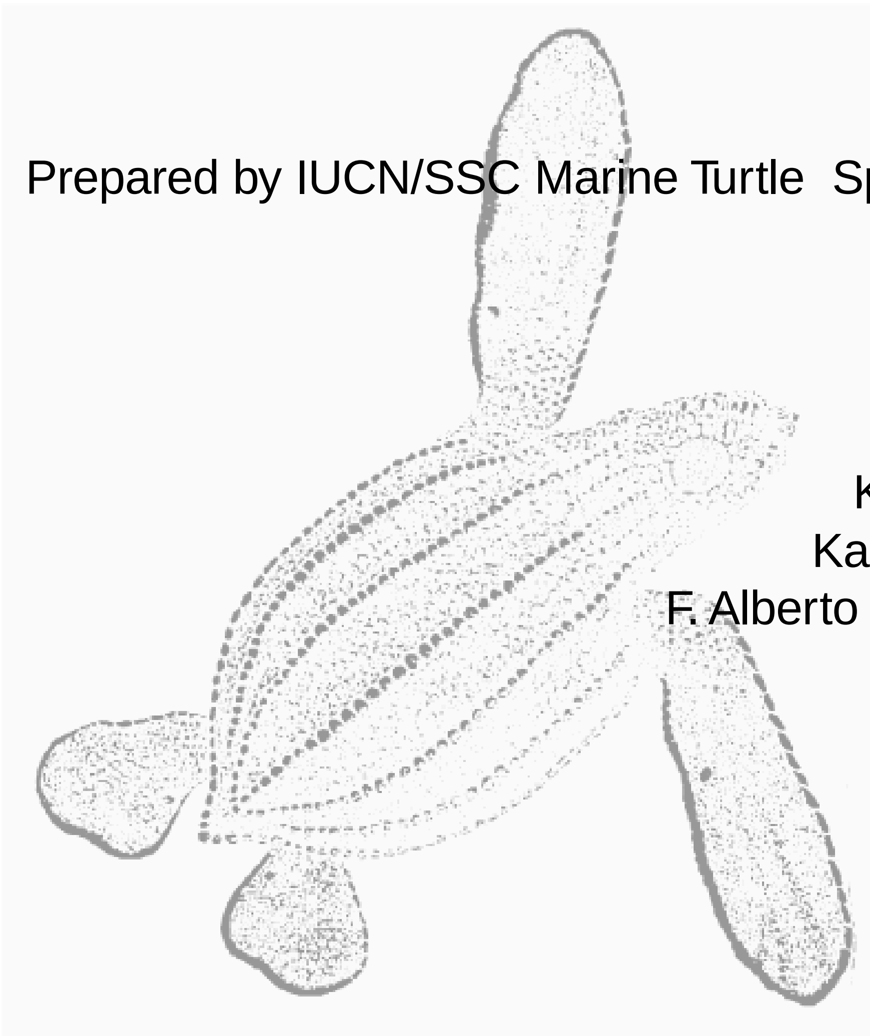
Research and Management Techniques for the Conservation of Sea Turtles



Prepared by IUCN/SSC Marine Turtle Specialist Group

Edited by
Karen L. Eckert
Karen A. Bjorndal
F. Alberto Abreu-Grobois
M. Donnelly

WWF CMS SSC NOAA MTSG CMC

Development and publication of *Research and Management Techniques for the Conservation of Sea Turtles* was made possible through the generous support of the Center for Marine Conservation, Convention on Migratory Species, U.S. National Marine Fisheries Service, and the Worldwide Fund for Nature.

ISBN 2-8317-0364-6

Printed by Consolidated Graphic Communications, Blanchard, Pennsylvania USA

Cover art: leatherback hatchling, *Dermochelys coriacea,* by Tom McFarland

This publication should be cited as follows: Eckert, K. L., K. A. Bjorndal, F. A. Abreu-Grobois, and M. Donnelly (Editors). 1999. *Research and Management Techniques for the Conservation of Sea Turtles.* IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

To order copies of this publication, please contact:

Marydele Donnelly, MTSG Program Officer
IUCN/SSC Marine Turtle Specialist Group
1725 De Sales Street NW #600
Washington, DC 20036 USA
Tel: +1 (202) 857-1684
Fax: +1 (202) 872-0619
email: mdonnelly@dccmc.org

Preface

In 1995 the IUCN/SSC Marine Turtle Specialist Group (MTSG) published *A Global Strategy for the Conservation of Marine Turtles* to provide a blueprint for efforts to conserve and recover declining and depleted sea turtle populations around the world. As unique components of complex ecosystems, sea turtles serve important roles in coastal and marine habitats by contributing to the health and maintenance of coral reefs, seagrass meadows, estuaries, and sandy beaches. The *Strategy* supports integrated and focused programs to prevent the extinction of these species and promotes the restoration and survival of healthy sea turtle populations that fulfill their ecological roles.

Sea turtles and humans have been linked for as long as people have settled the coasts and plied the oceans. Coastal communities have depended upon sea turtles and their eggs for protein and other products for countless generations and, in many areas, continue to do so today. However, increased commercialization of sea turtle products over the course of the 20th century has decimated many populations. Because sea turtles have complex life cycles during which individuals move among many habitats and travel across ocean basins, conservation requires a cooperative, international approach to management planning that recognizes inter-connections among habitats, sea turtle populations, and human populations, while applying the best available scientific knowledge.

To date our success in achieving both of these tasks has been minimal. Sea turtle species are recognized as "Critically Endangered," "Endangered" or "Vulnerable" by the World Conservation Union (IUCN). Most populations are depleted as a result of unsustainable harvest for meat, shell, oil, skins, and eggs. Tens of thousands of turtles die every year after being accidentally captured in active or abandoned fishing gear. Oil spills, chemical waste, persistent plastic and other debris, high density coastal development, and an increase in ocean-based tourism have damaged or eliminated important nesting beaches and feeding areas.

To ensure the survival of sea turtles, it is important that standard and appropriate guidelines and criteria be employed by field workers in all range states. Standardized conservation and management techniques encourage the collection of comparable data and enable the sharing of results among nations and regions. This manual seeks to address the need for standard guidelines and criteria, while at the same time acknowledging a growing constituency of field workers and policy-makers seeking guidance with regard to when and why to invoke one management option over another, how to effectively implement the chosen option, and how to evaluate success.

The IUCN Marine Turtle Specialist Group believes that proper management cannot occur in the absence of supporting and high quality research, and that scientific research should focus, whenever possible, on critical conservation issues. We intend for this manual to serve a global audience involved in the protection and management of sea turtle resources. Recognizing that the most successful sea turtle protection and management programs combine traditional census techniques with computerized databases, genetic analyses and satellite-based telemetry techniques that practitioners a generation ago could only dream about, we dedicate this manual to the resource managers of the 21st century who will be facing increasingly complex resource management challenges, and for whom we hope this manual will provide both training and counsel.

Karen L. Eckert
Karen A. Bjorndal
F. Alberto Abreu Grobois
Marydele Donnelly
Editors

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IUCN/SSC Marine Turtle Specialist Group Publication No. 4, 1999

Habitat Surveys

Carlos E. Diez
Negociado de Pesca y Vida Silvestre, DRNA - PR, P. O. Box 9066600, San Juan, Puerto Rico 00906 USA; Tel: +1 (787) 724-8774; Fax: +1 (787) 721-8634; email: cediez@caribe.net

José A. Ottenwalder
Coastal & Marine Biodiversity Project, UNDP-GEF/ONAPLAN, A.P. 1424, Santo Domingo, Dominican Republic; Tel: +1 (809) 534-1134 / -1216; Fax: +1 (809) 530-5094; email: biodiversidad@codetel.net.do

There are vast tracts of coastal domain potentially suitable for sea turtle nesting and foraging, but for which little is known about the presence (seasonality, distribution, abundance) or activity patterns of these increasingly rare creatures. When faced with identifying and/or prioritizing management actions, such as declaring a protected area or regulating territorial development or resource use, it is useful to know whether and how sea turtles might be affected by management decisions. Moreover, in regions where comprehensive sea turtle research or conservation programs are desirable but lacking, managers are faced with identifying potential study sites in the absence of comprehensive field data.

The purpose of this chapter is to illustrate and summarize various techniques which may be used to characterize nesting and feeding habitats potentially suitable for, or in use by, sea turtles. With the resulting baseline data in hand, more efficient allocations of effort and resources can be achieved than would otherwise be the case. Once preliminary investigations have identified potentially important habitat, population assessment methodologies described in subsequent chapters of this manual should be followed.

Nesting Habitats

The existence of many kilometers of sandy beaches does not guarantee the existence of suitable nesting habitat. In this section we discuss generalized techniques that may help to characterize and identify potential nesting beaches, without actually observing gravid turtles. The techniques are presented in the same order as they would be applied in the field.

Interviews

For our purposes, we assume that there are few or no formal reports of sea turtles nesting in the area(s) under investigation. In this case, the most cost-effective place to begin is by interviewing coastal residents. Although they may not necessarily be fishermen, residents are likely to have some knowledge of the major fauna inhabiting their surroundings. A series of questions addressing observations on sea turtles, such as the occurrence and seasonality of mating, egg-laying, or the appearance in markets of egg-bearing turtles, should be posed to obtain basic information. Care must be taken not to bias the responses of interviewees (see Tambiah, this volume).

Preliminary Surveys

On the basis of information gleaned by interviews, coastal areas reported to have nesting or some related activity, such as the consumption or marketing of sea turtle eggs, should be visited during the appropriate season. The most obvious confirmation of nesting is the presence of crawls, nesting pits, or egg shells on the beach. These should be recorded to species if possible and characterized as fresh or aged (see Pritchard and Mortimer, this volume; Schroeder and Murphy, this volume). Predominant threats, if discernible, should be noted *(e.g.,* slaughter of turtles, depredation of eggs, erosion or inundation of nests).

Relevant physical features should also be noted, such as dominant vegetation types, beach composition *(e.g.,* origin [calcareous, volcanic], grain size, sand compaction) and profile, typical wave conditions, and the presence of rivers or estuaries. There are several studies that have characterized nesting beaches based on features such as profile, vegetation and/or grain size (see Hirth, 1971; Márquez *et al.*, 1976; Balazs, 1978; Carr *et al.*, 1982; Mortimer, 1982; Corliss *et al.*, 1989; Márquez, 1990) and in the absence of any direct evidence of nesting, this literature should be examined for insight into potential nesting grounds.

While care should be exercised in interpreting results, generalizations are possible. For example (see Mortimer, 1982), leatherbacks prefer deep and unobstructed underwater access and a relatively steep (often windward) beach profile, while hawksbills routinely traverse shallow, coral strewn habitat to reach more heavily vegetated, low profile beaches. Leatherback and green turtles tend to nest in open habitat, whereas hawksbills often create obscure nesting pits in the littoral forest *(e.g.,* beneath *Suriana maritimia*, *Cocoloba uvifera*, or *Eterocarpus erectus* in the insular Caribbean). Olive ridley turtle nesting areas commonly occur on beaches separated from the mainland by coastal lagoons or estuaries.

In remote, uninhabited areas (where interviews are not practicable), preliminary surveys should be done by boat or, even better, by low flying aircraft. While aerial surveys are relatively expensive, they are also the fastest and most efficient method of covering long continental coastlines or otherwise inaccessible island groups. Able partners should be sought, such as the Coast Guard, missionary groups, or charter supply corps with access to air transport in outlying areas. For details on how to conduct an aerial survey, see Schroeder and Murphy (this volume).

Follow-up Techniques

Once preliminary assessments are complete and areas with a high potential to support nesting have been identified, field teams can be deployed to undertake a more detailed analysis. One or two two-week periods of ground patrol (preferably nocturnal) during what is believed to be the peak nesting or hatching season should be sufficient to confirm nesting, estimate nest density, verify species, and gain some degree of insight into any major threats. With these data in hand, a manager is well positioned to move forward with the design and implementation of more specific conservation or management action.

Foraging Habitats

Sea turtles spend most of their lives in underwater habitats, both coastal and oceanic. Identifying and assessing potential foraging habitat is fundamental to the success of any conservation or management program. Although studying sea turtles in the water is much more difficult than studying them on land, an increasing number of published studies illustrate a variety of proven methods *(e.g.,* Ehrhart, 1983; Balazs *et al.*, 1987; Collazo *et al.*, 1992; Limpus, 1992; see also Ehrhart and Ogren, this volume). In this section we discuss generalized techniques that may help to characterize and identify potential feeding grounds, without necessarily observing resident turtles. The techniques are presented in the same order as they would be applied in the field.

Interviews

As in the case of beaches (above), we assume that there are virtually no baseline data available. Again, the most cost-effective place to begin is by interviewing potentially knowledgeable residents, including fishermen, ferry or supply ship crews, Coast Guard or other marine patrol officers, and divers. A series of questions addressing observations on sea turtles, such as the presence of adults or juveniles in nearshore or offshore areas, patterns of seasonal movement, fisheries statistics, or the marketing of sea turtle products, should be posed to obtain basic information. As always, care must be taken not to bias the responses of interviewees (see Tambiah, this volume).

Preliminary Surveys

On the basis of information gleaned by interviews, areas where sea turtles are routinely or predictably observed should be targeted for further investigation. These areas should be visited by survey personnel using snorkel or SCUBA gear. Relevant biotic and abiotic characteristics (algae, corals, flora and fauna) should be recorded together with accurate locations of the sites using a Global Positioning Systems (GPS) device, if possible. For example, evidence of nibbling on sea grasses (by green turtles) or sponges (by hawksbills) might be discernible (Vicente and Tallevast, 1995; van Dam and Diez, 1997). Ecological data, including water temperature, current flows, depth, and obvious geological structure (significant rock formations, crevices, vertical walls) should also be recorded.

As a prerequisite to field investigation, a literature search should be undertaken to review pertinent features of sea turtle foraging habitats and habits, including dominant prey items and feeding patterns (Casas-Andreu and Gómez-Aguirre, 1980; Mortimer, 1981; Ogden *et al.*, 1980, 1983; Dodd, 1988; Limpus, 1992).

In many cases, key species or species indicators are food items; these include sponges, seagrasses, algae, and crustaceans. For example, encrusting sponges *(e.g., Chondrila, Chondrosia, Niphates, Cynachira, Geodia, Ricordia*) are the most common food items for hawksbill turtles which forage in coral reefs, rocky outcrops or some mangrove-fringed bays and estuaries of the Caribbean. Loggerhead and olive ridley turtles aggregate to feed on red crab, *Pleuroncodes planipes*, concentrations in upwelling areas of the Eastern Pacific; green turtles forage on sea grasses *(e.g., Zostera, Thalassia*) and algae *(e.g., Gelidium, Cracillaria*) in typically relatively shallow, protected waters.

Some organisms can also be considered as indicator species. For example, barrel sponges *(Xetospongia muta)*, some boxfish *(e.g., Lactophyrys)*, angelfish *(e.g., Holacanthus, Pomacanthus)*, and hard corals such as *Plexaura* sp., *Agaricus agaricites*, and brain coral *(Colpophyllia natans)*, are also typically found in areas of the Caribbean where hawksbills forage, although they are not known to be hawksbill prey items. Aerial photos and marine resource atlases may help to identify important benthic types *(e.g.,* coral reefs, seagrasses).

Foraging sea turtles surface regularly during bouts of feeding, so that surface observations can provide useful information. Species can sometimes be predicted from information available about the benthos. Hawksbills appear to be obligate spongivores, green turtles are herbivores, and loggerheads, ridleys and flatbacks are omnivores with a penchant for crustaceans and mollusks. Leatherbacks are mainly oceanic medusae feeders and, while there are seasonal exceptions in some parts of the world, this species is not likely to be routinely encountered in coastal waters (with the exception of gravid females in their internesting habitat).

In uncharted or less traveled areas where preliminary data are unavailable from interviews or marine resource atlases (the latter serving to identify where important foraging grounds might be located, based on the distribution of coral reefs, estuaries, or sea grass meadows), there is little recourse but to visit representative habitats by boat and examine the area first hand using snorkel or SCUBA gear. Standard methods, such as linear transects, should be employed for rapid assessment of potential areas (Rogers *et al.*, 1983; Sullivan and Chiapponne, 1993; Chiappone and Sullivan, 1994, 1997; Bolten *et al.*, 1996). In some cases, especially when large areas are involved, preliminary information can be gained from aerial surveys (see Henwood and Epperly, this volume).

Follow-up Techniques

When preliminary assessments indicate that a particular area constitutes potential foraging habitat, more detailed underwater appraisals should be undertaken. In-water studies *(e.g.,* capture-recapture studies) can provide insight into the distribution, abundance, size classes, and species of sea turtles present (see Ehrhart and Ogren, this volume). Food items can be quantified through the use of linear transects, quadrants, or other standard methods (Weinberg, 1981). Permanent grids should be considered for the purpose of monitoring changes in the habitat over the long term.

Sighting networks should be established to provide information to managers on an ongoing basis (see Shaver and Teas, this volume). As more and more information is assembled, managers are able to refine their conservation and management priorities, as well as to enact specific habitat protection measures to safeguard important foraging grounds and migratory corridors.

In all cases (terrestrial and marine) where follow-up initiatives are planned, priority should be placed on research design (see Congdon and Dunham, this volume), thereby ensuring an efficient allocation of human and financial resources, as well as maximizing the usefulness of data collected.

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