those who would be its advocates.

It is a recommendation of this Recovery Action Plan that all law enforcement agents, including Fisheries Officers, Game Wardens, Constables and others, be empowered with jurisdiction to enforce sea turtle protection regulations promulgated under the authority of the Fisheries Act, the Conservation of Wild Life Act, and/or the Forests Act. To achieve this goal, the Government must allocate the necessary resources to regulatory agencies to fulfill their law enforcement duties. Finally, the Government should take every opportunity to sensitise the range of its enforcement officers (and the public) to the importance of compliance with environmental regulations. To date there have been few arrests for violations of sea turtle conservation legislation and, until 1995, no jail time had been served.

Attempts by the Forestry Division to precept all Game Wardens and Forest Officers involved in enforcement with powers to enforce all environmental laws of Trinidad and Tobago has met with success and to date there are over 40 such Officers; moreover, by the end of 2005, 180 Honourary Game Wardens, their mandate rooted in the Wild Life Act, were available to participate in nesting beach surveillance. The term of office of the Honourary Game Wardens ended in 2008, and since then there have been no reappointments. A concerted effort should be made at the highest levels of Government, including the Magistrate offices, to visibly inspire and reward the active enforcement of wildlife law to the benefit of the national interest.

In May 1985, six persons, including a driver, were charged with possession of five bags of turtle meat, taken from Matura via Vega de Oropouche; the defendants were released after repeated “bungling” of the case by attorneys (James, 1987). In 1989, the Wildlife Section was alerted by the Coast Guard (in collaboration with the IMA) that an adult hawksbill turtle which had had its foreflippers amputated was being used to attract fishes at La Tinta, Chacachacare. The offenders were apprehended and one defendant was fined TT\$2,000 under provisions of the Conservation of Wild Life Act (Chap. 67:01). In 1992, five persons were arrested and three were charged, again under provisions of the Conservation of Wild Life Act, in Sangre Grande for transporting turtle meat from Fishing Pond; each was fined TT\$1,000. Local community members were instrumental in the apprehension of the offenders. In 1993, Police Officers observed stealing eggs from Matura Beach were, as a result of active lobbying by the Wildlife Section and Matura community, subsequently investigated and transferred to another area.

In November 1995, a poacher was apprehended in the act of removing an egg-bearing female from her nesting site in Matura. Members of the Nature Seekers wrestled with the offender and took possession of the badly injured animal, transporting the animal directly to the Matura Police Station. A complaint was filed, the suspect was apprehended, and, due largely to fines imposed by unrelated drug charges that the suspect was unable to pay, he was incarcerated. In 2005, six community poachers were caught stealing eggs on Rincon bay Matura. Through discussion with the Forestry Division and the Matura police, Nature Seekers received permission to provide the men with a community service requirement which mandated their participation in nesting beach patrols, giving them a chance to learn the importance of conserving the species. The Matura community and local authorities were commended for their quick response to this act of violence.

In July, 1998 a poacher at Manzanilla was apprehended and fined TT\$2,000 under the Fisheries Act for being in possession of approximately 300 kg of leatherback turtle meat in the closed season. In 2004, two fishermen were charged for possession of green turtles but the matter was dismissed because it was ruled that the charge should have been laid under the Fisheries Act for hunting in the closed season. In 2005, six persons were apprehended and severely reprimanded for entering the Matura Beach Prohibited Area without a permit (which carries a fine under the Forests Act of TT\$20,000) and also for poaching eggs. In response, the Sergeant from the local Police Station mandated that every Saturday and Sunday for the rest of the season (from 21 May onward), the men had to join Nature Seekers on the beach and participate in weighing nesting females; all the men complied. In 2008, one person was apprehended and charged by Forest Officer David Boodoo for slaughtering a leatherback turtle on Manzanilla beach; the matter was concluded in March 2010, when the defendant was discharged by the Magistrate based on submissions made by his Attorney.

The last sea turtle related case on record for Tobago dates back to 2001 when 3 men were charged TT\$1,000 each for possession of turtle eggs under the Fisheries Act. Their arrest on Minister Bay (Bacolet) came as a result of a stake out by DNRE staff acting on a report made by SOS and villagers of a poaching incident on the beach. The turtle had just been bludgeoned to death when some people walking their dogs scared off the original poacher. The three men had nothing to do with the actual kill but on hearing of the incident, stopped off at the isolated beach on their way to work to get what they could from the relatively fresh and completely intact carcass at which point they were apprehended. There have been no further arrests since then, largely due to the fact that the perpetrators must be caught in the act or with meat on their person. Most poachers run off when confronted and most meat is gone by the time a house search is initiated, in which case a verbal warning is all that is legally possible.

It was well known by all persons, throughout the Republic, who were interviewed during the development of this Recovery Action Plan that turtles are routinely harvested with impunity both on the nesting beach (where they are protected year-round) and at sea during the seven month closed season. Until arrest and incarceration are the assured result of illegal behaviour, it will continue unabated. The situation is particularly unpalatable in Tobago where illegal meats, including meat from egg-bearing leatherbacks, hawksbills and greens killed whilst nesting, are unabashedly served at Harvest Festivals and Fishermans Fetes during the closed season (see section 3.3).

4.213 Propose new regulations where needed

In accordance with the FAO Code of Conduct for Responsible Fisheries (FAO, 1995) which states that “the right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources”, sea turtle management in Trinidad and Tobago should seek to maintain the availability of the resource “in sufficient quantities for present and future generations in the context of food security, poverty alleviation and sustainable development”. Management measures should, therefore, seek to prevent over-fishing, rehabilitate depleted populations, incorporate the best scientific evidence, assign priority to research and data collection (including at international scales), and promote environmentally safe fishing gear and practices in order to protect both the target resource and the ecosystems upon which it depends.

Among the fundamental components of any regime aimed at management of wild populations are: restrictions on exploitation that are consistent with the species’ biological requirements; a monitoring programme—systematic, sustained, and rigorous collection and review of data—either on the specifics of exploitation or of wild populations so as to discern trends that can inform management; mechanisms to identify, monitor and address other threats to the species being exploited, so that these threats can be factored with exploitation to assess what level of overall mortality the species might sustain; and a high level of compliance (sometimes achievable only through vigorous enforcement) with the restrictions put in place to ensure that management goals are achieved.

It is clear that the 1975 Protection of Turtle and Turtle Eggs Regulations (see section 4.211) do not adequately respond to the need to protect sea turtles, which are classified as Endangered by several international treaties to which Trinidad and Tobago is a Party (see section 4.3), and fail to achieve management that is consistent with the principles and practice of sustainable use. **It must, therefore, be a recommendation of this Recovery Action Plan that sea turtle regulations promulgated in 1975 under the authority of the Fisheries Act be amended to reflect the spirit and letter of the earlier Conservation of Wild Life Act, and that a moratorium be implemented on the capture and sale of all sea turtles (including their eggs and products) – the moratorium need not be permanent, but logic dictates that it remain in force until such time as there is sufficient information to show that a regulated fishery will not lead to further population decline.**

Legislating a moratorium on the take of sea turtles is not a new recommendation. For nearly a quarter-century (starting with a May 1987 memo, FW:4/9/3, from the Head of the Wildlife Section-Forestry Division to the Ag. Conservator of Forests), Government officers of various Ministries have been urging regulatory reform on behalf of sea turtles (see Appendix II). To solicit contemporary public input on this subject, the Fisheries Division recently convened two Stakeholder Consultations to discuss sea turtle conservation and harmonization of the legislation. The first Consultation was held on 13 January 2005 at the Toco Regional Complex in collaboration with the IMA and Forestry Division-Wild-

life Section, and invited stakeholders from North East Trinidad. The Consultation noted and agreed to the following points (Nerissa Nagassar, Fisheries Division, *in litt.* 17 November 2010):

- Fisherfolk attending the meeting were opposed to a ban on the capture of sea turtles, although the majority had no problem with a moratorium on the capture of leatherback turtles;
- There was general consensus that fisherfolk needed help (assistance with bait/gear, skills training, alternative income options) in supporting their families during periods of low catches;
- There was support for the provision of financial assistance or subsidies granted to assist fisherfolk in the transition to new gear types and/or more readily available bait; and
- Alternative employment options should be developed for fisherfolk willing to leave the industry.

A second Consultation was held at the Botanic Station in Tobago on 20 January 2005, and again involved the Fisheries Division in collaboration with other government agencies (DMRF, THA, EMA, IMA). Stakeholders from Tobago were invited to discuss the issues, and there was heated debate with stakeholders expressing divergent views on the idea of a ban on sea turtle capture. Many fisherfolk indicated that their livelihood depended on the sale of sea turtles and opposed a ban, while others indicated that size limits and quotas should be adopted – no agreement could be reached on a way forward.

With this input in mind, the authors suggest following the recommendations of Bräutigam and Eckert (2006), who characterized sea turtle exploitation as “essentially unregulated” (e.g., there has been no monitoring of the legal fishery to record its landings and other parameters or to assess trends in these and their implications for management) in Trinidad and Tobago, and concluded that both existing legislation and enforcement of that legislation were inadequate to ensure the survival of the resource. They urged that immediate action be taken, and that if a full moratorium was not immediately practicable, intermediate steps, short of a moratorium, could be taken that would represent an improvement over the current situation. These steps are as follows:

First, undertake a comprehensive frame survey to assess the extent and economic importance of sea turtle exploitation at the national level (see also section 4.22). The survey should aim to quantify and characterize exploitation and use, including the landing of turtles at sea and hunting on nesting beaches; the numbers and types of fishers (and gears) involved, including the extent to which sea turtle landings result from incidental or opportunistic take in other fishing operations or from a targeted fishery; exchange, processing, and marketing patterns of turtles and turtle products; and the importance to livelihoods of the products and income derived from sea turtle exploitation. This investigation should also aim to establish the nature and extent of illegal exploitation and trade of sea turtles, eggs, and products, and the extent to which they may negatively impact sea turtle populations and compromise management and conservation measures.

Second, if any legal exploitation is to continue, restrictions should reflect biological parameters (e.g., delayed maturity and depleted status) and aim, at a minimum, to prevent further population declines. Any exploitation regimen promoting population recovery and maintenance should be established and conducted according to sound management principles and practice, which should include the following:

- 1) Bringing exploitation in line with biological principles, including:
 - complete protection of nesting females, their eggs and young at all times;
 - complete protection of all species during the primary nesting season, 1 February to 30 November;

- complete protection of leatherback turtles², which occur in the country only as reproductively active adults, including egg-bearing females;
- maximum size limits³, based on length (which is easier to undertake in the field) rather than weight, so as to safeguard large juveniles and adults;
- a conservative numerical limit on the numbers of animals that may be exploited on an annual basis, with such a limit necessarily based on a quantitatively robust harvest model such as a model designed to achieve Maximum Sustainable Yield (MSY) and implemented through a licensed quota;
- a requirement that such capture limits be based, if not on a stock assessment, on accurate data derived from national processes and research activities, and that, as far as practicable, these data should be collected in such a way as to be compatible with the goal of assessing stocks throughout their full geographic ranges.

2) Managing the legal fishery through an enforceable, high-compliance monitoring programme aimed at establishing trends and monitoring these over time. A national program to monitor sea turtle exploitation should document comprehensively and systematically, and in a manner allowing such records to be analysed and compared over time, the following:

- number of fishers taking marine turtles and by what means;
- number, size and species distribution of the marine turtles landed;
- localities where turtles were taken;
- catch-per-unit-effort (CPUE); and
- disposition of turtles landed, including value of the animal or products if sold or traded.

In further support of reliable monitoring of the fishery, it should be required by law that ownership identification tags be installed on approved gear; that turtles be landed alive and intact, prohibiting, for example, the use of spear guns and extended net sets that can result in drowning and providing for reliable recording and verification of turtle landings; and that the licensing process (open only to bona fide sea turtle fishers, as determined by the frame survey described above) include as a criterion full participation in the monitoring programme (Bräutigam and Eckert, 2006). Plater (2010) recommended that a Prohibited Area be designated offshore major nesting beaches wherein gillnet fishing would be banned.

² To the casual reader who might wonder how the locally abundant leatherback sea turtle should be classified as “critically endangered” at a global scale (see p.30) and in need of protection in Trinidad and Tobago, it is important to remember that until recently, the Pacific coast of Mexico supported an estimated one-half of all nesting females (Pritchard, 1982) – but mortality to adult females as fisheries bycatch (Eckert and Sarti, 1997) caused that population to decline at a rate of more than 20% per year during most of the 1990s before collapsing entirely (Sarti et al., 1996). The loss of this once large colony is an unsettling lesson for our country, given the level of bycatch documented off Trinidad’s nesting beaches (Eckert and Eckert, 2005; Lee Lum, 2006). Documented population declines in Tobago and the apparent extermination of some of our smaller nesting colonies lends further impetus to the call for full protection. There is no cultural or management necessity for harvesting the egg-bearing females of this species.

³ To meet this criterion and extend the closed season to include the primary nesting season, revised “Protection of Turtle and Turtle Eggs Regulations” should read: 2. No person shall -- (a) disturb, remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any turtle eggs; (b) interfere with any turtle nest, or turtle that is nesting; (c) remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any over-sized turtle; (d) fish for, remove from the fishery waters, or at any time have in his possession, expose for sale, sell, or purchase any turtle between 1st February and 30th November. In this Regulation, “turtle” includes the whole or any part of any turtle; “over-sized” means a curved carapace length of more than 30 cm for Olive Ridley Turtles (*Lepidochelys olivacea*), 40 cm for Hawksbill Turtles (*Eretmochelys imbricata*), and 60 cm for Green (*Chelonia mydas*) and Loggerhead (*Caretta caretta*) turtles. Offenders are liable on summary conviction to a fine of two thousand dollars and to imprisonment for six months. Plater (2010) made similar recommendations to Government based on a comprehensive legislative review.

4.214 Augment existing law enforcement efforts

Recognising that environmental law is becoming increasingly important and increasingly technical in Trinidad and Tobago, as is the case throughout the Caribbean region, it is a recommendation of this Recovery Action Plan that the Environmental Police Section created under the EMA be expanded. A minimum of 20 more officers in Trinidad and 5 more in Tobago should be hired to oversee compliance with environmental legislation. Existing officers have been trained in environmental law and enforcement procedures and are responsible for regulations concerning mainly pollution. However, more emphasis is necessary for training on regulations concerning mining and minerals, 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 of Public Utilities and the Environment Police authorities, Customs and 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 has been developed by the EMA and this should be made available for public distribution.

Clear and public support from senior Government officials (including the judiciary) is a prerequisite for effective law enforcement. The role of the Environmental Commission is crucial for the effective enforcement of all environmental laws, and this would foster a greater sense of confidence among arresting officers that offenders would be prosecuted. The media and NGOs also 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 illegal catches, and exert peer pressure to prevent violations. The owners of residential and commercial beachfront property should be enlisted to report turtles caught or eggs collected out of season, and to monitor nesting beaches for poaching and other disturbances.

4.215 Make fines commensurate with product value

Limited numbers of arrests have been made for the violation of conservation laws; fines and other penalties are characteristically low. A precedent is needed for stiffer penalties. Persons convicted of violating provisions of the Fisheries Act (Chapter 67:51), including sea turtle protection regulations, are liable on summary conviction to a fine of TT\$2,000 [ca. US\$340] and to imprisonment for six months. Persons convicted of violating provisions of the Conservation of Wild Life Act (Chapter 67:01), are liable to a fine of TT\$1,000 and imprisonment of three months (see section 4.211 of this Recovery Action Plan). **In keeping with a clear consensus conveyed by regulatory agency staff and enforcement officials, it is a recommendation of this Recovery Action Plan that penalties be stiffened to include higher monetary fines and the confiscation of any equipment used in the offence.** Logically, penalty fines should be considerably higher than the income generated from sale of turtle products and should be sufficiently high to act as a stern deterrent to potential offenders. This has been a standing recommendation to the Government for more than two decades (see Bacon, 1973a).

4.22 Investigate alternative livelihoods for turtle fishermen

An effective management plan cannot be put forth on behalf of a commercially exploited species without a study of the economic value of the product to the resource users (the turtle fishermen), the

purveyors, and the consumers. Before alternatives to the turtle fishery can be evaluated, it is necessary to know how many fishermen, beach hunters and artisans are involved, and what proportion of their livelihood is at stake. Some east coast residents interviewed for this Recovery Action Plan described the number of turtle fishermen as “plenty, plenty”, but in an early national survey of fishing depots, Chu Cheong (1984) concluded that only 12 fishermen were involved and described the fishery as declining. The truth is, the number of men involved is unknown, as is the size of the catch (which easily exceeds several hundred turtles per year) and its total market value.

There is consensus that no one depends on sea turtles for their primary livelihood, although the income derived may be seasonally important. Bacon and Maliphant (1971) wrote, “The effect that a ban on killing turtles would have is difficult to estimate in the absence of reliable fisheries statistics stating total catch and the profits realised by the fishermen. ... The sale of meat, eggs and shell supplement the incomes of many fishermen for short periods of the year, but at such times ordinary fishing may be neglected with loss of income from this source.” Nearly 40 years later, the same could be said.

In order to collect baseline data, it is a recommendation of this Recovery Action Plan that the Fisheries Division lead 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 seasonally active in the turtle fishery, (2) number of turtles caught per year, (3) species and size classes caught, (4) capture methods and gear in possession, (5) gear used and frequency of use, (6) cost of gear, (7) capture/landing sites, (8) catch per unit effort, (9) market price for turtle meat and products, (10) income and proportion of total income derived from turtles. Incidental catch is an important source of stress and mortality and should be quantified, as well (section 4.111 and 4.23).

A Sea Turtle Fishery Frame Survey will provide an opportunity for Fisheries extension personnel to talk with fishermen about the endangered status of sea turtles, emphasise the importance of a region-wide moratorium on these migratory species, and solicit comments and other input. If possible, historical trends in catch per unit effort should be evaluated (do hunters have to travel further today than they did 20 years ago to obtain turtles, or set their nets or wait on a nesting beach for longer periods of time?). The following points should be communicated to fishermen:

- Sea turtles are long-lived; most do not reach sexual maturity before 20-35+ years of age.
- Mortality is high in young juvenile stages, but low (under natural conditions) for the adult stage.
- Adult females average approximately five clutches of eggs per year and nest every 2-5 years; under natural conditions females live a long time and lay thousands of eggs in order to maintain stable populations.
- Large turtles have historically been targeted because they provide the most meat (Fisheries law usually protects small turtles), and egg-bearing females are taken in disproportionate numbers because they are easily obtained from the nesting beach.
- Harvesting large turtles, especially egg-bearing females, contributes strongly to population collapse – this has been observed at rookeries throughout the world and is easily shown mathematically.
- Nesting populations have been reduced or exterminated throughout the Caribbean Sea, including in Trinidad and Tobago, because adults are not surviving long enough to produce the next generation. The widespread take of eggs worsens the problem.
- The rising or falling trends of nesting (adults on land) and feeding (primarily juveniles at sea) populations are not necessarily related, since the adults and juveniles are often drawn from separate stocks of origin.

- Juveniles travel widely during the many years prior to maturity. During this time they will feed in the waters of many nations, staying at each location for varying periods of time. Upon reaching adult-hood they will return (sometimes traveling thousands of kilometers) to their birth beach to lay eggs. Thus local juveniles are not residents, but rather they represent a shared regional resource to be jointly managed (at a regional level) with care and foresight.
- Adult females return to Trinidad and Tobago at regular intervals to lay their eggs and then leave at the end of the nesting season to return to preferred feeding areas in other countries.
- Turtles play an important role in the ecological balance of the oceans, including in food chains (e.g., leatherbacks eat poisonous jellyfish; hawksbills help maintain species diversity in reefs).
- All nations must work together if this shared resource is to survive.

With Frame Survey data in hand, it is a recommendation of this Recovery Action Plan that credible scenarios for enhancing alternative sources of income be developed and implemented. Continuing the *status quo* is not an option. A moratorium on sea turtle hunting must be realised for the survival of this resource, and must remain in force until such time as there is sufficient information to show that a regulated harvest will not result in population decline (see section 4.213). Neither is it an option not to consider the effect(s) of such a regulatory move on stakeholders. If, for example, net fishing is to be disallowed in the inter-nesting habitat, then provision for bait fishing, line fishing, and/or other acceptable alternatives must be ensured (see also section 4.23).

4.23 Evaluate incidental catch and minimise sea turtle mortality

Sea turtles must surface to breathe. If they are forcibly submerged in a net, they will eventually drown. The incidental capture of sea turtles in active and abandoned fishing gear throughout the world is a serious threat to their survival (e.g., NRC, 1990; Lewison et al., 2004). In Trinidad, the incidental capture of leatherback turtles in *fillette*, or gill, nets during the period of March to July each year is the largest single source of mortality to this species in the country, killing more turtles than all other factors combined (Eckert and Eckert, 2005). In the paragraphs that follow, incidental capture in gill nets, as well as in shrimp trawls, is discussed in more detail. Recommendations are offered.

Gill nets: Chu Cheong (1984) reported to the Western Atlantic Turtle Symposium (held in Costa Rica in 1984) that leatherbacks were captured incidentally in gill nets. Subsequently, Bro. Robert Fanovich F.P.M. wrote, “Fishermen at Matelot have said that at least 15 leatherback turtles were drowned in nets [in 1989, as of 20 July], and this is only one fishing village” (*in litt.* to the Wildlife Section, July 1989). At Grande Riviere, a single net may stretch from one side of the bay to the other; one end remains attached to the boat. Smaller gill nets are sometimes set seven at a time. Interviews with fishermen between Carenage and Blanchisseuse (north coast, Trinidad) during April and May 1992, revealed that as many as 10 adult leatherbacks were being captured per 200 ft (61.5m) of net in gillnetting efforts between Paria Bay and Madamas Bay (Wildlife Section, unpubl. data).

Prior to 2005, when a national consultation resulted in action recommendations (Eckert and Eckert, 2005), all available data suggested that incidental catch was on the rise. Wildlife Section personnel received more reports of incidental capture in 1994-1995 than ever before, with fishermen from Grande Riviere and Matelot reporting as many as nine leatherbacks per haul. Nine decomposing leatherbacks washed ashore dead at Matura Bay beach from April-July 1995, more than in any previous year. These mostly had flippers amputated. Dr. S. Eckert deployed three satellite transmitters on leatherbacks nesting at Matura Beach in 1995. Within a week, one had been entangled in a gill net off Galera Point. The fisherman made every attempt to free the turtle, which was obviously a research

animal, and it survived. Often, however, the turtles are dismembered in order to safely retrieve the net. If the probability of capture in the inter-nesting range is anywhere close to 1-in-3, the extinction of the leatherback turtle in Trinidad and Tobago is virtually assured.

In an attempt to redress this serious problem, the UNDP Global Environment Facility – Small Grants Programme (GEF/SGP) in Trinidad provided a grant to GREAT in 1995 to initiate a project with fishermen in Matelot, adjacent to Grande Riviere on the north coast of Trinidad, in which the fishermen were encouraged to cut their nets to release ensnared sea turtles, particularly leatherbacks. In return for cutting their nets to free the turtles, CBOs provided the fishermen with portions of new net material to replace cut sections of their nets. Between February and August 1995, 139 leatherbacks were caught and released by seven fishermen participating in this programme. In an unspecified number of cases, the turtles were dead when the net was hauled or they were so thoroughly entangled that they had to be killed.

In March 1996, fisherman K. Moore reported to the Nature Seekers that 10 leatherbacks had “just been captured” in a single gill net at Balandra; it was not clear from the report, but it appeared that all had died (S. Lakhan, pers. comm., 1995). Two net-caught leatherback turtles washed ashore at Matura during the 1996 nesting season (S. Aguillera, pers. comm.) Five Matura leatherbacks were equipped with VHF radio transmitters early in the 1996 nesting season; in all cases, the signals disappeared abruptly in offshore waters within a few weeks. Equipment failure is unlikely, since the turtles would have returned (after a 10-day inter-nesting interval) with the expired transmitters. While death due to entanglement may not have been the fate suffered by all, it is certainly one possibility (Eckert, 1997b).

In interviews conducted for this Recovery Action Plan, personnel at the Balandra Bay fishing depot reported that 200 leatherbacks were captured in the Balandra Bay area each year (‘Kelly’ pers. comm. to M. Thiele, June 1997). Fishermen operating out of the Salybia Fishing Depot reported that three leatherbacks were caught in their nets each day (pers. comm. to M. Amos, June 1997), for a total of 450 turtles during peak nesting season (March to July). During interviews conducted in 1998, fishermen from Manzanilla (3 boats) reported catching one leatherback per day (5 days each week) from January to April, with an estimated 50% mortality. In Mayaro, where 50 boats operate (25 based in Mayaro, 25 out of other ports), each boat reportedly caught five leatherbacks between January and April; mortality was reported to exceed 95% due to an illegal black market sale of leatherback meat. Eckert and Lien (1999) offered management recommendations based on these and other interviews, and summarized current literature. A follow-up study conducted by IMA confirmed the general conclusions of Eckert and Lien (1999), but estimated that more than 3,000 leatherbacks had been captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000 and that more than half likely died as a result of such an encounter (Lee Lum, 2003).

Compensation for damaged nets is not an acceptable long term solution for the fisher (who must contend with the dangerous activity of releasing a flailing 250-450 kg turtle and most likely lose his catch in the process) or for the turtle, which is highly stressed during the encounter. The real answer must lie in mechanisms that encourage the fishermen to fish elsewhere (i.e., time and/or area closures), or to fish with gear that is shown to retain target species while minimising bycatch. For any solution to be effective, it must be tested by and embraced by fisher communities. Fisher led trials to date have shown promising results in reducing bycatch (Gearhart and Eckert, 2007) and are ongoing. **It is a recommendation of this Recovery Action Plan that Government develop and adopt policies that restrict the use of fishing techniques that demonstrate high levels of bycatch, and promote viable alternatives that both minimise bycatch and protect fisher livelihoods (e.g., that retain or increase target catches).**

Other sea turtle species besides the leatherback are also caught accidentally in fishing gear. One shark fisherman operating in Manzanilla Bay (which marks the southern boundary of the Fishing Pond Prohibited Area) reports catching hawksbill turtles in his 10 cm mesh shark gillnets “regularly”, with up to “several” per haul in 1995 (pers. comm. to K. Fournillier, 1995). In November 1995, four hard-shelled turtles were found in a gill net in Matura Bay; one drowned and one green and two hawksbills) were released. The extent of the problem is unquantified, but every fisherman interviewed for this Recovery Action Plan was aware of the incidental drowning of sea turtles in gill nets, and many reported that several turtles were routinely captured at one time. Many of them die before the nets are hauled.

Foreign fishermen are also involved and, according to north coast CBOs, “incidental catch is often on purpose.” For example, Venezuelan longliners and trawlers often come close to north coast nesting beaches, such as Grande Riviere, during the nesting season. They arrive in the evening and stay a couple of days before moving on. In 1995, Grande Riviere residents witnessed one such vessel stationed about 300 m from shore, with its occupants butchering two sea turtles (S. Ruiz, pers. comm., 1995). The most recent sighting of trawlers in the area was in 2008 (L. Peters, pers. comm., 2010).

Shrimp trawls: The capture of sea turtles by trawlers plying the waters of Trinidad and Tobago has been documented for more than two decades. For example, Pritchard (1984) states that “a fair proportion” of olive ridleys tagged while nesting in Suriname in the late 1960s and early 1970s were subsequently ensnared by trawls “in Trinidad and western Venezuela.” While the full extent of this mortality will never be known, the well-documented collapse of the olive ridley nesting colony in Suriname (once the largest in the Western Atlantic) is attributed to unsustainable levels of adult mortality incidental to trawling by the nations of northeastern South America (Reichart, 1989, 1993; Reichart and Fretey, 1993).

In 1989, legislation passed in the United States Congress to “ban the importation of shrimp or products from shrimp . . . [unless] (a) the government of the harvesting nation has provided documentary evidence of the adoption of a regulatory programme governing the incidental taking of sea turtles in the course of such harvesting that is comparable to that of the United States, (b) the average rate of that incidental taking by the vessels of the harvesting nation is comparable to the average rate of incidental taking of sea turtles by United States vessels in the course of such harvesting, or (c) the particular fishing environment of the harvesting nation does not pose a threat of the incidental taking of sea turtles in the course of such harvesting” (see Appendix I). Trinidad and Tobago, being an exporter of shrimp to the U.S., was directly affected by this legislation. In an attempt to meet the requirements of the new law, the Government promulgated Regulations specifying where demersal trawling could take place (The Fisheries [Control of Demersal (Bottom) Trawling Activities] Regulations, 1994) and requiring shrimp vessels to use turtle excluder devices (TEDs). The Fisheries (Conservation of Marine Turtles) Regulations, enacted in 1994 under the authority of the Fisheries Act (Chapter 67:51 of the Laws of Trinidad and Tobago), “apply to all commercial trawlers that are registered in the Republic or that are permitted to fish in the territorial waters of the Republic” and stipulate that “every commercial shrimp trawler shall be fitted with a turtle excluder device by April 30, 1994 and such device shall be of the type and specifications authorised by the Minister.”

The Fisheries (Conservation of Marine Turtles) Regulations further specify that, “5. (1) Where a person using a commercial shrimp trawler accidentally captures live marine turtles during fishing operations, the person shall immediately return such turtles to the sea. (2) Where such a person accidentally captures live marine turtles that appear to be in a comatose state, the person shall resuscitate or cause them to be resuscitated in accordance with procedures authorised by the Minister.” The Regulations instruct owners of commercial shrimp trawlers to participate in all national and international marine turtle

conservation practices specified by the Minister, and to permit the Fisheries Officer (or other authorised person) to inspect the trawler “with a view to collecting and submitting data on the fisheries activities involving marine turtles.” Penalties for violations include a fine of TT\$2,000 [ca. US\$340] and imprisonment for six months. Trinidad licenses between 25-33 Class III and IV trawlers to operate in national waters; these trawler classes are required under present legislation to use TEDs (Fisheries Division, 1994). Compliance is mandatory to retain the U.S. market for Trinidad’s shrimp products.

Prior to promulgation of the 1994 Regulations, shrimp bound for the U.S. were embargoed in 1992 when the U.S. ruled that data were insufficient to confirm that sea turtles would not be caught in local shrimp trawls. To regain the export market, Government had to demonstrate that 30% of the trawling fleet was consistently and properly equipped with TEDs (which allow sea turtles – but not shrimp – to escape the trawl). To assist in meeting this mandate, the Ministry of Agriculture, Land and Marine Resources sent a representative to the U.S. for training in April 1993. Despite these efforts, the fleet was not adequately prepared to meet the 1 May 1993 deadline, and shrimp were once again banned from export to the U.S. market. The situation was soon rectified, however, and certification was granted 13 May 1993.

To assist the Fisheries Division in enforcing TED regulations, eight Wildlife Section officers and 20 Coast Guard officers were authorised, pursuant to Section 5 of the Fisheries Act (Chap. 67:51) to “carry out the provisions of this Act as well as the following regulations made under Section 4 of said Act”. These regulations include (i) Protection of Turtle and Turtle Eggs Regulations, 1975; (ii) Fisheries (Control of Dermal [Bottom] Trawling Activities) Regulations, 1994; and (iii) Fisheries (Conservation of Marine Turtle) Regulations, 1994. The programme advanced fitfully, and shrimp were embargoed again from 1 May to 2 August 1995. TED compliance dwindled with the lifting of the ban; in response, the Fisheries Division scheduled community level workshops with trawlers for the purpose of answering technical questions, providing gear information, demonstrating TED use, and emphasising the importance of keeping the U.S. market open to Trinidad exports. This extension effort temporarily resulted in higher, but not perfect levels of compliance with the 1994 Regulations, as evidenced by a renewed embargo from May 1999 to May 2001, at which point the country regained its certification until losing it again in December 2004. Due to ongoing compliance issues, the embargo continues to the present day (John Mitchell, NOAA, *in litt.* 8 December 2010).

It is a recommendation of this Recovery Action Plan that workshops and other extension activities continue as a priority, that compliance be regularly monitored (such as by vessel boardings), and that fines, equipment confiscation, and other appropriate penalties consistent with the law be levied. As part of its commitment to retaining access to the U. S. shrimp market, the Government has pledged to “introduce legislation to prevent the harvesting of sea turtles and sea turtle eggs throughout the year, and introduce public awareness and education programmes to promote sea turtle conservation” (GOTT, 1994), a move fully endorsed by this Recovery Action Plan.

4.24 Supplement reduced populations using management techniques

Management intervention should always be targeted at a specific threat, and priority should be placed on data collection that serves a specific management objective. Different threats demand different responses; for example, one remedy will not address both the incidental capture of adults offshore (which demands fundamental changes in gear use and perhaps a redistribution of fishing effort) and the loss of eggs onshore. Moreover, different responses are called for depending on whether the eggs are lost to dogs or to seasonal erosion. The IUCN/SSC Marine Turtle Specialist Group (section 4.54) has published a field manual of sea turtle management techniques (Eckert et al., 1999).

4.241 Management techniques for turtles

The illegal slaughter of egg-bearing females on the nesting beach is a significant management challenge in Tobago, as well as at remote beaches in Trinidad. In addition, mortality of juveniles and adults through direct harvest (section 3.3) and incidental capture in non-selective fishing gear (section 4.23) occurs throughout the Republic.

To minimise the killing of egg-bearing females on their nesting beaches, habitat surveillance by CBOs or other locally-based programming (e.g., Honorary Game Wardens) can be more effective than formal law enforcement, especially since the latter is chronically incapacitated by under-staffing and a lack of transportation. Surveillance should be nocturnal, since nesting occurs at night, and focus, at least initially, on as many beaches as are practical and embrace the most important nesting sites on each island (see section 4.25 for a discussion of Index Beaches). Surveillance personnel should be adequately equipped to accomplish the task of deterrence: they should carry VHF radios, be trained in law enforcement protocol, and be visibly and consistently supported by formal law enforcement authorities. The community surveillance project should be well publicised and inaugurated with a sense of community spirit – a press conference, posters, flyers, and visible Ministerial support. **It is a recommendation of this Recovery Action Plan that Government place priority on supporting and strengthening established programmes, which can all use improvement, as well as expanding these models to other nesting grounds, especially in Tobago and at sites important to hawksbill nesting.**

If patrol and protection efforts are to be coupled with the tagging of nesting females, training and advice should be sought from experienced CBOs already proficient in these skills. With training and commitment, a long-term tagging programme can provide valuable management information about the reproductive output of females, nest site fidelity (including exchange between nesting grounds), and even details of post-nesting migration. Tagging is typically accomplished using a standard metal or plastic flipper tag and/or a small internal tag (Passive Integrated Transponder, or PIT tag) which requires field workers to carry an electronic “reader”. Tagging should be undertaken only where there is an underlying scientific justification; tagging is expensive and requires trained personnel, as well as a long term commitment to the effort (see Eckert and Beggs, 2006, for details). Nothing that is not already known can be learned from intermittent tagging. Moreover, tagging databases are complex and time consuming to maintain; computer literacy is essential for data archiving and retrieval.

While on the subject of tagging, it is useful to note that the “small hole in the trailing edge of one foreflipper” (Bacon, 1971b), which is sometimes seen on nesting leatherbacks, should not be confused with a tag scar (a mark left by a flipper tag that has fallen off). These odd scars, often perfectly round and well healed, have roused the curiosity of students of leatherback nesting ecology around the world for many years. They are recorded on turtles in populations that have never been tagged, as well as on turtles still carrying their tags in populations for which precise tagging histories have been kept. While small, open holes do on occasion represent tag loss, it is more common that a tag scar consist of a shallow, well healed ‘V’ notch at the point of tagging or an internal scar. The latter is seen by holding a flashlight flat against the fore flipper and shining the light through the flesh. This candling procedure reveals an internal keyhole-shaped scar which looks to be completely healed from all external appearances.

Management techniques to increase the survival of egg-bearing females need not be confined to the nesting beach. The Wildlife Section, with support from Amoco-Trinidad, now bpTT, BHP Petroleum and other sources, has sponsored offshore telemetry research on leatherback turtles nesting at Matura. Preliminary data (1995-1996) suggest an inter-nesting range with a radius of at least 50 km from the

nesting beach, and post-nesting destinations in the north central Atlantic and west Africa (Eckert, 1997a,b; Eckert, 2006). Continuing studies of this sort can illuminate crucially important management questions, especially those concerning the intersection of sea turtle distribution with subsistence and commercial fishing efforts. **Given the serious threat facing local sea turtle populations by incidental catch in fishing gear (section 4.23), it is a recommendation of this Recovery Action Plan that studies into the offshore behaviour, distribution, and movements of sea turtles continue.** Bycatch solutions should be based on the results of trials that involve fishers in defining acceptable alternatives.

4.242 Management techniques for eggs and hatchlings

It is a recommendation of this Recovery Action Plan that manipulative management techniques, such as the collection and reburial of eggs, be undertaken only after there is documented evidence of a threat serious enough to warrant such action. The advice of WIDECASST or another technical authority should be sought during the planning stages. Proposals submitted to the Government should be peer-reviewed by experts both inside and outside the Republic.

The following paragraphs have been designed to assist managers in deciding whether the collection and reburial of eggs threatened by predators or erosion is desirable and, if so, how to proceed. Eggs should always be collected as they are laid. Excavating nests after 12 hours or more have passed heightens the risk of dislodging the tiny embryo from the inner lining of the eggshell and killing it. In emergencies, such as when eggs are exposed by a storm surge or human activity, an attempt to salvage the mid-term clutch is prudent, despite the likelihood of a steep decline in hatch success. 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. Hatcheries should be constructed only as a last resort. Eggs should not be incubated in Styrofoam boxes or other artificial media which may bias the natural sex ratio of hatchlings. Hatchlings should never be retained as pets.

In situ relocation: The collection and reburial of eggs should never be undertaken lightly. Even when eggs are carefully collected at deposition, a decline in average hatch success for moved nests is expected. Nevertheless, in some cases this type of manipulation can substantially improve overall reproductive output by reducing large annual losses to beach erosion. So-called *in situ* relocation is preferred to an enclosed hatchery (see below). A programme of all-night patrol is requisite for this technique, since eggs laid in high risk zones should be gathered as they drop into the nest cavity. Eggs should be placed immediately in a clean bag, bucket or basket. Alternatively, a plastic bag can be positioned in the hole to receive the eggs. The bag or other container must be strong enough to reliably carry 12 kg. If a bag is placed in the hole, the opening should be clasped shut (to exclude falling sand) and the bag swiftly dug out from behind as soon as egg-laying is complete. Efforts should be made to minimise the amount of sand gathered with the eggs. Scoring of the eggshell during handling and transport can reduce hatch success. Be careful. Eggs are fragile.

When all the eggs have been collected and nest depth recorded, the eggs should be transported without delay to the relocation site (if transport occurs by vehicle, the egg bag/bucket should be secured and cushioned). Reburial should occur within 1-2 hours to minimise movement-induced injury to embryos, and the negative effects of changes in the temperature and moisture content of the eggs. To simplify project logistics, minimise transport trauma, and promote the perpetuation of the population at its chosen nesting beach, every effort should be made to translocate eggs elsewhere on the same nesting

beach. The new nest site should be well above the high tide line and should approximate the type of habitat chosen by the female; care should be taken not to locate the nest too near other nests. The eggs should be replaced carefully, not dropped. The nest should be covered by replacing the damp subsurface sand removed from the hole (do not place hot surface sand on the eggs) and gently but firmly tamping it in place in layers of 8-12 cm. Sifting dry sand over the site conceals the new nest's location.

Hatchery relocation: In contrast to *in situ* relocation, enclosed hatcheries are relatively ineffective when the threat is erosion or poaching. Since hatcheries concentrate all the eggs in one place, the risk of loss to erosion or poaching may actually increase. In the case of poaching, nocturnal beach surveillance (see section 4.241) and public awareness efforts are more effective than hatcheries. To discourage poaching, patrollers should disguise nesting crawls by smoothing them over with a broom, palm frond or rake. Enclosed hatcheries are also relatively ineffective against feral or unkept animals, such as pigs or dogs, which can dramatically reduce the reproductive success of a sea turtle population. Under these circumstances, the *first* priority should be to restrain or impound the offending animals. Enclosed hatcheries should be considered only as a last resort, and only if a suitable site can be found. Hatcheries are expensive to construct and maintain, they are likely to alter natural hatchling sex ratios, and average hatch success generally declines.

If after all other alternatives have been considered and discarded in favour of an enclosed hatchery, a flat site on the upper beach platform should be selected that mimics natural nest habitat (e.g., open beach for leatherbacks and green turtles, largely shaded for hawksbills). The site should be well drained. A high water table (such as close to an estuary) or a low-lying site susceptible to storm flooding will drown developing embryos. The enclosure should be solid and able to withstand strong winds and storms. Nests should be buried one metre apart from one another; thus, an enclosure 7 m x 12 m will accommodate 50 nests and allow room for hatchery personnel to move around. Animal fencing (5 cm x 10 cm mesh) should be secured at regular intervals by 10 cm x 10 cm posts. A perimeter wire (electrified with a battery-powered charger) will discourage dogs from lunging against the enclosure; fencing should be dug 0.5 m into the sand to prevent dogs from digging under the fence. The fencing should be at least 1.5 m wide so that after it is buried 0.5 m (or more) in the sand, it is a convenient height for beach patrollers to step over to bury eggs inside the enclosure. If theft by poachers is a threat, fencing must be adequate to exclude trespassers and a guard posted day and night.

The hatchery must be maintained so that wind-blown sand does not accumulate over incubating nests. Deepening the overburden alters incubation temperature and can make it impossible for the hatchlings to emerge. The site of the hatchery should be changed every year. If this is not done, hatch success will diminish due to destabilisation of the beach from repeated hole-digging, and an accumulation of bacteria and pathogens from decomposing nest contents (live hatchlings enter the sea, but egg shells, rotten eggs and dead hatchlings remain in the nest). Hatchlings must be released immediately upon emergence. Their scurrying about will frenzy predators, and if they are left until morning they will die in the heat of the sun. About two weeks prior to expected emergence (i.e., at about 40 days of incubation), it is convenient to place a small-mesh wire corral atop each nest to contain emerging hatchlings so they are not crawling all about. Alternatively, the hatchery might be constructed of large-mesh (12-15 cm) wire so that hatchlings can crawl through the enclosure and on to the beach.

It is worth repeating that constructing a hatchery is not an effective management technique for reducing egg losses to dogs. Hatcheries concentrate eggs in one place, offering an easy meal to any dog able to jump over or dig under the fence. Since dogs constitute such a serious threat to egg and hatchling survival at Grande Riviere (dogs consume "upwards of 40%" of eggs laid each year, see section 3.2), it is

a matter of urgency that a remedy be identified. The problem and potential solutions should be discussed openly with local authorities and constituents before a decision is made.

It is a recommendation of this Recovery Action Plan that dogs found roaming the nesting beach be collected and impounded, and the owners charged a fee for their release (including the license fine, when applicable). If the dog is unclaimed, standard procedures should be followed, such as remanding the dog to an animal shelter. In 1997, the TSPCA removed stray dogs from Great Courland Bay, Tobago, because they were persistent in disturbing turtle nests. Removal has continued on an annual basis, but has not successfully eliminated the problem. The Dogs Act (Chap. 67:54) provides for the impoundment of dogs found unattended in public areas, presumably including public beaches. Moreover, it is a violation of the Act to keep an unlicensed dog; offenders are subject to a fine of TT\$40. Regulations might be considered under Section 18 of the Act that speak directly to the threat of predatory dogs.

With regard to removing hatchlings from the beach that have emerged during the heat of the day, and retaining them for evening release, see section 4.252 for guidelines.

4.243 Sea turtle mariculture

Rearing experiments were conducted at IMA in 1981 and 1982. In 1981, five leatherback hatchlings were brought to IMA from Matura Beach. They were fed a variety of foods, including jellyfish, a chicken egg and squid mixture, and, to a lesser extent, chicken liver. The hatchlings adapted poorly to captivity, swimming constantly and refusing food for the first eight days. After two weeks a “grey fungus” developed on the carapace, shoulders and flippers. At 41 days the last of the turtles was dead. The following year, an attempt was made to rear three more hatchlings; all developed the fungus within three weeks, two were released after 53 days and the third died at 56 days of age. In 1981, three olive ridleys were raised at IMA facilities. They fed well on fish and shrimp, showing an 80% weight increase in the first four weeks. They were aggressive toward one another, especially during feeding, and this behaviour resulted in lesions that could not be successfully treated; the last one died at 202 days of age. The hawksbills showed the best survival rate. Two groups of 10 hatchlings each were observed; one from the first group lived 225 days and two from the second group were released after 454 days in captivity. Based on difficulties encountered in the rearing experiments, the study concluded that “declaring nesting beaches as national parks and reserves may be the best conservation approach” (Chu Cheong, 1995).

It is a recommendation of this Recovery Action Plan that mariculture (farming, ranching, head-starting) not be considered as a conservation or management option at this time. Mariculture projects are expensive, requiring elaborate facilities and trained husbandry and veterinary staff. “Head-starting” (raising turtles for about one year and then releasing them), in particular, serves no known conservation purpose. Tank rearing can result in poor physiological and muscular development, and captive juveniles are prevented from participating in the complex life cycle that involves an open sea stage lasting from one to several years after leaving the nesting beach. The release of diseased, captive-reared turtles may have serious health consequences for wild populations. Long-term head-starting projects in Florida with green turtles, in Texas with Kemp’s ridleys, and in Palau (Central Pacific) with hawksbills were terminated because there was no evidence that the programmes were benefiting wild populations (Huff, 1989; Sato and Madriasau, 1991; Williams, 1993; Byles, 1993).

On the subject of ranching (which involves an annual harvest of eggs from the wild) and especially if the intent is to export meat or products, technical guidelines and criteria are available from the CITES Secretariat. The 1994 Conference of the Parties to CITES approved a rigorous set of guide-

lines interpreting the CITES regulations for ranched specimens (Conf. Res. 3.15) as they pertain to sea turtles. A major component of the new guidelines is the inclusion of requirements for "... the effective implementation of a national management plan for sea turtles", and that, "A party submitting a ranching proposal shall take the lead in the development and effective implementation of a regional management protocol designed to enhance the conservation of the population." Details for biological information needed, trade control mechanisms, ranch operation procedures, a statement describing conservation benefits, and regular reporting are specified (Ross, 1995). **It is a recommendation of this Recovery Action Plan that Government participate actively in the critique of mariculture proposals that may be submitted to the CITES Secretariat for the consideration of range States.**

The "Sea Turtle Conservation Strategy" adopted by the 1979 World Conference on Sea Turtle Conservation concludes that until definitive answers to questions concerning the impact of commercial turtle culture on prices of turtle products, on the creation of new markets, on the capture of turtles from wild populations, and on the trade in products derived from wild-caught sea turtles are forthcoming, the following cautions are necessary: (a) commercial mariculture must be in conformity with all applicable conservation regulations and laws, whether local, national, regional or international, (b) care should be taken that special legal provisions and exemptions for farmed [or ranched] products are not misused by importers and exporters, (c) any effort by commercial mariculture interests to develop markets for new turtle products or to create demand for turtle products where it did not previously exist is insupportable, and (d) the establishment of new commercial mariculture operations must be discouraged until it is certain that such operations will not cause, directly or indirectly, a further decline in turtle populations.

4.25 Monitor stocks

A government office, conservation organisation or community partner on each island should be designated to function as a repository for statistical data. The repository office should have a demonstrated institutional capacity to manage complex, multi-annual statistical databases, and should have the staff expertise to enter, summarise, and archive field data. The development of national database software by Nature Seekers, with initial funding by the UNDP-GEF-SGP in 1999, now archives all tagged turtles in Trinidad and Tobago and records nesting activity of leatherback turtles. In 2004, the database software was significantly expanded and upgraded in partnership with WIDECASST. The database is currently administered by the Wildlife Section and community-based co-management partners. Data Use Agreements are needed to ensure that data providers and data users abide by mutually agreed protocols related to information access, data ownership, publication privileges, and so on.

Since it is neither practical nor necessary to monitor all sandy beaches at all times, it is a recommendation of this Recovery Action Plan that Index Beaches be monitored for long-term fluctuations in numbers that will reveal the success or failure of conservation efforts. An island-wide survey (see section 4.112) should be conducted to identify with confidence which areas are most used by turtles. At least four beaches in Trinidad and three in Tobago (selected on the basis of having the most nesting activity) should be designated as Index Beaches and carefully protected from activity that will compromise the suitability of the habitat to support sea turtle nesting. These beaches should be monitored for nesting and hatch success during the full breeding and hatching season for all sea turtle species present (most likely leatherbacks, at least 1 March - 31 August; and hawksbills, 1 April - 30 November). Field workers should receive preparatory instruction prior to their survey efforts (see section 4.55). Data collected from these nesting beaches will enable the Wildlife Section to evaluate the success of conservation and recovery measures implemented on behalf of sea turtles.

In Trinidad, the Matura/Fishing Pond and Grande Riviere Prohibited Areas should be designated as Index Beaches for leatherbacks. The remaining two Index Beaches should include at least one important breeding site for hawksbills. In Tobago, Turtle Beach (Great Courland Bay) and Grafton Beach (Stone Haven Bay) are the preferred candidates for Index Beach designation in the southwest, and King Peters Back Bay (Cotton Bay) and L'Anse Fourmi in the northeast. To date, no Index or 'prohibited' sites have been designated in Tobago for the benefit of sea turtles.

Nesting by green turtles, olive ridleys and loggerheads occurs at such low density that intensive monitoring of nesting populations is not possible. Research to provide statistical estimates of stocks should be encouraged at Index Beaches and a long-term stock assessment programme to identify trends over a period of decades should be developed. **It is a recommendation of this Recovery Action Plan that population monitoring should continue for at least one sea turtle generation; that is, about 35 years.** [Note: Generation length is based on the age to maturity plus one half the reproductive longevity (Pianka, 1974). For sea turtles (excepting Lepidochelys), maturity is generally reached at 25-35 years and tag returns suggest that "reproductive longevity" (the number of years that a female returns to the nesting beach to lay eggs) rarely exceeds 20 years. Based on this information, one sea turtle generation can be estimated at 35 years.] The following subsections articulate standard monitoring methodology.

4.251 Monitoring nesting populations

Five species of sea turtle nest in Trinidad and Tobago (section II). Monitoring nesting populations and the deposition of eggs provides useful information on the distribution and timing of the breeding effort, species involved, location of the most important nesting beaches, and nest fate (e.g., successful hatch or eggs lost to predators, poaching or erosion). Any successful management programme must be based on accurate estimates of the number of reproductively active females, as well as annual productivity (the number of nests laid) and mortality (losses due to erosion, predators and poachers). Monitoring nests can provide baseline data from which to evaluate the success of nest and habitat protection efforts. Inconsistent monitoring programmes are insufficient to provide policy-makers with coherent data.

The number of crawls is not equal to the number of nests, nor is the number of nests equal to the number of turtles. If a census is undertaken in the early morning hours (as opposed to during the night when the turtles can be observed directly), it is rarely possible to determine whether or not eggs were laid. Not all crawls result in a successful nest. Sometimes the female encounters an obstacle (e.g., erosion bluff, fallen tree, beach lagoon). Sometimes she is disturbed or frightened away by human activity, dogs, excessive noise or lighting. She may try to dig a nest, but if she encounters impenetrable roots, buried debris, water, or sand which is too dry to properly excavate a nest cavity, then she will return to the sea. Finally, she may be injured and unable to complete the nest. Thus, while a crawl and signs of nesting may be evident on the beach, an observer cannot be sure that eggs were laid unless (1) egg-laying was actually witnessed or (2) the eggs have been exhumed by poachers or predators. For this reason, most databases which result from morning nest counts – or from night patrols where not every nesting female is seen – are based on "crawl counts" (successful and unsuccessful nesting attempts, combined) and not "nest counts" (a "nest" is defined as the successful deposition of eggs).

Since, in general, the number of crawls counted has formed the basis for comparison among beaches and between years, it is essential to determine the ratio between successful and unsuccessful nesting emergences; that is, the proportion of crawls which resulted in egg-laying. Crawls which do not result in egg-laying are referred to as "false crawls". **It is a recommendation of this Recovery Action Plan that the ratio of nests to false crawls be calculated for all Index Beaches** (see section 4.25). The

calculation is straightforward -- if direct observation reveals that out of 100 crawls, 80 nests are laid, then the nest:false crawl ratio is 80:20, or 4:1. This information allows a manager to estimate the number of *nests* laid on a beach for which only the number of *crawls* is known. At most sites, all-night patrol is not a practical option; but with some idea of how many crawls include nest cavities, crawl tallies from day-time surveys can be converted to estimates of nest density. [Note: The nest:false crawl ratio depends on the physical character of the beach and differs among beaches (as well as between species); nevertheless, this methodology provides the best estimate of the number of nests laid in areas where all-night patrol is impossible.]

Once the nest:false crawl ratio has been determined for a beach (or estimated based on information gathered elsewhere in the country) and the number of nests laid (per species per year) 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 nesting season, hawksbills 5 nests, and green turtles 4-5 nests. Thus, using our hypothetical 4:1 nest:false crawl ratio, we can estimate that 500 leatherback crawls represents 400 nests which, when you remember that each turtle lays 6-7 nests, represents 57-67 adult females. Similarly, 20 hawksbill tracks on a beach may represent only 16 actual nests, which in turn represent only three adult females. To obtain a precise count of the number of females nesting per year on a particular beach, as well as their return intervals both within and between seasons, all-night patrol must be undertaken by trained personnel and the tagging of nesting females initiated (see section 4.241).

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 and rear flippers in an alternating rhythm. Leatherbacks leave a deep, symmetrical crawl about 2 m in width. Green turtles also leave a symmetrical crawl, but it is only about 1 m in width; the nest site is often characterised by a deep, solitary pit 1 m or more in depth and breadth. Hawksbills and loggerheads have asymmetrical crawls, about 0.7 m and about 1.2 m in width, respectively. The hawksbill crawl is often faint because 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 within the shelter of Coccoloba or other beach vegetation. There is some evidence that olive ridleys nest on the west coast of Trinidad. It would be nearly impossible to discern the nesting crawl of a hawksbill from that of a ridley.

4.252 Monitoring hatchlings

Any successful management programme must be based upon credible estimates of reproductive success. Thus, while nest counts are vital (section 4.251), follow-up at the hatchling stage is also important. Estimates of mortality, including losses due to erosion or high seas, domestic or feral animals (e.g., dogs), natural predators (e.g., crabs, birds) and poachers should be obtained. Other threats should also be 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, predation, or the spilling of eggs from a bluff created during a storm. On beaches with organised turtle watching (see section 4.271), a “control area” must be established in which visitation is excluded. In this way, the effect(s), if any, of beach traffic on average hatch success can be fairly evaluated.

It is a recommendation of this Recovery Action Plan that a sample of nests be marked for detailed study. It is best if the exact nest site is not marked. The distance from the nest site to two proximal objects, such as trees or other landmarks (or numbered stakes placed for this purpose), should be recorded so that the site can be precisely located by triangulation at hatching two months later. If possible, 5 cm x 5 cm stakes should be established every 20 m along the tree line; in other words, out of reach of tides and tourists (this need only be done in a study plot 800-1000 m in length, in an area of high nest concentration). The stakes should be driven securely into the beach using a sledgehammer, and each stake should be sequentially numbered and marked with a tab of reflective tape. Each nest should be measured to the two nearest stakes with a Fiberglas[®] 50 m measuring reel. The coordinates should be recorded on the nesting record sheet. This system will enable patrollers to triangulate nests, as well as monitor erosion by regularly measuring from selected stakes to the mean high tide line. Photographs taken in three directions while standing over the nest are also 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 2-3 days, the nest can be excavated and the number of hatchlings roughly estimated from the remains of broken eggshells. In addition, unhatched (whole) eggs can be counted to determine the proportion of eggs that 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 at the time of egg-laying to higher ground might be considered (section 4.242). In this case, it is crucial that nest dimensions (depth and width) reflect the original nest so that incubation temperature and hatchling sex ratios are not distorted. **It is a recommendation of this Recovery Action Plan that an evaluation of hatch success be undertaken by trained personnel at Index Beaches.** This is especially important where tour guiding is ongoing, since persistent traffic on the beach may compact the sand and reduce hatch success.

Guidelines are available (Phelan and Eckert, 2006) for the rescue and release of hatchlings. If hatchlings are rescued, such as after being disoriented by lighting, they should be released immediately. If rescued during the heat of the day, they should be kept until late afternoon or evening in a lightly covered plastic cooler or bucket. Place a few inches of damp beach sand in the cooler. If the sand is too dry, the young turtles may desiccate (dry out); if too wet, energy will be wasted in swimming, and weak hatchlings may be unable to hold their heads above the water to breathe. Cover the cooler or box and place it in the shade until late afternoon or nightfall. Supervise the container to avoid the unwanted attention of predators (e.g., dogs) and onlookers. At the time of release, keep potential predators away from the hatchlings as they cross the beach. Select an unlit stretch of beach (preferably the beach where the eggs were laid) to release the hatchlings; if the beach is well lit, ask the landowner/ hotelier to turn off the lights briefly as the hatchlings make their way to the sea. To encourage natural sea-finding, use minimum light and prohibit flash photography during hatchling releases.

Never toss hatchlings directly into the sea, or “ferry” them into deeper water. It is important that the hatching process be as undisturbed as possible, so as not to interrupt the natural progression of the hatchling from the nest, across the beach, through the coastal zone, and into the open sea where it will spend the first several years of life. *Exception:* Sometimes hatchlings successfully leave the nest, enter the sea, and wash ashore weeks later (e.g., by storms) as “post-hatchlings”. Depending on its size, the young animal may have to be ferried out to an oceanic convergence where fishermen would normally encounter that life stage.

4.253 Monitoring turtles at sea

Juvenile turtles are not likely to be resident for more than a few months or years. Sea turtles are late-maturing and juveniles spend many years in “developmental habitats”, meaning that they take up residence in one foraging area, then move on to another, then another, etc. These years are characterised by extensive movement that can encompass the jurisdictional waters of many nations. We are entrusted with the survival of these turtles, which will someday return to distant nesting beaches, while they are in our waters. Similarly, turtles which will ultimately recruit into breeding populations that nest in Trinidad and Tobago are spending their growing years in distant waters, under the care (hopefully) of other Caribbean governments. Monitoring the numbers of juveniles on local foraging grounds can be a very useful exercise. In addition to changing patterns of abundance, shifts in average size and spatial distribution can indicate unsustainable exploitation, or habitat loss/degradation.

The monitoring of juvenile and adult turtles at sea requires special preparation and can be considerably more difficult (and more expensive) 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). There are a variety of capture-recapture, transect, and other statistical methods available for at-sea monitoring. Methodology is described in Eckert et al. (1999) and more recently reviewed by Bolten and Bjorndal (2000).

In addition to monitoring population trends in juvenile populations on foraging grounds, monitoring the movements of egg-bearing females in interesting zones can yield important management data. At present it appears that the highest source of mortality to leatherback turtles is incidental catch in gill nets (section 4.23). Determining the temporal and spatial overlap between the inter-nesting range (leatherbacks are only present during the egg-laying stage) and fishing effort will empower the Government to make informed decisions relative to reducing this mortality.

4.26 Promote co-management

It is a strong recommendation of this Recovery Action Plan that the Government and relevant community-based organisations continue to pursue and formalize, in good faith, the often difficult partnership known as “co-management”. Co-management brings together, on equal terms, stakeholders and agendas which can be vastly different from one another. It takes time and patience to learn to work together, and successful case histories are not yet commonplace. This option cannot be neglected, however, because a successful partnership yields enormous benefit to governments (which may have the will, but neither the staff nor the resources to fulfill its legislative mandate to safeguard the nation's ecological integrity), to communities (which are yearning for quality local employment and a larger measure of control over issues that directly affect them), and to imperiled natural resources (which derive no benefit from traditional “us vs. them” conservation and law enforcement options).

Trinidad is proud of the fact that co-management on behalf of sea turtles has already demonstrated, in a practical way, that rural communities *can* be entrusted with a large measure of responsibility for the conservation of their natural resources. As a result, threats to natural resources (in this case, harassment and killing of sea turtles) have been virtually halted and these same resources have been utilised for socioeconomic and other benefits in a sustainable manner. The following paragraphs briefly describe the process by which co-management was undertaken between the Forestry Division (through its

Wildlife Section) and the community of Matura on the east coast of Trinidad. The process is not yet complete, as room for growth still exists; however, much has been accomplished, including a professional and mutually beneficial working relationship between the Wildlife Section and the communities, safer beaches for turtles to nest, organizational and leadership development among community organizations, and strong community-based and supported conservation programmes. Government and community partners are proud of the inspiring progress which has been realised in a formal sense, since 1990, and sea turtles have profited immeasurably from the collaboration.

A workshop and training course entitled, “Principles of Participation and Co-Management for Resource Management Professionals”, held in Trinidad in May 1997 and sponsored by CANARI (Caribbean Natural Resource Institute), summarised the basic components of a successful co-management relationship. These are reprinted in Appendix III. These principles are wholly endorsed by this Recovery Action Plan. Always keeping in mind the basic principles of co-management, and its obligations on both sides, the Government and its community partners should make it a priority to fully evaluate the successes and shortcomings of the unprecedented collaboration on behalf of leatherback turtles nesting at Matura/ Fishing Pond and Grande Riviere beaches, seek to improve the process, and move forward in duplicating the effort at other major nesting beaches and with other threatened species throughout the Republic.

Matura case history: James and Fournillier (1993) describe the first formal co-management activity in Trinidad and Tobago. The illegal slaughter of leatherback turtles at their nesting beaches had plagued enforcement authorities for decades (section 3.3). The persistent harvest, which was estimated at 30% or more of the annual nesting population in the 1970's, was made all the more objectionable because of an increasing trend toward wasting much of the carcass. Wildlife Section observations of carcasses found on Matura and Fishing Pond in the years (1983-1989) preceding declaration of these beaches as Prohibited Areas, indicated that most turtles were slaughtered for one flipper (25-40 kg meat); occasionally two flippers were removed. This criminal activity outraged Government and community activists alike, but the remote location of many of the nation's most important nesting beaches presented a formidable challenge to traditional law enforcement.

Adding to these problems, the management of turtles in Trinidad and Tobago had fallen victim to a jurisdictional maze. No single agency was responsible for all aspects of sea turtle conservation, and no clear management responsibilities for any agency were defined for turtles whilst nesting on land. Basic management objectives were not developed until 1982 when the Wildlife Section of the Forestry Division (Ministry of Agriculture, Land and Marine Resources) recognised the problem and initiated a formal programme for managing nesting beach habitat. After attempting various strategies (including six years of night patrols) with very limited success, it became clear that new approaches had to be examined. There had been some successes, such as in the areas of public awareness and a fuller understanding of the scope of the problem, but no significant scientific or conservation advances could be claimed. Such was the situation in 1989 when a new phase of sea turtle management was inaugurated.

A variety of solutions were examined at that time. Increasing the frequency of beach patrols by enforcement personnel was deemed impossible without significant expansion of human and financial resources. Existing personnel were already functioning at unsustainable levels of output. There was also some doubt as to whether increasing patrols would be effective in the face of uncontrolled public access to all nesting beaches. Other recommendations, such as creating sanctuaries and introducing stiffer fines and penalties, all hinged on increasing enforcement personnel and effort without identifying strategies or mechanisms for increasing recurrent expenditure and other inputs needed for success. Allocation of funds for wildlife conservation was a low priority, and only in very recent years have even limited funds been

allocated. The Wildlife Section realised that the underlying problem with past efforts, as well as the options articulated above, was an “outside/inside” (or, “us vs. them”) approach. Perhaps it was this underlying approach which needed revision, and not just in a small way.

In 1989, the Wildlife Section embarked on what many would characterise as a radical approach. It was labeled “co-management” and involved sharing responsibility for sea turtle conservation with the rural communities of Matura and Fishing Pond in a true partnership fashion. In truth, none of the players knew where this idea would lead. The process took on a life of its own and evolved gradually, forming and conforming to the needs of individual elements within the partnership, until the needs of both the communities and Government were met in a manner acceptable to both sides. The outcome appeared to be a solution that embraced all of the objectives for the conservation of endangered species and community development and socioeconomic gain. It embodied the fundamental concept that management of natural resources must be for people – and people who had been considered part of the problem must now be made to feel that they were (or could be) part of the solution.

In a first effort to foster a partnership, meetings with village leaders were undertaken. Informal dialogue with the President of the Matura Village Council and the Principal of the Matura Government School proved very valuable in two key areas. First, it was an opportunity to “test the waters” with respect to village opinions and perceptions before formally approaching the larger community. Second, the Village Council President, one of their very own “sons of the soil”, took the opportunity to articulate the problem in a manner which suggested that the problem was truly a local community problem, and that the role of “the Government people” was really in “helping us to help ourselves.” The interaction assisted the Wildlife Section in fine-tuning its information for the formal approach. Invitations to the formal meeting were conveyed through the executive of the Village Council and through students attending the Government Primary School.

Attendance at the first meeting was overwhelming and exceeded the capacity of the schoolroom. Village elders, youths, primary school children, wealthy landowners and former residents of the community all listened attentively from every vantage point available. Discussions were not confined to “the turtle problem”; villagers expressed a range of issues that had been troubling to various sectors of their community for a long time. It is very important for governments and NGOs involved in the co-management of natural resources to be willing to listen to community concerns above and beyond the principal issues of the partnership. This serves to foster trust and a belief that the overall well-being of the community is important. While tangential issues and problems may not be addressed with the same vigor and intensity of action reserved for the central problem, advice can be given or referrals made. The first tenet upon which a successful partnership is built is the non-compartmentalisation of community issues. In a community, all issues are important. As non-village partners in this exercise, the Wildlife Section had to make every effort to understand the culture, aspirations, needs and fears of its village partners.

Legislative support for the process was limited. The Wildlife Section considered a variety of legal options to enhance protection to nesting turtles, and concluded that the only mechanism which could provide legislative support to a suite of short-term management actions was a provision under the Forests Act allowing designation of Prohibited Areas and imposing a fine of TT\$1,000 [ca. US\$160] for entering such an area without permission from the Forestry Division. To offset this, one agreement reached during negotiations with the village was that all *bona fide* residents of both communities would automatically receive free permits to allow unrestricted entry to nesting beaches. The Wildlife Section considered this necessary in order for villagers to continue enjoying social interactions normally undertaken on the beach, as long as such activities were not likely to impact negatively on sea turtles during the nesting period.

In working with the communities, the Wildlife Section proposed that awareness, education, and the training of villagers were important first steps in enlisting community support for turtle conservation. Village elders agreed that training the youth of the community was desirable and gave their blessings to the Forestry Division to embark upon a training programme which the Wildlife Section undertook to design especially for these two rural communities. The programme was comprised of a mix of lectures with written and graphic handouts on basic biology and ecology, and field trips to forested, riverine and coastal marine habitats. Eleven persons completed the "Introductory Nature Tour Guide Training Programme" and received certificates from the Minister in a formal graduation ceremony witnessed by the Director of Forestry, Schools Supervisor for Northeastern Counties, Principals of both village schools, the Wildlife Section Project Co-ordinator, village elders, and community peers. It was an event of singular pride for the communities and is still remembered fondly several years later. One outstanding success that was an unexpected byproduct of the training was that one youth who was unable to read at the start of the programme, became literate.

As a result of this training programme the community became active managers of the sea turtle resource, taking part in beach patrols, research surveys, beach clean-ups, and public education. Spurred by the Wildlife Section, an ecotourism initiative emerged and attempts at improving the infrastructure for visiting tours began in 1991 (see section 4.271). Community pride, fostered as a result of increased environmental awareness about the special phenomenon taking place in their community, and pride in the achievement of having graduated from an intensive conservation training programme, spurred the graduates on to work together for the good of their villages. In 1990, the graduates of the "Introductory Nature Tour Guide Training Programme" formed a tour guide organisation, the Nature Seekers. This was an outstanding outcome of the collaborative process between Government and the rural communities; in this way, an organisational mechanism for continuing the co-management initiative was born, as well as a venue for community-centered socio-economic development.

The successful initiative at Matura was later used as a model for co-management agreements between the Wildlife Section and community groups at Fishing Pond and Grande Riviere who oversee conservation and monitoring programmes at these nesting grounds. The initiative at Grande Riviere was initially hindered by a chronic lack of attention on the part of relevant Government agencies to repeated requests by the Wildlife Section (see also 4.121) that the nesting beach, one of the most important leatherback nesting beaches in the Western Hemisphere, be granted Prohibited Area status under the Forests Act (section 4.121). Thankfully, Prohibited Area status was formally granted in 1997. The successful initiative at Matura has also provided an opportunity for local businesses, including Aleong and Agostini, Shell Chemicals and Services (Eastern Caribbean) Ltd., Amoco-Trinidad Oil Company Ltd. (now bpTT), National Petroleum, the Port of Spain Rotary Club, BHP Petroleum (Americas Division), the Canadian High Commission, First Citizens' Bank Ltd., UNDP (GEF/SGP) (see Sections 4.3, 4.33) and others to support sea turtle conservation directly. These offices have contributed meaningfully (grant monies, in-kind services) to the conservation activities of these groups since 1992, thus broadening the base of support for conservation within the country.

The co-management effort has not been without its problems. During the early period of collaboration, village politics threatened the future of the project. Moreover, the Government has at times been wholly incapable of meeting its obligations to the partnership due to internal shortages of personnel, fuel, transport, etc. An unexpected obstacle was with so-called 'establishment conservationists'. Despite the open invitation to all environmental NGOs with an interest in sea turtle conservation to share their experiences and participate in the co-management process, few NGOs chose to participate and some openly criticised the initiative. Except for helpful commentary by the Pointe-à-Pierre Wildfowl Trust on printed

materials, and a positive response to offers of free permits for volunteer patrols by the UWI Biological Society and the Wildfowl Trust, no other group offered any measure of support for the initiative. Instead, members of the Wildlife Section were branded as novices who were not likely to succeed in field conservation, and who lacked the “considerable experience” of long established NGOs.

On the other hand, the Forestry Division was convinced that many established groups were unaware of the magnitude of the problem. The Forestry Division remained convinced that a direct partnership between Government and the affected communities was the only viable option to long term conservation of the sea turtle resource. The vision proved true. Today the community-based programmes have matured into multi-faceted enterprises that include public relations, tour guiding, fund raising, habitat maintenance (e.g., beach clean-ups), population monitoring, and biological research. There has been a high level of personal commitment, including the donation of personal time and financial and material resources, within community partners. Overall, the regular collection of scientific information and the effectiveness of the sea turtle protection component of the programme have far surpassed the expectations of the Forestry Division. Without community assistance, the Wildlife Section would not have been able to protect the sea turtles or their habitat at Matura Beach, and certainly it would not have been able to collect data on a daily basis without an impossible allocation of human and financial resources.

The proud achievement of newly educated youth and the strength the Matura community feels from being empowered to address its own problems are significant and tangible benefits to co-management. Many young villagers, some as young as nine years of age, offered to patrol the nesting beaches and apprentice under their peers in Nature Seekers. Lessons learnt from the partnership with Government were soon being transferred to the next generation of villagers. These “links to the future” bode well for the long term success of co-management in Trinidad and Tobago. Today, through its partnership with the regional WIDECAST network, Nature Seekers offers training to communities elsewhere in the Caribbean (e.g., Sammy and Baptiste, 2008).

4.27 Investigate non-consumptive uses to generate revenue

The potential value of non-consumptive use has long been recognised (summarized by Troëng and Drews, 2004). A quarter-century ago, Pritchard (1984) realised that, “In Trinidad and Tobago, the greatest value of the leatherback lies in its benefit as a scientific and educational resource. The value of the experience gained by both Trinidadians and by visitors when they have the opportunity of observing the nesting of a 1,000-pound turtle is greater than any value that could be derived from direct utilisation of the animal or its eggs for human consumption.”

The potential for sustainable income from well-designed ecotourism is significant, and Trinidad and Tobago has invested heavily in several community groups which to date have made invaluable contributions both to local conservation and resource management, and to the larger issue of whether or not the non-consumptive use of endangered wildlife can contribute meaningfully to the income of rural residents. **It is a recommendation of this Recovery Action Plan that a professional critique of the economic contributions of sea turtle ecotourism in the country be undertaken, including lessons learned and recommendations for next steps.** Indirect benefits should be factored in, including related advances in community literacy, governance, and so on.

There has been some discussion of expanding beach-based ecotourism offerings to sea turtle watching at sea, and certainly the experience of nesting beach guides should be brought to bear in this regard. Tour guiding in the interesting habitat has potential to employ some fishers, but there are

obstacles and challenges to consider, such as transport to remote areas, an undeveloped client base, enforcement of guidelines, and harassment of turtles, including egg-bearing females (see section 4.271 for recommendations).

4.271 Ecotourism and tour guiding

Interest in “ecotourism”, nature-based tourism, and community tourism is rising world-wide. Where there were once a few well-known destinations (e.g., Asa Wright Nature Center, Pointe-à-Pierre Wild Fowl Trust, Buccoo Reef Marine Park, Caroni Swamp), there are now a variety of rural initiatives that offer the visitor a respite from traditional, mass-marketed tourism. The Toco Foundation’s Eco Tourist Project, for example, offers trips to a number of approved sites including waterfalls and natural rock formations, and tours include opportunities to purchase local crafts and food. Established Turtle Watches at Grande Riviere, Matura and Fishing Pond nesting beaches draw thousands of visitors annually. A two-fold effect is realised from this type of tourism: sustainable income for rural communities and, in the case of sea turtle ecotourism, an end to hostilities toward sea turtles as a result of both increased awareness and a steady presence on the nesting beach of tour guides and visitors.

James and Fournillier (1993) suggested the following three objectives for sustainable sea turtle ecotourism: (i) to promote ecotourism *as a tool* for conservation of ecosystems and species, using the spectacular ecological behaviour of nesting leatherback turtles as the principal focus of this activity, (ii) to provide training for self-employment of young people in local communities as nature tour guides and other entrepreneurial activities, and (iii) to enhance the development of other sectors of the community by fostering the establishment of backward and forward linkages between ecotourism and local agriculture, cuisine, culture, accommodation and other services. These objectives are fully endorsed by this Recovery Action Plan. **Moreover, it is a recommendation of this Recovery Action Plan that continued development of well designed, village-based ecotourism be supported at all levels of Government, from Parliament to the Regional Corporations.**

‘Tour guiding’ on the beach: Sea turtle ecotourism is firmly established in Trinidad and to a lesser extent in Tobago. In 1990, efforts on the part of Government to curb the slaughter of leatherback turtles on the east coast resulted in the development of a co-management partnership with villagers (see section 4.26). As a gesture of commitment, Matura and Fishing Pond beaches were declared Prohibited Areas (under the authority of the Forests Act) during the annual March - August nesting and hatching season. A permit system was subsequently introduced at a cost of TT\$5 [ca. US\$0.83] per entry. In an attempt to ensure that protecting the sea turtles and supporting the co-management concept was not just an administrative objective which lacked practicality, Dr. C. James, former Head of the Wildlife Section, initiated a dialogue with local villages that ultimately led to pilot ecotourism projects in the Matura and Fishing Pond communities.

In 1990, after several meetings with the Matura Village Council and the Fishing Pond Parents-Teachers Association, 13 persons ranging from 16-42 years old were nominated for a tour guide training programme. The training programme was conducted by the Wildlife Section with resource personnel from the National Parks Section-Forestry Division and the former Tourism Development Authority (now Tourism Development Corporation). [Note: In 1991, a similar training course was provided to 16 trainees from Grande Riviere/Matelot (12), Matura (3) and Manzanilla (1); and subsequent to these initial training courses, the Wildlife Section has continued to provide its services upon request. Nature Seekers has also taken up this aspect and conducted training courses, often in partnership with WIDECAS, to national and international colleagues.] Upon receipt of their certificates in 1990, the Matura graduates went on to

form a tour-guiding group called Nature Seekers. Members of Nature Seekers are partially supported by the Government in that they are paid part-time (the balance of the full-time work is largely volunteer) for patrolling the Prohibited Area and for collecting biological and management data on the leatherback turtles nesting there. They also provide tours at the beach, for which visitors pay a modest fee.

In an attempt to standardize procedures on the nesting beaches, SOS Tobago offers tour guide training to THA registered tour guides already involved in providing turtle watch tours. However, the beaches are not prohibited (i.e., access is not restricted) – so SOS has no control over the number of visitors on the beach each night and there is no established carrying capacity or tourist:guide ratio. Tour range from US\$20-40 per person, including transport to and from beach, and some tour guides have at least 4-10 clients per week during peak nesting season, representing a significant economic activity for local guides.

Based on experience during the first two years of Prohibited Area status, a ‘carrying capacity’ of 200 persons per night was implemented for the 8.85 km Matura Beach (100 at Orosco and 100 at Rincon Bay) and 200 persons for the 10.45 km Fishing Pond Beach; the limit is reduced by 50% during peak hatching (July-August). The carrying capacity is enforced by internal decree within the Wildlife Section. Permits are sold at five government offices and information on regulations and conditions, including contact information for the tour guiding organization, is passed on to visitors. It is mandatory that visitors to the Prohibited Areas must be accompanied by a trained tour guide (i.e., a person graduating from a formal training course offered periodically by the Wildlife Section). This stipulation has proved effective and has the support of the Matura, Fishing Pond, and Grande Riviere communities. **It is a recommendation of this Recovery Action Plan that the carrying capacity, as well as the mandatory use of an accredited guide, be formalised as necessary in order to provide for the strongest protection of these fragile areas.**

Training within the communities is ongoing. Since 1993, WIDECAS has been a valuable source of technical information, training and guidance, both for the community-based conservation groups and for the Wildlife Section. Today the co-management initiatives are well known internationally, and revenue generated from the tour guiding business provides a part-time salary to the community groups involved; this is the only source of employment in many cases. A further advance has been the creation of the Turtle Village Trust, a national programme designed “to place Trinidad and Tobago as the premier turtle tourism destination globally” and seeking to “foster and strengthen strategic partnerships between turtle conservation groups and nearby coastal communities to protect these endangered species, whilst providing sustainable livelihoods for resident communities through the creation of superior quality products and services for patrons/customers” (Turtle Village, 2006).

It is a recommendation of this Recovery Action Plan that a comprehensive Sea Turtle Eco-tourism Plan be developed, based on a critical evaluation of experience to date. Community groups, tour guides, Government, Turtle Village Trust, WIDECAS, and other stakeholders and experts should participate in the development of such a Plan, which should establish criteria for concessionaires (groups with permission to profit from turtle watching in Prohibited Areas) and guides (including training, apprenticeships and tenure, performance evaluation), carrying capacity and turtle watching ‘etiquette’, law enforcement response, etc. Based on mutually agreed criteria, a Memorandum of Understanding or similar agreement should be co-signed by Government and community groups sponsoring tour guiding, specifying the responsibilities each has to the other and granting sole concessionaire privileges to village-based tour groups that meet the minimum guidelines and criteria requisite for such a privilege.

'Tour guiding' at sea: Taking tourists out in motorised vessels to observe sea turtles at sea logically involves interactions with (i) adult female leatherback during the egg-laying season (peak: April-July), or (ii) juvenile and adult hard-shelled sea turtles resident on foraging grounds. There are special considerations that must be given to this type of activity, as the potential for harassment is high. **It is a recommendation of this Recovery Action Plan that 'at sea' ecotourism initiatives be guided by the following conditions:**

1. Guides should be trained and licensed as concessionaires, including standard training in safety, tour guiding etiquette, and sea turtle biology. There should be a mechanism for apprenticeship and tenure for guides, as well as a periodic review of performance.
2. Guides should be enabled to draw an established fee for their guiding services.
3. Standard materials should be provided by guides to their clientele describing turtle watching etiquette (e.g., watch distance [swimmer, vessel], active/idle motoring, photography, a no-tolerance policy on pursuing a turtle) and the biology of sea turtles.
4. 'No visitation' area(s) should be established as refugia for the turtles. These should be easily enforceable (e.g., "the coast and seas west of Matelot" or "the coast and seas south of Toco") and should be selected based on data demonstrating the value of the area as refugia. By establishing control zones from the start, the groundwork is laid for studies to evaluate the effect(s) of visitation on sea turtle behaviour.
5. An integrated programme of training, fees, watching etiquette, educational materials and refugia should be developed before any permits are granted by the government authority for turtle guiding at sea.
6. Permits should be renewable on an annual basis, with firm criteria established for performance evaluation, including routine onboard inspections by permitting agencies or their designees.

The interesting phase of sea turtle reproduction is a uniquely vulnerable phase, and leatherbacks in Trinidad may also be recovering from multiple *fillette* (gill) net captures. The combined stresses of incidental capture and close approach(es) may compromise reproductive output and divert turtles from their nesting sites, thereby reducing the effectiveness of ongoing conservation and management efforts on the nesting beaches. Any at-sea venture would benefit from consultation with experienced Caribbean whale watching groups (<http://www.caribwhale.org/>).

4.3 Encourage and Support International Cooperation

Sea turtles are migratory, and no single nation can adequately protect them without the cooperation of other States. The Government is encouraged to participate in and to support international sea turtle conservation initiatives, including global treaties, regional and bilateral agreements, and symposia. With regard to international treaties to which Trinidad and Tobago is a Party, the Government is encouraged to take every advantage of these treaties to obtain technical and financial support for implementation action, and to use the commitment implied by ratification to strengthen conservation priorities at home.

4.31 Global treaties

4.311 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 sys-

tem of import/export permits. The Convention regulates international commerce in animals and plants (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 does not regulate or control any aspect of the domestic harvest and usage of species, including sea turtles; such regulations must be promulgated by the Government.

Despite the fact that Trinidad and Tobago ratified CITES in 1984, tortoiseshell was, until quite recently, openly sold in many tourist-oriented retail markets including both national airports (Piarco and Crown Point) – and is still available for sale, though in much lower volume, at some popular tourist beaches in Trinidad (e.g., Manzanilla, Las Cuevas) and in Tobago (section 3.3; Table 4). No credible argument can be made that these items are not being sold primarily for export since tourists ultimately leave the Republic and return to their nations of residence, where they may face stiff fines and other penalties for possession of illegal wildlife products (section 4.211). Because national fisheries law allows the sale of turtle shell items during the open season (October- February), but CITES prevents these items from leaving the country, this “loophole” should be closed and law enforcement authorities should make every effort to confiscate any remaining inventory. Consideration should be given to using the confiscated items in an educational display at ports of entry, reminding tourists that tortoiseshell looks best on the back of a sea turtle.

4.312 Convention on Biological Diversity

The Convention on Biological Diversity (CBD) came into force in 1993. Its objective is the conservation, as well as the equitable and sustainable use, of biological diversity for present and future generations. It binds nations to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity; to identify and monitor the status of components of biological diversity; to develop and manage protected areas and other areas of importance for biodiversity; and integrate *in situ* and *ex situ* methods of conservation. It also deals with sustainable use, incentives, research and training, public education and awareness, impact assessment and mitigation, access to genetic resources, technology transfer, information exchange, technical and scientific cooperation, and biotechnology. Importantly, it sets up a funding mechanism, the Global Environment Fund (GEF), to encourage developed nations to assist developing nations with their plans, programmes and projects.

Trinidad and Tobago ratified the Convention in 1996. In accordance with Article 6 of the Convention on Biological Diversity, a national planning project for the conservation and sustainable use of the country’s resources was held between 1998 and 2001. The National Biodiversity Strategy and Action Plan (NBSAP) resulted from this exercise and was approved by Cabinet in 2001. A number of its recommendations have been undertaken through the coordination of the EMA, and with the consultation of stakeholders. **It is a recommendation of this Recovery Action Plan that the terms of this Convention receive the support of the Government at all levels.**

4.313 Marpol Treaty

The 1973 International Convention for the Prevention of Pollution from Ships, known as the Marpol Treaty, is an important treaty for the conservation of the marine habitat. Its objective is “to preserve the marine environment by achieving the complete elimination of international pollution by oil

and other harmful substances” (UNEP, 1989). The Convention has five Annexes (oil, chemicals in bulk, packaged chemicals, liquid sewage, garbage) providing detailed technical specifications regarding the way in which a ship must be built and equipped to prevent marine pollution in the case of an accident, and also norms and technical requirements to minimize operational discharges. Government acceded to Annexes I through IV in June of 2000.

It is a recommendation of this Recovery Action Plan that this Convention receive the support of the Government at all levels.

4.314 U. N. Convention on the Law of the Sea

The objective of this United Nations convention is to set up a new legal regime for the seas and oceans. Its environmental provisions aim to establish rules concerning environmental standards and enforcement of provisions dealing with pollution of the marine environment. It also includes provision for an Annex of highly migratory species, and thus there is the possibility that sea turtles could receive some protection under this Convention. Trinidad and Tobago ratified the Convention in April of 1986.

It is a recommendation of this Recovery Action Plan that the terms of this Convention receive the support of the Government at all levels.

4.315 Convention for the Conservation of Migratory Species

The Convention on the Conservation of Migratory Species of Wild Animals, commonly referred to as the Convention on Migratory Species, or the Bonn Convention, came into force in 1983. Two appendices list migratory species that would benefit from concerted conservation measures. Endangered species, listed in Appendix I, are accorded full protection. Range States of Appendix I species are to endeavor to conserve their habitat, to counteract factors impeding their migration, and to control other factors that might endanger them. Moreover, Range States are obliged to prohibit the taking of these species, with few exceptions. The definition of “taking” includes hunting, fishing, capturing, harassing and deliberate killing. Appendix II lists migratory species that have a conservation status that requires, or would benefit from, international cooperative agreements which provide for species and habitat conservation measures, research and monitoring, training and information exchange. Where appropriate, a species may be listed in both appendices, as is the case with Caribbean sea turtles.

Trinidad and Tobago has not yet acceded to this Convention, and **it is a recommendation of this Recovery Action Plan that the Government consider the benefits of accession, and move to support this important treaty.**

4.32 Regional treaties

4.321 Cartagena Convention and SPAW Protocol

An important treaty with regard to the protection of Caribbean sea turtles and their habitats is the United Nations Environment Programme’s (UNEP) Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (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 in Montego Bay, Jamaica, 6-8 April 1981. Representatives

from 22 Governments in the region 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 and ultimately adopted both the Convention and a Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean 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, land-based sources, seabed activities, and airborne sources, as well as the at-sea dumping of waste). 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.” Trinidad and Tobago ratified the Convention in January 1986.

In January 1990, a Protocol Concerning Specially Protected Areas and Wildlife (SPA) 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, aestivation 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 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 (Eckert, 1991; UNEP, 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. Trinidad and Tobago played an important role in the adoption of the new SPAW Protocol, and ratified it in 1999. **It is a recommendation of this Recovery Action Plan that the terms of this important Convention receive the full support of the Government.**

4.322 Inter-American Convention

The 2001 Inter-American Convention for the Protection and Conservation of Sea Turtles, seeks “to promote the protection, conservation and recovery of sea turtle populations and of the habitats on which they depend, based on the best available scientific evidence, taking into account the environmental, socioeconomic and cultural characteristics of the Parties.” Under Article III, the Convention applies to coastal habitat in the Americas, as well as maritime areas for which the Parties exercise sovereignty under the UN Convention on the Law of the Sea (i.e. up to 200 miles from shore), thereby covering a significant portion of the ranges of sea turtles in the Western Hemisphere.

The treaty requires Parties to protect and conserve sea turtle populations and their habitats; reduce the incidental capture, injury and mortality of sea turtles associated with commercial fisheries; prohibit the intentional take of, and domestic and international trade in, sea turtles, their eggs, parts and products; and foster international cooperation in the research and management of sea turtles. Additionally, the

Convention specifically obligates Parties to require the use of Turtle Excluder Devices (TEDs) by commercial shrimp trawling fleets.

It is a recommendation of this Recovery Action Plan that the Government consider the benefits of accession to the Inter-American Convention, and move to support this important treaty.

4.323 Western Hemisphere Convention

The Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, often referred to as the Western Hemisphere Convention, was opened for signature at the Pan American Union on 12 October 1940 and entered into force on 1 May 1942. Currently there are 22 Parties, including Trinidad and Tobago and 12 other Wider Caribbean nations.

The Convention's stated objective is to preserve all species and genera of native American fauna and flora from extinction, and also preserve areas of wild and human value. Provisions include the establishment of national parks and reserves (article 2), strict wilderness areas to remain inviolate (article 4), protection of species listed in the annexes which are declared to be of "special urgency and importance" (article 8), and controls on trade in protected fauna and flora and any part thereof (article 9). Five species of sea turtle are listed. The language of this Convention is far-reaching, encompassing all the basic elements necessary to undertake the conservation and sustainable use of natural resources.

It is a recommendation of this Recovery Action Plan that the Government seeks information on the status of this treaty and its obligations, as a Party, with specific regard to protecting the sea turtles which nest on our beaches and feed in our waters.

4.33 Sub-regional sea turtle management

It is a recommendation of this Recovery Action Plan that Government negotiate bilateral agreements, as practicable, as well as participate in international treaties that both protect sea turtles (see sections 4.31, 4.32) and support the nation's strategic interests. It is intuitive that any action taken to protect sea turtles must be shared among nations that hold these species in common. In the case of Trinidad and Tobago, foraging populations are shared with neighbouring nations in the southern Caribbean Sea, as well as South America. It is clear that hard-won local victories in the management and sustainable use of local stocks will come to naught as sea turtles continue to be killed in other parts of their Caribbean and wider Atlantic range. Just as other range States depend on Trinidad and Tobago to safeguard the breeding grounds of five locally-occurring species, so, too, does Trinidad and Tobago depend on its "neighbours", near and far, to defend these same turtles from threats abroad.

Tag returns documenting international movements date to more than 30 years ago – in that case, adult olive ridleys between Suriname and Trinidad (Pritchard, 1973, 1976) – and more recent satellite-tracking studies demonstrate that adult female leatherbacks depart from national waters after the breeding season and return to foraging grounds in the north Atlantic and western Africa (Eckert, 1997a, 2006) (see section 2.3 and Figure 5).

In addition to documenting international tag returns, **it is a recommendation of this Recovery Action Plan that genetic research be conducted to define the genotypes comprising nesting and foraging populations, and how these relate to populations elsewhere in the region.** Based on these relationships, the Government should coordinate with range States on conservation and management actions.

4.4 Develop Public Education

To promote an awareness among citizens and visitors of the biology and endangered status of sea turtles, as well as the legislation protecting them, **it is a strong recommendation of this Recovery Action Plan that a national sea turtle education programme be designed and implemented.** The programme should inspire residents to get involved, as well as guide those who have already shown initiative. People are drawn to sea turtles, and there is a need to embrace and channel this interest with information that is both accurate and useful. The national education programme should be designed in partnership with experts and should be coordinated as part of the National Sea Turtle Conservation Programme (see section 4.6). If the programme is successful, residents with a desire to become personally involved in the plight of the Republic's sea turtles will not find it difficult to obtain the information they need to make their campaigns a success. Care should be taken to reach beyond an urban audience to rural fisherfolk, beachfront hoteliers, and coastal landowners. Special attention should be given to public awareness efforts in March; i.e., the start of both the nesting season and the annual closed season.

4.41 Residents

Despite the best efforts of natural resource agencies and CBOs at major nesting beaches, laws designed to protect sea turtles are widely ignored. There is general consensus that turtles are caught during the open season, that eggs are poached with impunity, and that egg-bearing females are killed on the nesting beaches (although the killing of egg-bearing females has decreased dramatically over the course of the last decade) – all of these activities are illegal. **It is a recommendation of this Recovery Action Plan that efforts to educate the national citizenry on matters regarding the legal and conservation status of endangered sea turtles be a top priority.**

Whenever possible, sea turtle displays should be incorporated into existing educational programmes; such as World Environment Day celebrations, TIC (Government-operated television), the Toco Cultural Extravaganza, Wildlife Section's annual "Open Day" (designed for school children), "Sand Competition", etc. Wildlife laws should be more widely known, and residents should be encouraged to report violations. Consumers should be warned not to purchase sea turtle meat or products out of season, and encouraged to consider the linkages between sea turtle survival and beach litter, indiscriminate anchoring, beachfront lighting, etc. This information should be communicated in a variety of media and venues, including newspapers, conservation periodicals, and public seminars.

Children should be included in the educational campaign. Further, as there is growing interest in having environmental education programmes in the public schools in Trinidad and Tobago, curricula focused on the marine environment, sustainable fisheries, and endangered species should be actively encouraged by the Ministry (Harold and Eckert, 2005, is an excellent example). Nature Seekers is developing a community-focused environmental education programme, and is also designing an outreach initiative aimed at the Matura Primary and High Schools; in addition, IMA teaches a 10-week course in primary schools on marine conservation that includes sea turtles. Accurate, colorful information should be incorporated directly into summer camp programmes (cf. Marin, 2010), year-round Saturday library programmes for young audiences, national wildlife contests, etc.

All levels of society, including children, would benefit from an organised campaign that included locally produced jingles, audiovisual documentaries, and a competitive national quiz. A short documentary produced by Media Methods was recently aired on national television and served to heighten interest in turtle conservation. **It is a recommendation of this Recovery Action Plan that the development of**

a comprehensive educational programme, such as that initiated (with support from RARE) for the white-tailed sabre-winged hummingbird, Campylopterus ensipennis, be initiated for turtles, and that marine biology and conservation units become a standard aspect of the national curriculum.

Partnerships with the business community are important to successful outreach. Such partnerships can provide financial assistance, in-kind services, support for materials distribution, media coverage, and general endorsements and sponsorship. Several corporate sponsors already enjoy credit for their support of sea turtle conservation and public awareness initiatives throughout the Republic. For example, First Citizens' Bank Ltd.'s CARE project awarded a grant to Nature Seekers in 2000 to assist in constructing an office; Guardian Life Trust donated an overhead projector to support its educational activities; and BHP Billiton sponsored the distribution of professional curriculum materials designed by WIDECASST to every secondary school in the country. In addition to supporting research, conservation and education directly, potential sponsors should consider a conservation message when they lend their support to events and products that reach a wide audience.

4.42 Fishermen

It is a recommendation of this Recovery Action Plan that every effort be made on the part of Fisheries Extension personnel to inform fishers, as well as industry representatives and cooperatives, about the plight of sea turtles, to discourage violations, and to encourage reporting. Fishermen should also be invited to participate in surveys and to provide relevant information (i.e., turtle sightings) to the appropriate office; equally important, they should be encouraged to participate in community-based conservation programmes and have access to data. A recent (2005-2006) series of Town Meetings held in key coastal communities and focused on achieving a more progressive management framework for sea turtles, was successful in imparting basic information about sea turtle biology and status, as well as opening a dialogue with fishers on strengthening the legal framework, reducing bycatch, encouraging more accurate reporting, and visualising a transition to a zero annual quota. Follow-up meetings focused on the basic biology of sea turtles (e.g., why late-maturing, long-lived species must be managed differently from reef fisheries) provided additional opportunities for informed dialogue and reflected the seriousness with which the Government approaches issues of sustainable use.

Fisheries Division and THA efforts to communicate directly with fishers on the subject of sea turtle regulations are important and should be encouraged. As early as March 1994, the Director of Fisheries posted an "Explanation to Turtle Regulations" to Fishermen, Fishing Cooperatives and Associations, Market Authorities, Wholesale and Retail Fish Vendors, Police Officers, and other interest groups. Moreover, the nation's newspapers routinely announce the opening and closing of turtle hunting season. Specific to the TEDs issue (see section 4.23), the Fisheries Division has, in the past, collaborated with the U. S. Embassy to host training workshops for fishers, trawl owners, wildlife enforcement staff, and the Coast Guard. Training exercises were also conducted on enforcement related exercises with Police Service resource personnel. Training, promoted and sponsored by the Government, should be ongoing.

The positive and sustained participation of the artisanal fishing community, especially pertaining to coastal gill nets, has demonstrated the willingness of fishers to participate in conservation research and advocate for livelihood options aimed at eliminating sea turtle bycatch (Eckert and Eckert, 2005; Gearhart and Eckert, 2007). Other types of research (e.g., biotelemetry, behavioral studies) can also involve fishers directly, and these also have positive educational value.

4.43 Tourists

The sale of shells and tortoiseshell items made from hawksbill turtles (sections 3.3, 4.31; Table 4), while greatly reduced from past levels, is still aimed at tourists. It is important that visitors be made aware of laws regulating commerce in the parts and products of protected species. **It is, therefore, a recommendation of this Recovery Action Plan that notices be placed in the arrival and departure lounges of Piarco International Airport in Trinidad and Crown Point International Airport in Tobago, as well as in cruiseship ports and popular yacht arrival bays, to alert arriving tourists about regulations concerning possession and transport of protected wildlife species (including all species of sea turtles), and that law-abiding vendors be encouraged to display WIDECAST's "Certificate of Pride", which identifies the vendor as not selling sea turtle products.**

Tourist-oriented magazines and other relevant periodicals should carry regular features on wildlife law, which can be presented in a way that both informs and entertains the visitor. Trained guides (e.g., operating at Caroni Swamp, Asa Wright Nature Center, Buccoo Reef Marine Park, Matura Beach/Fishing Pond Prohibited Areas, Grande Riviere) come into regular contact with tourists and should make it a priority to educate tourists about wildlife laws.

In addition to alerting tourists to the threat posed to sea turtle populations by the shell and shell product trade, visitors should be made aware of the detrimental effects on important sea turtle habitat that arise from activities generally associated with coast- and marine-based tourism (e.g., irresponsible/inexperienced divers, indiscriminate anchoring, beach and nearshore litter, "joy-riding" on sandy beaches, noise and lights on nesting beaches, harassment of sea turtles, etc.). Such damage may be reduced if tourists were more aware of the implications of their actions.

It is a recommendation of this Recovery Action Plan that every effort be made to solicit the support of the tourism industry in properly educating tourists. Beachfront hotels should set an example by modifying lighting so as not to disorient nesting and hatching turtles, keeping nesting beaches clear of lounge chairs and other obstacles, and enforcing rules of turtle watching etiquette on hotel beaches. Attractive and educational sea turtle brochures should be available in hotel rooms, dive shops, and other relevant locales. Members of the WIDECAST network in Tobago give weekly audio-visual presentations on sea turtle biology, conservation, and "watch etiquette" at selected hotels during the nesting season; this type of outreach is encouraged.

It is a recommendation of this Recovery Action Plan that in cases where hotel security staff are actively involved in the enforcement of rules of conduct on turtle nesting beaches, they be granted the appropriate authority to ensure that national wildlife laws and policies are not violated. Security staff should be considered when the Wildlife Section is selecting persons to participate in the Honourary Game Warden programme under the Conservation of Wild Life Act. At present it is difficult for hotel staff to discipline unruly tourists gathering to observe nesting turtles. The seriousness of this situation should not be underestimated, and every effort should be made to empower hotel staff in tactfully controlling paying guests. Because the predictable arrival of egg-laying females on hotel beaches represents an enormous marketing advantage, a 'no tolerance' policy *viz* harassment is both imperative and strategic. Relevant recommendations are provided in Choi and Eckert (2009).

4.5 Increase Information Exchange

4.51 Exchange of information among local groups

The preparation and publication of this Recovery Action Plan, including its earlier drafts, has significantly advanced the exchange of information about the sea turtles of Trinidad and Tobago, as it has given all groups a common basis of knowledge and a common set of management and conservation recommendations from which to base their field activities, their outreach, and their individual and collective advocacy. Notwithstanding the significance of this document in advancing our knowledge of sea turtle conservation and management needs, there is a clear consensus that a mechanism for greater exchange of information is needed. UNDP (Port of Spain) developed a *TRINBAGOTURTLES* listserv in February 2001 to facilitate such exchanges but, with the retirement of its convener, the listserv faded. Natural resource agencies on both islands, as well as a number of NGOs and CBOs are specifically involved with sea turtles on a regular basis, and a readily accessible electronic communication mechanism would be very useful.

Recognising that a lack of regular information exchange among Government agencies, conservation practitioners, resource users and coastal land owners is an impediment to effective management and conservation action, **it is a recommendation of this Recovery Action Plan that: (i) every advantage be taken to share information and (ii) Government agencies coordinate with each other to maximise the expertise and resources that can be brought to bear on conservation challenges and implementation actions.** Information venues include the national print and audiovisual media, community newsletters, national and local radio, cultural celebrations, civic group meetings, community-level meetings, interagency meetings, listserves, and scientific conferences.

4.52 Workshops on research and management

It is a recommendation of this Recovery Action Plan that all field personnel be regularly updated concerning the nation's research and management priorities, including basic implementation skills. Training should include basic biology and ecology of sea turtles, species identification (based on observation of a live turtle, a hatchling, an egg, or a crawl on the beach), beach etiquette, beach patrol methodology, record-keeping and database management, and technical skills as needed (e.g., tagging, moving eggs, aerial surveys). Refresher courses should be convened annually by the Government, Turtle Village, or other relevant authorities to ensure that field personnel and community co-management partners are up-to-date in areas of law enforcement, management techniques and reporting, tour guiding, and other programme skills. In addition, the Fisheries Division and THA should convene such workshops as are necessary to provide the fishing community with current information and management skills; e.g., sea turtle resuscitation, use of conservation gear technologies (e.g., TEDs), sea turtle handling, reporting.

Regular exchanges should be organised between beach patrollers and data collectors to ensure continuity of methodology and reporting. Researchers, both local and foreign, should be required to actively involve local community members and relevant Government personnel in any field research permitted by the Government; sufficient training of local partners should be provided by the researcher. To promote networking and harmonised data collection among range States, WIDECASST can often arrange opportunities for peer-exchanges with field projects elsewhere in the Wider Caribbean.

4.53 International Scientific and Technical Meetings

The importance of participating in regional and international forums focusing on sea turtle issues cannot be overemphasized. The Republic of Trinidad and Tobago participated in the first (Chu Cheong, 1984) and second (Nathai-Gyan, 1987) Western Atlantic Turtle Symposia (WATS). Trinidad and Tobago was a valued participant in the November 1999 regional meeting, "Marine Turtle Conservation in the

Wider Caribbean Region: A Dialogue for Effective Regional Management held in Santo Domingo, Dominican Republic” (Eckert and Abreu Grobois, 2001). Trinidad and Tobago also participated in the First CITES Wider Caribbean Hawksbill Dialogue Meeting in Mexico in 2001, as well as the second such meeting in the Cayman Islands in May 2002 (www.cites.org/eng/prog/HBT/intro.shtml). Local biologists often attend the international Sea Turtle Symposium (www.seaturtlesociety.org/) and WIDECAST’s annual meeting (www.widecast.org/What/AnnualMeeting.html); continued participation in these professional forums is encouraged. **It is a recommendation of this Recovery Action Plan that emphasis be placed on maintaining regional ties with range State colleagues, and that every opportunity be taken for sea turtle workers to participate in international technical meetings.**

4.54 WIDECAST

The Wider Caribbean Sea Turtle Conservation Network (WIDECAST, <http://www.widecast.org>) is a regional network of experts affiliated with the UNEP Caribbean Environment Programme and comprised of Country Coordinators resident in more than 40 Caribbean nations and territories, including Trinidad and Tobago. Our national WIDECAST coordinators are Mr. Stephen Poon (Wildlife Section-Forestry Division, poon_st@hotmail.com), Mr. Dennis Sammy (Nature Seekers, dennispsammy@gmail.com), Ms. Tanya Clovis (SOS Tobago, tanyaclovis@gmail.com), and Ms. Angela Ramsey (DNRE/THA, angelapr1@yahoo.com). Former WIDECAST Country Coordinator Kenneth Fournillier (then with the Wildlife Section-Forestry Division) expertly guided several earlier drafts of this document.

It is a recommendation of this Recovery Action Plan that sea turtle researchers, community-based project participants, policy-makers, educators and others stay connected to the region’s sea turtle science through this unique network, which has contributed so much to our country for so many years. Among the primary project outputs of this network are Sea Turtle Recovery Action Plans (STRAP), developed under the aegis of the UNEP Caribbean Environment Programme, for each of more than 40 government regions, including Trinidad and Tobago, in the Wider Caribbean. Each STRAP is tailored specifically to local circumstances and provides the following information:

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

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

- Implementing WIDECAST through resident Country Coordinators
- Utilising local network participants to collect information and draft, with the assistance of regional sea turtle experts, locally appropriate sea turtle management recommendations

- Providing or assisting in the development of education and outreach materials
- Sponsoring or supporting local or subregional workshops on sea turtle biology and management
- Assisting governments and NGOs with the implementation of science-based management and conservation programmes for turtles

Beyond supporting the local and national efforts of governments and NGOs, 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 organisations, government personnel, divers, fishermen, teachers, restaurant owners, hoteliers, and other concerned citizens have been actively involved in WIDECAST for more than two decades.

4.55 IUCN/SSC Marine Turtle Specialist Group

The Marine Turtle Specialist Group (MTSG) of the World Conservation Union's (IUCN) Species Survival Commission (SSC) was founded in 1966 in response to a growing recognition of the endangered status of marine turtles. The Group, as part of its mission, develops, supports, and implements programmes "which promote the restoration and survival of healthy marine turtle populations that fulfill their ecological roles." The Group is a valuable source of information on sea turtle biology, management (e.g., Eckert et al., 1999), conservation and policy. For further information, contact Dr. F. Alberto Abreu G., Latin America/Caribbean Vice-Chair, IUCN/SSC Marine Turtle Specialist Group at Universidad Nacional Autónoma de México in Mazatlan, Sinaloa (abreu@servidor.unam.mx).

4.56 Marine Turtle Newsletter

The Marine Turtle Newsletter (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 MTN is presently received by Fisheries Officers on both islands, the Wildlife Section-Forestry Division, Institute of Marine Affairs, University of the West Indies (Zoology), Caribbean Epidemiology Center, Eastern Caribbean Institute of Agriculture and Forestry, U. S. Embassy (Economic and Commercial Affairs), and a large number of NGOs and interested individuals. The newsletter is published quarterly in English and Spanish and is available electronically at <http://www.seaturtle.org/mtn>.

4.6 Implement a National Sea Turtle Conservation Programme

4.61 Rationale

Five of the six species of sea turtle found in the Caribbean Sea are encountered in Trinidad and Tobago. Two species (the loggerhead and the olive ridley; see section II) are very rare, and all but the leatherback appear to have sustained noticeable declines. These five species, and a sixth (Kemp's ridley) which is confined to the northern latitudes of the region, are variously classified as Endangered or Vulnerable throughout their global ranges (www.iucn-redlist.org) and are protected by various treaties (see section 4.32). Domestically, however, an unmonitored, open access sea turtle fishery operational during an annual open season has been a part of life in Trinidad and Tobago for more than three centuries.

The purpose of this Recovery Action Plan has been to compile what is known about these ancient creatures in our country, and to chart a course forward. It summarises the distribution and abundance of sea turtles, documents contemporary survival (and habitat) threats, evaluates existing management stra-

tegies (including community-based conservation initiatives), and provides resource and habitat management recommendations. Based on this information, the goals and objectives of a national Sea Turtle Conservation Programme are herein articulated.

The Sea Turtle Conservation Programme is envisioned as lending impetus to training personnel, collecting baseline data on nesting and foraging assemblages by, *inter alia*, investing in long-term population monitoring programmes, establishing mechanisms to safeguard critical nesting and feeding habitats, encouraging the participation of rural communities and the general public in sea turtle conservation actions, strengthening and modernizing the regulatory framework, and evaluating sustainable alternatives to consumptive practices. In addition to the sea turtles, expected beneficiaries include the tourism, fisheries, and resource management sectors, as well as all nationals.

4.62 Goals and objectives

The goal of the National Sea Turtle Conservation Programme is to promote informed and inclusive decision-making, proactive management and sustainable use, and modern scientific investigation in order to prevent the extirpation and realize the sustained recovery of sea turtle populations in Trinidad and Tobago. With this in mind, a Priority-Setting Workshop was convened by the Wildlife Section-Forestry Division on 30 April 2010. Participants⁴ defined and then, by means of a standard pair ranking exercise⁵, ranked ten core programme objectives. The tally clearly articulated five objectives which are largely action-oriented (°), followed by five objectives which are more institutional and regulatory in nature (•):

- Safeguard important habitat (e.g., nesting, foraging), including development of area-specific management plans that address specific threats (e.g., lighting, debris and pollution, poaching)
- Reduce and eliminate bycatch and other unintended mortality to sea turtles
- Ensure sufficient funding for sea turtle management and conservation
- Collect data sufficient for the management and sustained recovery of sea turtle populations (e.g., critical habitat, population trends, threats)
- Create, implement (fund) a structured, holistic national education programme that communicates stakeholder benefits (e.g., cultural, monetary, ecosystem services) resulting from strong conservation policies
- Promote progressive, sustainable CZM policies (e.g., oil/gas, coastal hotels, cruiseships), including monitoring and compliance to the benefit of biodiversity
- Formalise and actuate co-management agreements with communities
- Modernise the regulatory framework: harmonize legislation, close the open season, emphasize enforcement (land, sea), increase fines for offenses
- Create a national coordination mechanism (e.g., interagency task force for sea turtle policy)
- Create strong civil commitment to advocacy/activism for policy change

⁴ Stephen Poon, Chair; Atherley Harry and Avisha Mohan (Wildlife Section-Forestry Division), Nerissa Lucky (Fisheries Division), Dennis Sammy (Nature Seekers), Lori Lee Lum (Institute of Marine Affairs), Michelle Cazabon-Mannette (Turtle Village Trust), Len Peters (Grande Riviere Nature Tour Guide Association), and Dr. Karen Eckert (WIDECAS); colleagues from the Environmental Management Authority (EMA) and from Tobago were invited but could not attend.

⁵ A round-robin tournament technique by which every item in the list is compared to every other item according to a single criterion (in this case, “between these two priorities, which would you do first?”), and the final ranking emerges from a simple tally of the number of wins.

4.63 Activities

Through several rounds of national-level peer-review, the following activities have been proposed to meet the stated goals and objectives. Of necessity, these statements are general in their nature. As there are many agencies and organisations already involved in sea turtle conservation in Trinidad and Tobago, and each can contribute in meaningful ways to multiple activities, we leave it to the collective capacity of the National Sea Turtle Task Force (under the aegis of EMA) to work closely with all relevant sectors to ensure that all priorities are met, and that the activities of all participating groups are integrated toward the common goal.

Institutional Capacity

1. Assemble and empower a National Sea Turtle Task Force to oversee and coordinate sea turtle research and conservation activities, and to give strength and voice to advocacy. The Task Force should be large enough to fairly represent key interests, but small enough to promote efficiency. The relevant agencies of Government (*inter alia* EMA, Fisheries, Forestry, Parks and Wildlife, Town and Country Planning, Ministry of Foreign Affairs, Tobago House of Assembly) should be represented. Also represented should be IMA, community groups engaged in co-management with Government, national NGOs with current involvement in sea turtle conservation, University of the West Indies, the hotel/tourism sector, and a WIDECAST representative.
2. Designate a Lead Agency for the National Sea Turtle Conservation Programme, giving equal attention to sea turtles and their habitats in Tobago. Appoint/hire a National Sea Turtle Co-ordinator. Manage a national listserve to maximize communication among stakeholders.
3. Endorse and support the established National Sea Turtle Database and efforts by the Data Manager to oversee the development of standard, national data record sheets for at-sea sightings and beach patrols. (Data collected by specific projects may vary, but all projects should collect compatible baseline information.) The development of negotiated data use agreements should be viewed as a priority.
4. Strengthen the Government's ability to conserve the nation's sea turtles by nurturing additional co-management initiatives with rural community partners (see section 4.26 and Appendix III).
5. Strengthen community co-managers' abilities to conduct scientifically sound field work by assisting these groups with financial planning and fund raising, governance and organisational structure, research priorities and field technique, and data collection and reporting.
6. Encourage and facilitate the participation of employees and volunteers in localised, national and regional training programmes, research projects (including exchange initiatives with projects in neighboring countries), and scientific meetings and symposia.
7. Organise workshops targeting fishermen (including spear fishermen), relevant communities, and coastal landowners, including hoteliers, to inform them of the current state of knowledge of sea turtle biology and conservation, to introduce the Sea Turtle Recovery Action Plan, and to request their expertise, assistance, and support on behalf of sea turtle conservation measures.

8. Conduct on-site demonstrations for planners, developers and architects to reinforce “sea turtle friendly” recommendations proposed in this Recovery Action Plan.

Research and Management

9. Conduct an assessment of the ecological and economic values of sea turtles to the country. Seek to preserve these through the development (and implementation) of holistic management plans that take into account the specific recommendations of this Recovery Action Plan and encourage active participation on the part of resource users.
10. Implement a long-term population monitoring programme on at least six Index Beaches (see section 4.25), four in Trinidad and two in Tobago. Determine species composition, distribution and timing of the annual nesting season, nest density and hatch success at these sites.
11. Mandate control zones (such as has been done at Matura Beach) on high visitation beaches to exclude foot traffic, thereby providing an essential comparison between ecotourism and natural sites and allowing for an evaluation of the effects of ecotourism on sea turtle nesting and hatch success.
12. Continue support to the turtle tagging programme on Index Beaches to increase understanding of inter-nesting frequencies, rates of exchange among nesting beaches, and remigration intervals, ensuring that data is archived in the National Sea Turtle Database (see Section 4.33). Encourage fishermen who have captured turtles incidentally to their fishing activities to submit tags (taken from dead turtles) to the database Manager.
13. Identify foraging grounds and determine the distribution, abundance and trend of turtles at sea over five consecutive years using *inter alia* sightings data collected from marine patrol officers, fishermen, and dive operators, as well as information collected through research.
14. Expand capture-tag-release-recapture studies at important foraging sites to gain insight into residency patterns, offshore movement, growth and age at maturity, and use modern biotelemetry tools to increase understanding of local and international movements, including the intersection of turtle habitat(s) with localised and international fisheries.
15. Using genetic research, determine stock origin for all major nesting and foraging assemblages in Trinidad and Tobago. Collaborate with experts in sampling and interpretation; publish results.
16. Design and distribute a Field Techniques Manual to complement this Recovery Action Plan which describes in detail how to conduct beach surveys, complete sightings data forms, tag turtles, protect nests, report violators, submit annual reports, and other related activities.

Regulations and Revenue

17. Implement a moratorium on the take of sea turtles until such time as data are available to define a sustainable fishery. Strengthen the regulatory framework, including coastal zone planning and protected areas legislation, based on recommendations put forward in this Recovery Action Plan.

18. Monitor the capture and sale of turtle products, emphasising regular survey and monitoring of landing sites, as well as formal and informal marketing outlets. Based on these data, quantify the legal and illegal annual exploitation of sea turtles.
19. Engage stakeholders (fishermen, artisans, vendors) in discussions of viable alternatives to the sea turtle harvest. Evaluate sustainable, non-consumptive means to generate revenue from sea turtles, including ecotourism and tour guiding. Support those means that appear promising.
20. After a publicised grace period, confiscate any remaining commercial inventory of sea turtle products (mainly tortoiseshell items marketed to tourists). Feature these items in educational displays at major ports of entry, reminding visitors not to purchase sea turtle products.
21. Establish and enforce standard regulations for construction and development at nesting beaches. See sections 4.13 and 4.14 for details (see section 4.123 for a summary).
22. Establish and enforce standard regulations for nighttime visitation to nesting beaches and tour guiding at sea, utilizing lessons learnt from more than a decade of experience at Matura, Fishing Pond and Grande Riviere
23. Establish a national system of marine protected areas, and a national system of moorings to protect coral reef and seagrass habitat.
24. Increase the effectiveness of law enforcement by increasing the numbers of trained personnel, cultivating media attention, and promoting greater community involvement. Investigate the feasibility and desirability of employing fishermen as community-based Deputies to enforce Fisheries regulations. (Such a programme might be modeled after the Forestry Division's Honourary Game Warden programme.)
25. Ensure that fines and other penalties are adequate to serve as effective deterrents.

Public Awareness and Participation

26. Enhance public awareness of the need for sea turtle conservation by designing and distributing educational materials for adults and children, as well as relevant sectors, including fisherfolk, tourists, coastal landowners and developers.
27. Initiate a national public awareness campaign making use of posters, brochures, media events, school and library programming (including a national quiz competition), narrated slide shows, video productions, etc. The campaign will be targeted at specific sectors of society, including fishermen, rural audiences, divers and yachters, coastal planners and developers, and visitors; as well as to the general public.
28. Assist hotel staff with training and educational materials to encourage their own and visitor participation in sea turtle monitoring and conservation activities.
29. Lend market visibility to restaurants and retail outlets that do not sell sea turtle products. One component of this effort could be a "certificate of pride" issued to stores who neither carry nor promote such products.

30. Train teachers in the use of sea turtle-focused classroom materials, and encourage and support the participation of educators in local research and conservation, as well as in international sea turtle conferences and workshops.

4.64 Results and Outputs

As a result of the implementation of a National Sea Turtle Conservation Programme, the goal of promoting “informed and inclusive decision-making, proactive management, and modern scientific investigation” (see section 4.62) will be met. With more precise data on the numbers of turtles nesting, number of hatchlings released, and the numbers of turtles killed; the distribution of important nesting and foraging sites; and an inventory of priority threats and potential solutions, decision-making and management will become more focused and effective. With a national Sea Turtle Management Committee in place, the implementation of the Turtle Village concept, an inclusive National Sea Turtle Database, and a national listserv, the benefits of increasing training and knowledge will be made available nation-wide. In addition, as employees and volunteers active in the Programme receive ongoing training in sea turtle conservation and management, the nation’s ability to wisely conserve remaining stocks – within the context of a modernised legal framework – will increase. Efforts at public awareness will enhance resident and visitor understanding of, and participation in, sea turtle conservation in Trinidad and Tobago. As a result, the country will enjoy rising populations of sea turtles available to fulfill their full potential as ecological and economic resources.

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Figure 1. Geographic location of the Republic of Trinidad and Tobago in the southern Caribbean Sea.

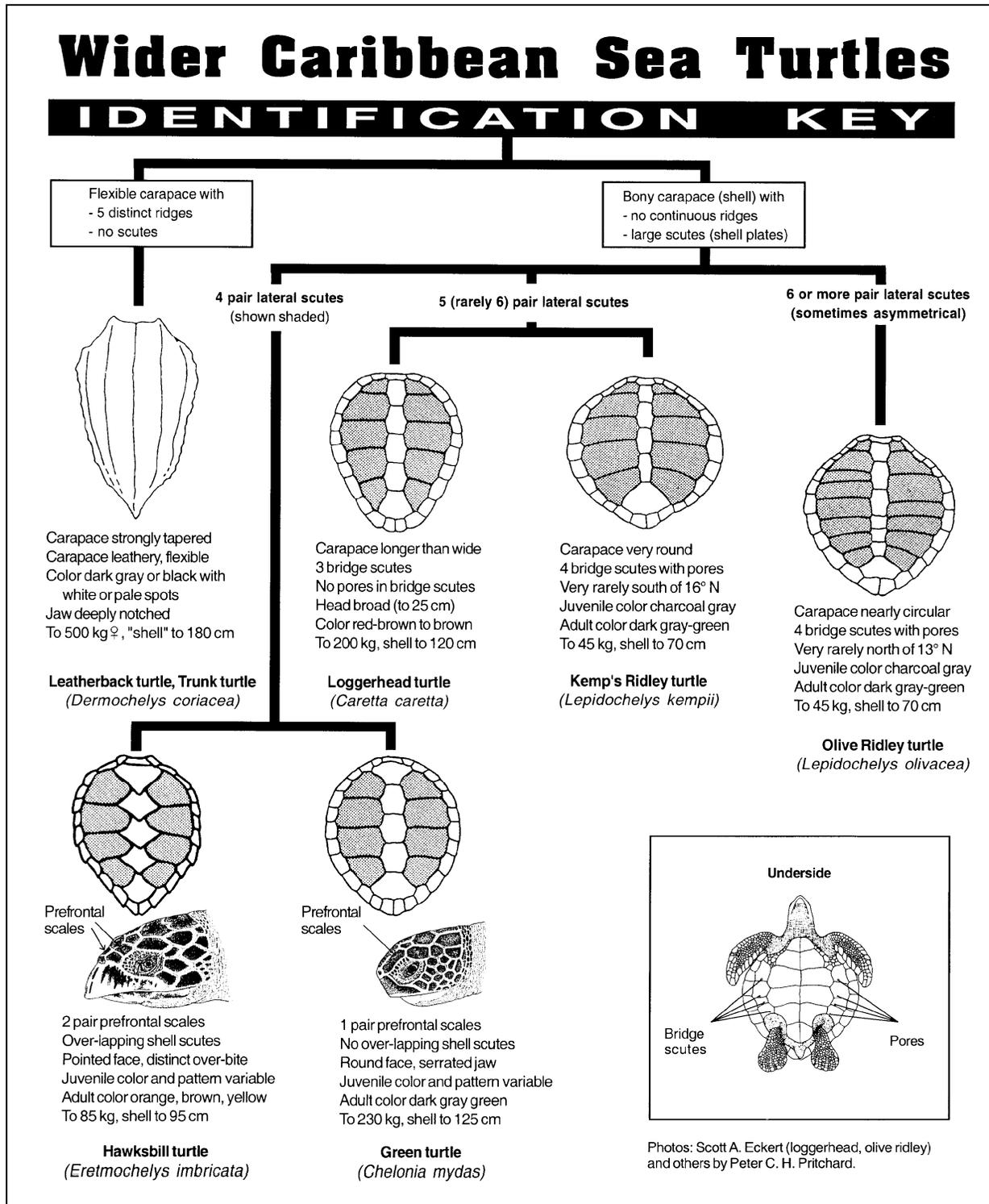


Figure 2. An identification guide to sea turtles in Trinidad and Tobago, with the exception of Kemp's ridley (*Lepidochelys kempii*) which is not known to occur in the Republic. Source: WIDECAS (1992).

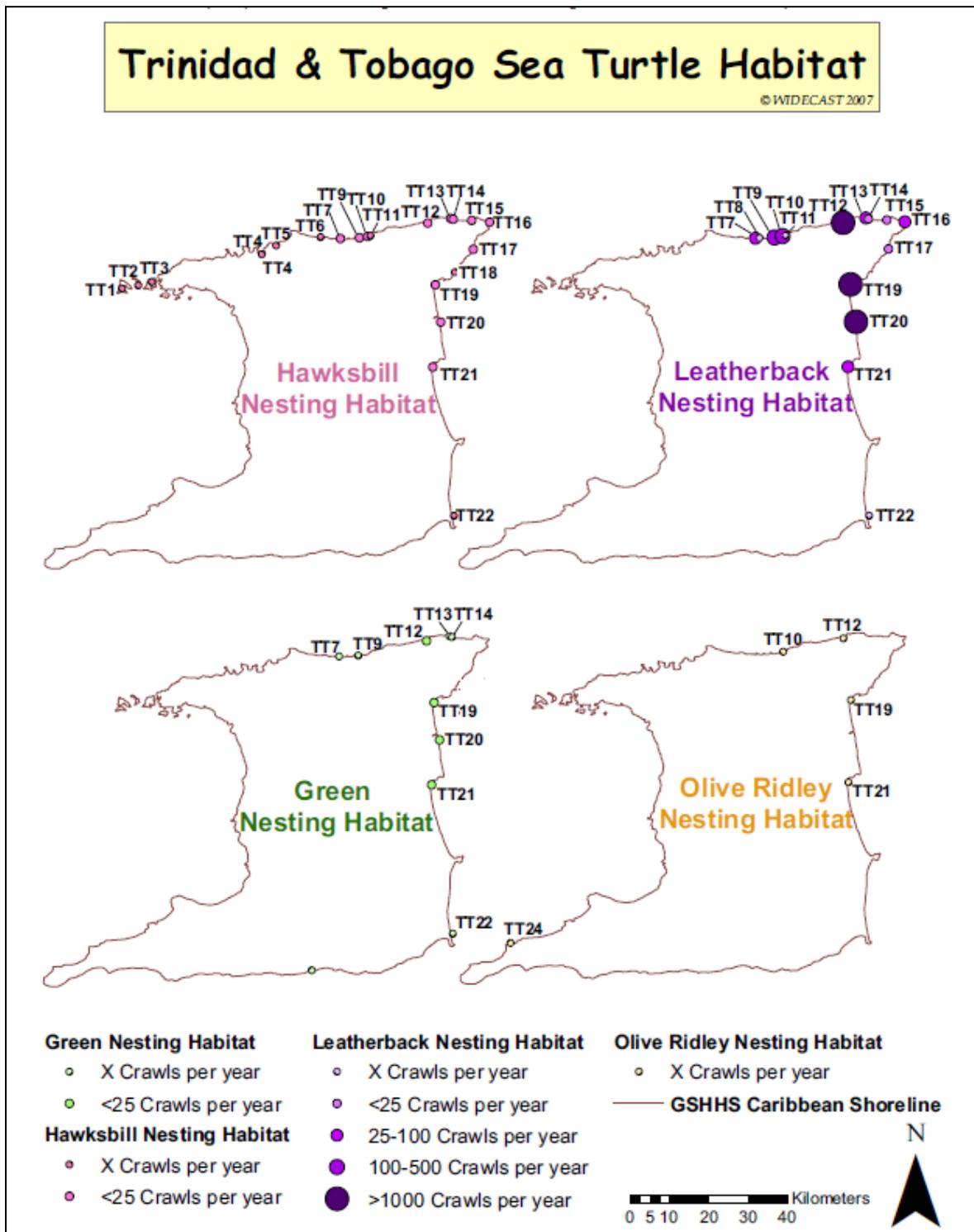


Figure 3a. Nesting by four species of sea turtle in Trinidad (for a key to the numbered nesting beaches, see Figure 3c). Source: Dow et al. (2007), online at <http://seamap.env.duke.edu/widecast/>

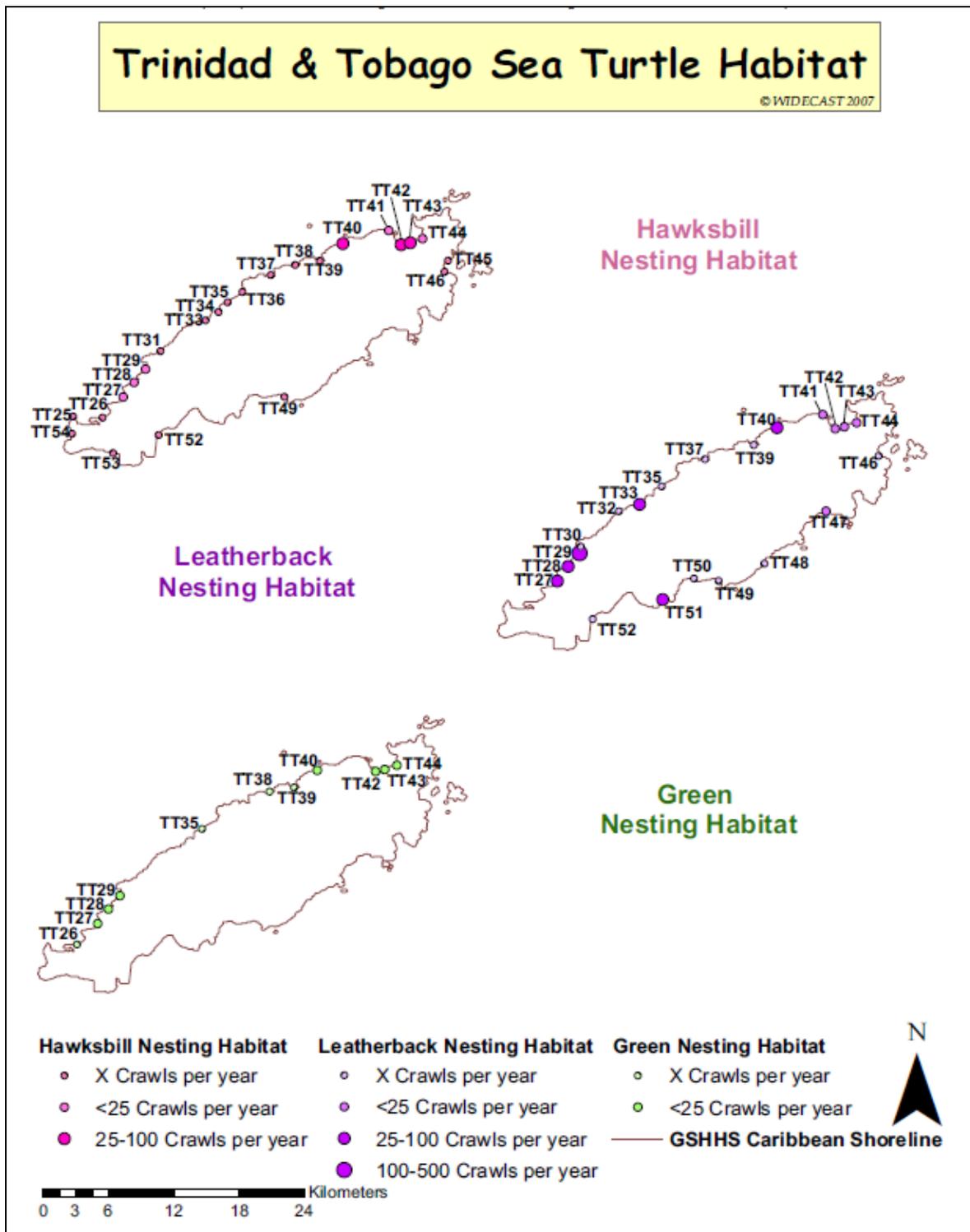


Figure 3b. Nesting by three species of sea turtle in Tobago (for a key to the numbered nesting beaches, see Figure 3c). Nesting by olive ridley turtles is not confirmed in Tobago. Source: Dow et al. (2007).

Trinidad & Tobago Sea Turtle Habitat

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Beach Identification Codes with Beach Names			
TT1	Chacachacare	TT28	Grafton Beach (Stone Haven Bay)
TT2	Huevos Island	TT29	Turtle Beach (Great Courland Bay)
TT3	Monos Islands	TT30	Back Bay (Plymouth)
TT4	Maracas Bay	TT31	Amos Vale
TT5	Las Cuevas Bay	TT32	Culloden Bay
TT6	Blanchisseuse Bay	TT33	King Peters Back Bay (Cotton Bay)
TT7	Paria Bay	TT34	Gordon Bay
TT8	Murphy Bay	TT35	Celery Bay
TT9	Grand Tacaribe	TT36	Emerald Bay - Castara Bay
TT10	Madamas Beach	TT37	Englishmen's Bay
TT11	Cachipa	TT38	Parlatuvier Beach (Erasmus Cove)
TT12	Grand Riviere	TT39	Bloody Bay
TT13	Sans Souci	TT40	L'Anse Fourmi Beach
TT14	Big Bay	TT41	Man O War
TT15	Mission Bay	TT42	Hermitage
TT16	Toco Bay	TT43	Cambleton
TT17	No Head Beach	TT44	Pirate's Bay (Charlotteville)
TT18	Balandra Bay	TT45	Anse Bateau
TT19	Matura Beach	TT46	Speyside
TT20	Fishing Pond	TT47	Roxborough Beach
TT21	Manzanilla Beach - Cocos Bay	TT48	Goldsborough Beach
TT22	Mayaro Bay	TT49	Barbados Bay
TT23	Moruga	TT50	John Dial Beach (Hope)
TT24	Cedros - Granville Beach	TT51	Minister Bay -Bacolet
TT25	Pigeon Point	TT52	Little Rockley Bay
TT26	Buccoo Bay	TT53	Kilygwyn Bay
TT27	Rocky Point (Mt. Irvine Back Bay)	TT54	Swallows Bay - Milford Bay

Figure 3c. Key to the nesting beaches identified in Figure 3a (Trinidad) and Figure 3b (Tobago). Source: Dow et al. (2007), online at <http://seamap.env.duke.edu/widecast/>

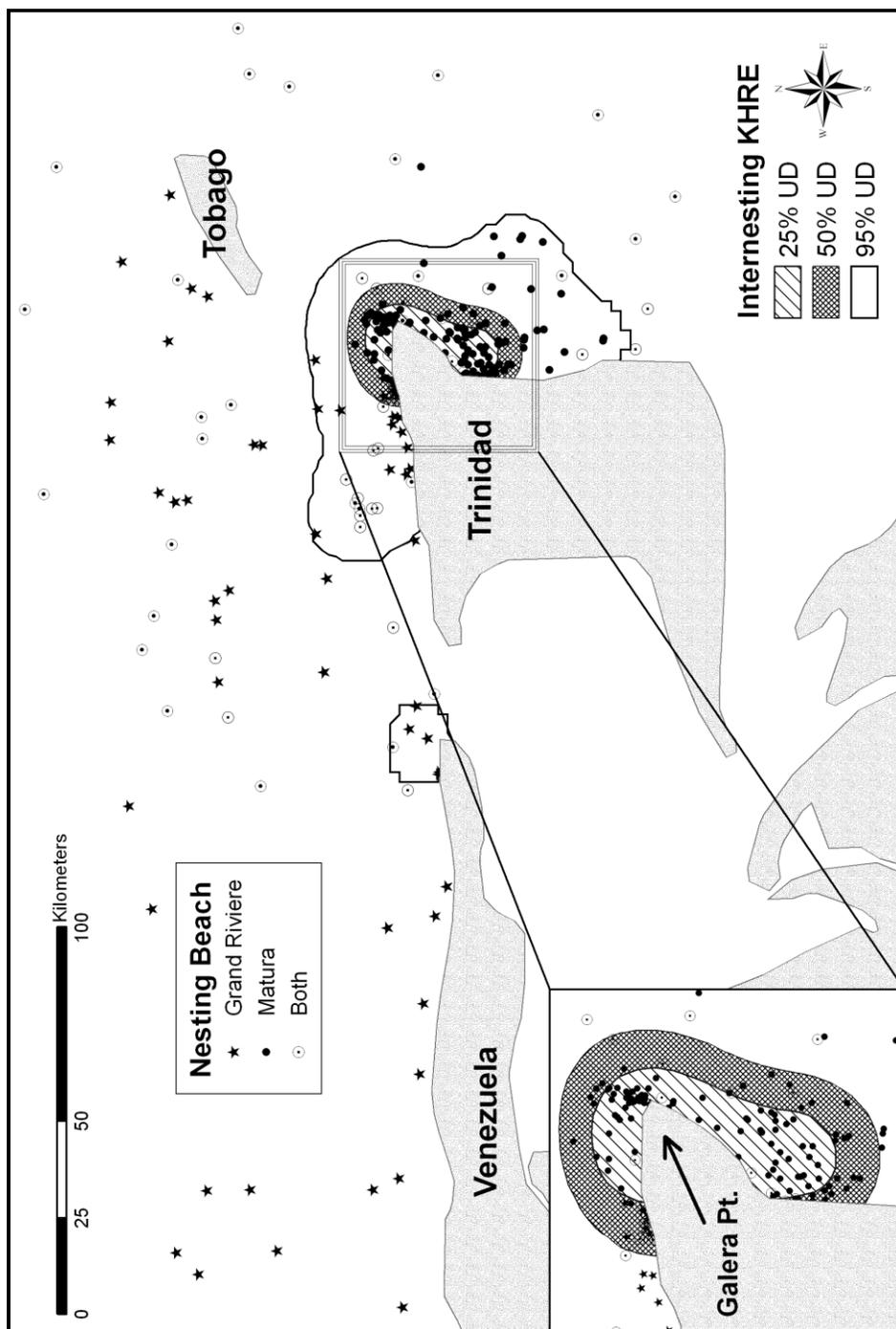


Figure 4. Leatherback inter-nesting habitat use areas delineated by Kernel-Home Range estimation for 9 adult females in Trinidad. Point locations are coded by where the turtles nested, either Grande Riviere on north coast, Matura Beach on east coast, or both. Primary inter-nesting usage areas extended from nesting beaches toward Galera Point, an important residence area. Source: Eckert (2006).

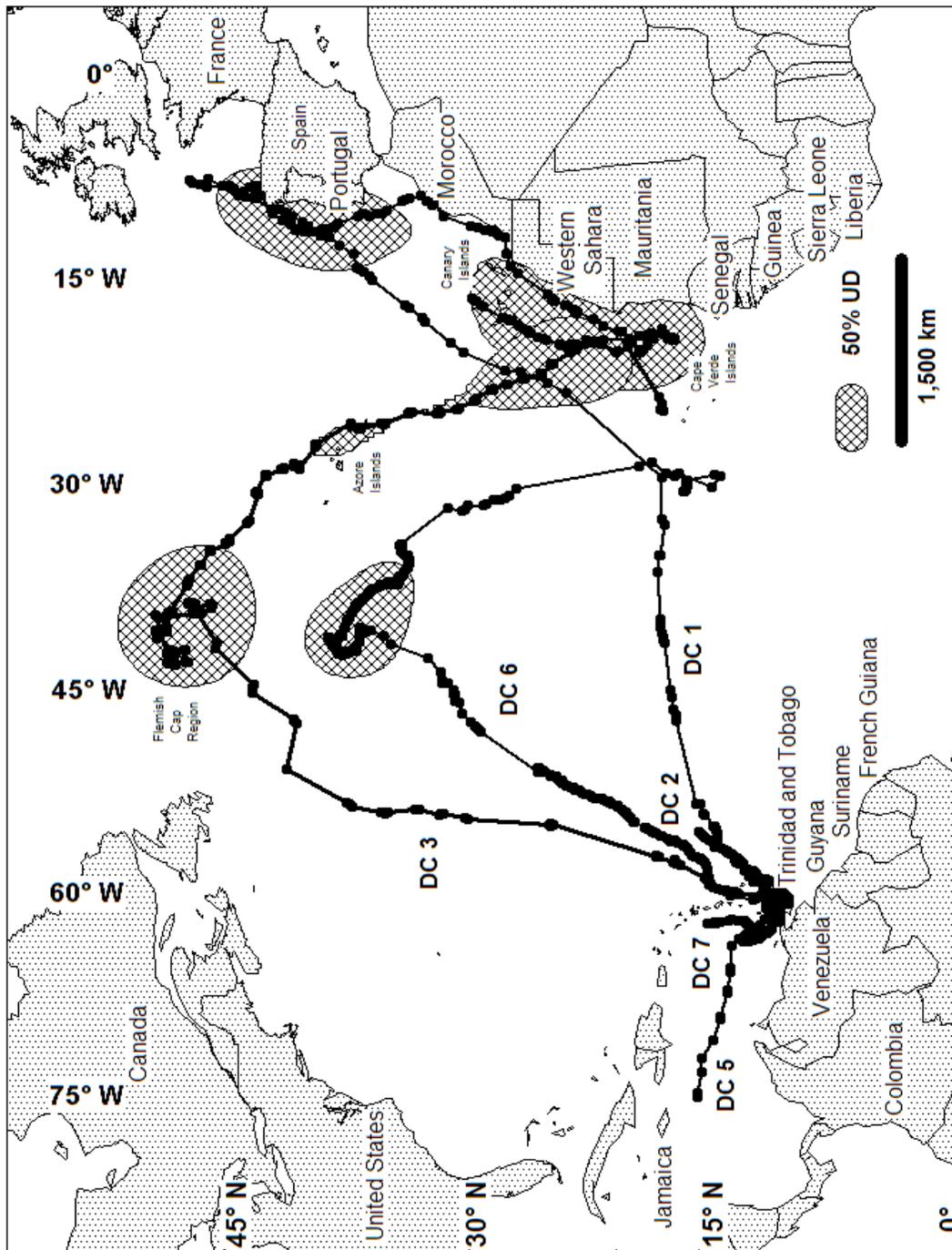


Figure 5. Post-nesting movements by six leatherback turtles after nesting at Matura Beach, Trinidad, and monitored by satellite telemetry. High use or foraging areas delineated using 50% utilization distribution (UD) of Kernel Home Range estimation. Three high-use, high-latitude and one low-latitude area were described. Source: Eckert (2006).

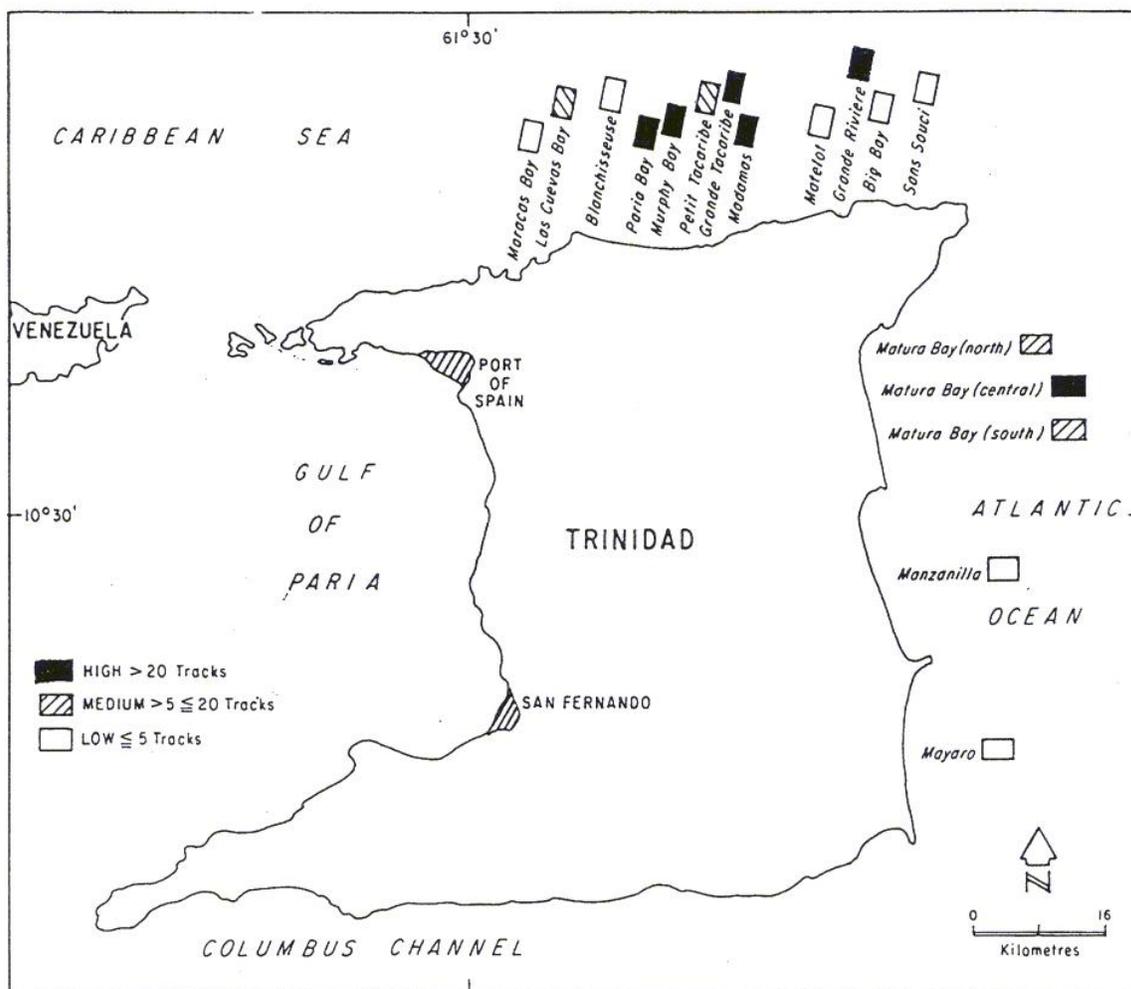


Figure 6. Relative density of leatherback nesting track as determined from aerial surveys between June and September 1982, and between March and August 1983. Source: Chu Cheong (1995).

Table 1. Sea turtles tagged while nesting in Trinidad and Tobago, 1970-1980 (no tagging in 1974). Tagging occurred during aperiodic beach patrols by members of the Field Naturalists' Club during the annual nesting season. Source: Field Naturalists' Club of Trinidad and Tobago, unpublished data.

Year	Species	Tagged	Beach	Comments
1970	Leatherback	16	Matura	6 renested [1], 1 killed [2]
	Olive ridley	1	Matura	
	Loggerhead	1	Las Cuevas	
1971	Leatherback	18	Matura	2 renested
1972	Leatherback	22	Matura	4 renested, 2 killed
		9	Las Cuevas	1 renested
1973	Leatherback	15	Matura	4 renested, 2 killed
1975	Leatherback	70	Matura	22 renested
		2	Las Cuevas	
	Hawksbill	64	Gr. Tacarib	18 renested, 1 killed
1976	Leatherback	3	Matura	1 renested
		1	Las Cuevas	
		15	Gr. Tacarib	
1977	Leatherback	53	Matura	3 renested, 1 killed
		4	Gr. Tacarib	
		1	Great Courland Bay, Tobago	
1978	Leatherback	11	Matura	1 renested
		5	Gr. Tacarib	
1979	Leatherback	8	Matura	
		4	Gr. Tacarib	
1980	Leatherback	5	Matura	
		5	Gr. Tacarib	

[1] In all cases, reneesting refers to subsequent sightings during the year in which the turtle was tagged; [2] In all cases, this refers only to tagged turtles known to have been killed, not the total number of carcasses.

Table 2. Turtle fishery statistics by depot, 1969-1980; total kg (lb in parentheses) of turtle meat handled by the depot is listed. Source: Chu Cheong (1995); data courtesy of the Fisheries Division. [*Note:* Bacon (1973a), referring to the 1969-1971 data, wrote, "These figures must be treated with great caution; their value as fishery statistics is negligible. They represent only a small percentage of the turtle meat actually sold in the country as most of this does not pass through any formal market. Furthermore, turtle meat is sold on many more beaches than those listed." We, as did Bacon before us, consider these data to be minimum estimates in the absence of more complete information. See section 3.3 for a complete discussion.]

Depot	1969	1970	1971	1972	1973	1974
<u>Trinidad</u>						
Matelot	--	10.4 (23)	--	995.1 (2194)	--	72.5 (160)
Mayaro	--	--	893.1 (1969)	1109.0 (2445)	154.6 (341)	349.6 (771)
Orange Valley	--	--	--	--	--	--
Iacos	83.0 (183)	--	--	--	--	--
Gran Chemin	--	--	1421.1 (3133)	341.1 (752)	426.8 (941)	3470.4 (7651)
San Fernando	--	22.6 (50)	19.9 (44)	204.5 (451)	--	90.7 (200)
Carenage	5244.9 (11563)	3942.2 (8691)	4293.3 (9465)	4061.0 (8953)	3011.4 (6639)	1340.8 (2956)
<u>Tobago</u>						
Castara	--	185.9 (410)	13.6 (30)	--	249.4 (550)	--
Man-O-War	--	31.7 (70)	--	--	--	--
Speyside	--	--	131.5 (290)	18.1 (40)	--	138.3 (305)
TOTAL (kg):	5327.9	4193.0	6772.5	6729.1	3842.3	5462.6

Table 2, *continued*.

Depot	1975	1976	1977	1978	1979	1980
<u>Trinidad</u>						
Matelot	--	659.9 (1455)	108.8 (240)	112.0 (247)	--	--
Mayaro	167.8 (370)	--	--	--	--	--
Orange Valley	--	--	47.1 (104)	--	--	--
Iacos	--	--	--	--	--	--
Gran Chemin	2391.3 (5272)	--	--	--	--	--
San Fernando	220.9 (487)	--	--	--	--	--
Carenage	3321.2 (7322)	3443.2 (7591)	2411.7 (5317)	3068.1 (6764)	--	--
<u>Tobago</u>						
Castara	--	--	--	--	--	--
Man-O-War	--	--	--	--	--	--
Speyside	18.1 (40)	--	--	--	--	--
TOTAL (kg):	6119.4	4103.2	2567.8	3180.1	3836.0	7251.2

Table 3. Records of live leatherback turtles and carcasses on beaches in North and East Trinidad, 1983-1992. Patrol days in parentheses. “Random qualitative assessments of all beaches suggested that the problem of slaughters was much higher than these figures revealed, as there were reports that carcasses were also being dragged out to sea to eliminate tell-tale signs.” Source: James and Fournillier, 1993.

Beach	Total live turtles / carcasses									
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Matura	5/0 (13)	69/8 (33)	166/11 (34)	57/0 (18)	99/1 (20)	101/3 (14)	20/0 (4)	52/3 (22)	112/2 (31)	640/0 (37)
Fishing Pond	2/8 (2)	21/11 (7)	69/30 (24)	29/7 (13)	16/24 (8)	24/14 (3)	--/--	--/8	--/2	--/5
Manzanilla	--/--	1/3 (2)	--/--	5/0 (5)	15/0 (3)	12/-- (3)	--/--	--/--	--/--	--/--
Gr.Riviere	--/--	--/--	4/5 (3)	32/1 (2)	23/2 (4)	--/--	--/--	1/-- (1)	16/-- (8)	--/--
San Souci	--/--	--/--	--/--	10/2 (1)	4/0 (2)	--/--	--/--	--/--	--/--	--/--
Madamas	--/--	--/--	--/--	--/--	--/--	--/--	--/--	8/2 (2)	--/--	3/2 (1)
Guayaguayare	--/--	--/--	--/--	--/--	--/--	--/--	--/--	22/-- (5)	--/--	--/--
Blanchisseuse	--/--	--/--	--/--	--/--	--/--	--/--	--/--	--/--	--/1	--/--
Paria Bay	--/--	--/--	--/--	--/--	--/--	--/--	--/--	--/--	8/-- (1)	9/-- (1)
Tacarib	--/--	--/--	--/--	--/--	--/--	--/--	--/--	--/--	4/2 (1)	7/1 (1)

Table 4. Retail survey of the Piarco Airport (Trinidad) and selected shops in Tobago for items made from hawksbill shell (“tortoiseshell”) in November 1995. All vendors reported that the items were made by local artists who used locally-caught sea turtles. Source: Wendy Herron, WIDECAS-Tobago.

Location	Item	Price (\$TT)	Comments
<i>Piarco Airport (Trinidad)</i>			
	earrings (40 pr)	30 - 40	
	pins (25)	10 - 25	
	bracelets (14)	22 - 40	
	spoons (8)	15 - 30	
	keyring (2)	40	
	hair clip (2)	40	
	bookmark (1)	40	
	buckle (1)	30	
<i>Scarborough (Tobago):</i>			
<i>Jack In The Box (gift shop)</i>	initials	10	more than 50 items, combined prominently displayed in three glass cases
	rings	15	
	spoons	26	
	hair clips	30	only tourists buy the items
	bracelets	45	items are popular and sell well
<i>Souvenir Gift Shop</i>	“mostly earrings”	20 - 35	only tourists buy the items items are fashioned locally with turtles caught “off season” items do not sell very well items are not prominently displayed
Cotton House	none		clerk: “we haven't sold tortoiseshell in years”
<i>Cruise Ship Complex (Tobago)</i>	“assorted small items”	not recorded	fewer than 10 items only tourists buy the items items do not sell very well

Table 4, continued.

Location	Item	Price (\$TT)	Comments
<i>Southwestern coast (Tobago)</i>			
<i>Crown Point Hotel</i>	initials hair clips bracelets pins	range: 20 - 45	vendor: "Seventeen Boutique" more than 50 items, combined clerk: "we sell a good bit" shell is purchased both in Tobago and in Trinidad from "whoever's selling it"
<i>Coco Reef Hotel</i>	none		Tobago's newest luxury hotel, opened in 1995 two boutiques, no turtle times
<i>Conrado Beach Hotel</i>	none		vendor: "Shore Things Boutique" clerk: "we've never sold tortoise- shell"
<i>Hook, Line and Sinker (gift shop)</i>	earrings pendants	not recorded	fewer than 10 items mostly sell to tourists clerk: "European tourists seem less likely to buy and seem more educated about endan- gered species [presumably compared to American and Canadian tourists, who "know not to buy it, but buy it any- way"]; we sell it because it's cheap and we have a legal hunting season"
<i>Mount Irvine Bay Hotel</i>	initials pendants "a few others"	30 120	fewer than 20 items clerk: "we sell it when we have business" (hotel is rarely full)
<i>Grafton Hotel</i>	"assorted small items"		vendor: "Marie's General Store" fewer than 20 items, sells poorly clerk: "we've had the stock a long time"

Table 4, continued.

Location	Item	Price (\$TT)	Comments
<i>Turtle Beach Hotel</i>	none		many fashionable ‘turtle items’ for sale, but none made from turtle shell; stock included coconut shell turtles (pendants, earrings) and ceramic turtles; items sell very well
<i>Store Bay</i>	none		about 10 small stands (local vendors) near/on the beach heavily visited tourist area generally well stocked with tortoiseshell items

APPENDIX I

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

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

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

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

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

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

- (5) provide to the Congress by not later than one year after the date of enactment of this section--
- (A) a list of each nation which conducts commercial shrimp fishing operations within the geographic range of distribution of such sea turtles;
 - (B) a list of each nation which conducts commercial shrimp fishing operations which may affect adversely such species of sea turtles; and
 - (C) a full report on--
 - (i) the results of his efforts under this section; and
 - (ii) the status of measures taken by each nation listed pursuant to paragraph (A) or (B) to protect and conserve such sea turtles.

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

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

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

APPENDIX II

Legislating a moratorium on the take of sea turtles is not a new recommendation. For more than two decades (starting with a May 1987 memo, FW:4/9/3, from the Head of the Wildlife Section-Forestry Division to the Ag. Conservator of Forests), Government officers of various Ministries have been urging regulatory reform on behalf of sea turtles. The history of this correspondence is documented by the former Head of the Wildlife Section in a memo (FW:4/14/7) dated 10 October 1991 to the then Permanent Secretary, Ministry of the Environment and National Service (u.f.s. Director of Forestry). The Wildlife Section has regularly updated its government colleagues on sea turtle conservation actions undertaken by Section staff and community groups since 1982, and has repeatedly urged that the provisions of the Fisheries regulations that provide for the harvesting of sea turtles be repealed. In a comprehensive report submitted by the Government of Trinidad and Tobago to the Secretariat of the Western Atlantic Turtle Symposium (WATS II), convened in Puerto Rico in 1987, paragraph 3.1 recommends "Amendment of the Fisheries Act, Chapter 67:51 of the Laws of Trinidad and Tobago to give complete protection to marine turtles." The Director of Forestry later endorsed the recommendation (memo FW:4/13/9).

Two years later (29 March 1990), a joint meeting of Fisheries and Wildlife staff formally discussed management problems associated with the incidental capture of sea turtles and the annual open season. The Report of the Meeting records that, "The following suggestions were made by the Senior Fisheries Officer: (1) no open season for marine turtles, (2) ban on capturing marine turtles, (3) amendments be made to have the sale of turtle meat illegal. The penalties be increased so as to deter offenders." Later that year (4 September 1990), the Director of Forestry sent a letter to the Director of Fisheries "seeking assistance from the Fisheries Division to protect Marine Turtles and their habitat." Noting that there had been "no recent developments or feedback" since the joint meeting, the Director summarised relevant concerns and verified that "the Forestry Division is optimistic if institutions and agencies express concern and assist with whichever areas fall within their portfolio . . . it would mean additional years of existence for marine turtles not only in Trinidad but internationally. It is our belief that, if certain amendments are made in the Fisheries Act, this would positively contribute towards reducing harvesting of turtles from coastal waters." The Director of Fisheries promptly replied, "As you correctly pointed out, protection of the marine turtles can be accommodated under the Fisheries Act, 1916 (Chap. 67:51) i.e., under Section 4. I am willing to lend support."

Further dialogue between the two agencies culminated in a "Draft Guide to Amendments of Regulations Fisheries Act Ch. 67:51, 119/1975 Protection of Turtles and Turtle Eggs Regulations made Under Section 4" submitted to the Director of Fisheries in February 1991 by the Director of Forests (memo FW: 4/16/13). The following text was suggested: "2. No person shall -- (a) kill, harpoon or capture any marine turtle, (b) take or remove or cause to be removed any turtle eggs after they have been laid and buried by a female turtle or after they have been buried by any person; (c) purchase, sell, offer or expose for sale or cause to be sold or offered or exposed for sale or be in possession of any turtle eggs. 3. No person shall take possession, sell, offer or expose for sale or cause to be sold or offered or exposed for sale any turtle meat or turtle products." The memo also suggested that regulations be drafted to "give effect to the use of approved specification of fish nets in order to minimise incidental catch of marine turtles" and to require that "marine turtles brought ashore as a result of incidental catch should be reported to the Forestry Division, Wildlife Section within a period of 48 hours."

These guidelines were endorsed by the Fisheries Division in their March 1991 report, "Trinidad and Tobago Regulatory Program on Sea Turtle Conservation." Section 2.1 (Legislation) of this report states, "Trinidad and Tobago has long been concerned with conservation and protection of sea turtles and regulations are in place which limit the exploitation of sea turtles to a particular season of the year and to a particular distance from the shore. (The Fisheries Ordinance Chap. 25:409, Protection of Turtles and Turtle Eggs Regulations, 1975). Further additional amendments to this legislation are currently being drafted to include a total ban on harvesting. The amendments under consideration are as follows: Regulation 2(a): No person shall kill, harpoon or capture any Marine Turtle. Regulation 3: No person shall take possession, sell, offer or expose for sale or cause to be sold or offered or exposed for sale any Turtle Meat or Turtle Products." The report goes on to endorse an amendment specifying that "Marine Turtles brought ashore as a result of incidental catch should be reported to the Forestry Division, Wildlife Section within a period of 48 hours" and that the regulation should include "provisions for the resuscitation and release of live turtles caught in nets. In the case of drowned turtles, these animals should be reported to the appropriate authorities for disposal."

No action was taken, and later that year (October 1991), following an incident exposed on national television in which endangered sea turtles were being offered for sale by a fish vendor in Matelot, the Ministry of Environment and National Service drafted a Press Release expressing regret over the incident, highlighting overlapping jurisdictions "in which the Ministry of the Environment and National Service administers the Conservation of Wild Life Act Chapter 67:01 and the Ministry of Food Production administers the Fisheries Act Chapter 67:51", and noting that amendments to the Fisheries Act which would fully protect sea turtles had been drafted and accepted by both the Director of Forestry and the Director of Fisheries. The Press Release concluded, "It is imperative that these changes are made urgently to afford total protection of marine turtles. This would serve not only to conserve an important component of our natural biodiversity under domestic legislation but would also serve to fulfill our international legal obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Specially Protected Areas and Wildlife Protocol (SPAW) which this country signed in 1984 and 1991, respectively."

APPENDIX III

Principles of Co-Management

Developed by the participants of the training course “Principles of Participation and Co-Management for Resource Management Professionals” (Trinidad, May 1997)

1. Equity between partners in determining the balance of power at any given time.
2. Shared responsibility.
3. Accountability for the products of the agreement.
4. Transparency in the process of collaboration.
5. Clear understanding of roles and responsibilities.
6. Mutual respect.
7. Mutual understanding of goals and expectations.
8. Shared vision.
9. Active participation of all partners.
10. Clear channels of communication.
11. Gender sensitivity.
12. Engendering of pride and confidence, leading to empowerment.
13. Legitimacy of the partners.
14. Positive use of conflict to achieve objectives.
15. Sensitivity to the needs of the disadvantaged.
16. Enhancement/conservation of the resource.
17. Capacity building for all partners.
18. Continuous evaluation.

Framework for Co-Management

Developed by the participants of the training course “Principles of Participation and Co-Management for Resource Management Professionals” (Trinidad, May 1997)

1. Title (including names of partners and date of agreement)
2. Preamble
 - i. Background/context
 - ii. Philosophy of agreement (based on principles of co-management as understood by both parties)
 - iii. Objectives and expected outcomes of the agreement
3. Definition of the scope of the agreement (what are we managing/protecting?)
 - i. Geographic (boundaries)
 - ii. Legal
 - iii. Temporal (time frame)
 - iv. Biological (resources involved)
 - v. Physical
4. Description of the partners in the agreement
5. Objectives to the collaborative activity
6. Definition of roles and allocation of responsibilities of partners
7. Procedures for:
 - i. Technical management
 - ii. Administration
 - iii. Decision-making
 - iv. Conflict management
8. Provisions for compensation of partners (who gets paid, for what, how much, from where, by whom, and when)
9. Provisions for review, evaluation, and modification
10. Legalities, conditionalities, and procedures for termination
11. Duration of agreement

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