

Sea Turtles and Beachfront Lighting

**An Interactive Workshop for Industry Professionals
and Policy-Makers in Barbados**

*Fairmont Glitter Bay Hotel
October 13, 2000*



Proceedings

*Karen L. Eckert
Julia A. Horrocks
Editors*

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"Sea turtle populations have suffered worldwide declines, and their recovery largely depends upon our managing the effects of expanding human populations. One of these effects is light pollution – the presence of detrimental artificial light in the environment. Of the many ecological disturbances caused by human beings, light pollution may be among the most manageable. Light pollution on nesting beaches is detrimental to sea turtles because it alters critical nocturnal behaviours, namely, how sea turtles choose nesting sites, how they return to the sea after nesting, and how hatchlings find the sea after emerging from their nests. . . . Making the public aware of light pollution problems on sea turtle nesting beaches is a fundamental step towards darkening beaches for sea turtles. Many of those responsible for errant lighting are unaware of its detrimental effects and are generally willing to correct the problem voluntarily once they become aware."

-- *Witherington and Martin (2000)*

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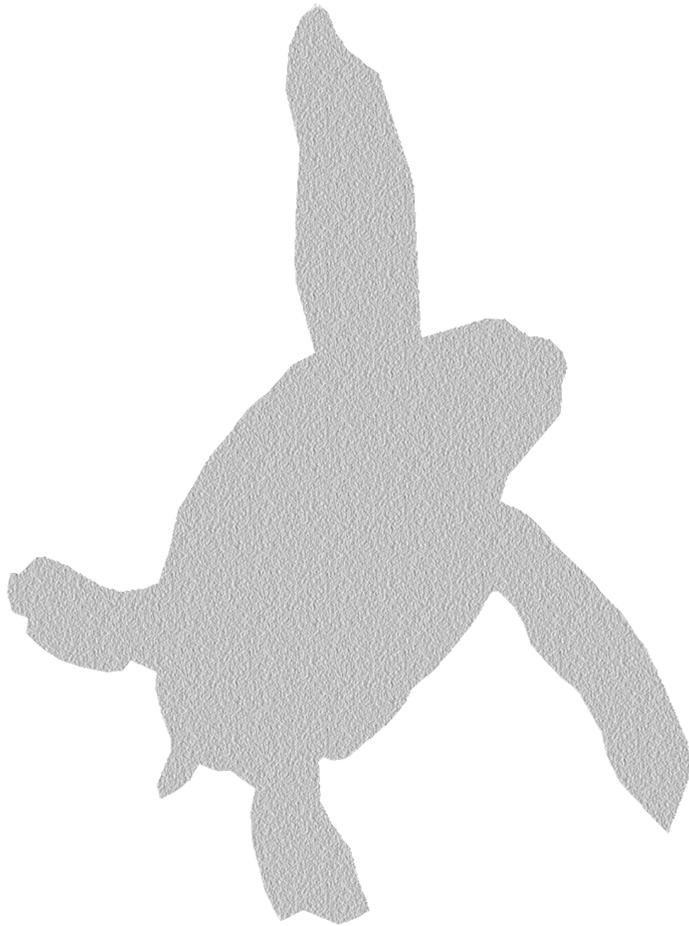
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WIDECAST

Wider Caribbean Sea Turtle Conservation Network



Tourism
**DEVELOPMENT
CORPORATION**

RESOLUTION OF THE MEETING

RECOGNISING that Caribbean sea turtle species are classified either as Endangered or Critically Endangered by international authorities, and are fully protected in Barbados under the Fisheries (Management) Regulations, 1997;

CONCERNED that sea turtle populations in Barbados have declined dramatically over the course of the 20th century, due to threats both domestic and foreign;

AWARE that natural sandy beach habitat is essential to the survival of the tourism industry in Barbados, as well as to the survival of our sea turtles;

ALARMED that the majority of sea turtle hatchlings emerging from the beaches of Barbados are confused and disoriented by artificial lighting and that, as a result, thousands of them die every year;

SENSITIVE to the impact the modern tourism industry, including coastal construction and artificial beachfront lighting, has on the plight of sea turtles;

ENLIGHTENED, based on the results of this workshop, about how the coast-based tourism industry can participate in sea turtle conservation and protection; and

COMMITTED to taking effective action, both as individuals and as an industry, to ensure the survival of sea turtles in Barbados -

WE PLEDGE TO:

ADOPT a Policy Statement regarding the protection of sea turtles on hotel grounds;

REVISE Standard Operating Procedures (SOPs) to implement the Sea Turtle Policy Statement and further encourage reporting and protecting nesting turtles and hatchlings by hotels and other beachfront properties;

SEEK to ensure that funding is available to support annual training (by the Barbados Sea Turtle Project) of support staff in those departments that are responsible for actualisation of the Sea Turtle Policy Statement;

UNDERTAKE a lighting assessment (following the guidance of Witherington and Martin, 2000) and investigate our individual hotel and villa capacities to participate in “turtle friendly” lighting schemes; and

IMPLEMENT, as soon as practicable, “turtle friendly” lighting on all beaches (e.g., replace HPS lights with LPS alternatives, install motion-sensitive security lights, turn off purely aesthetic lights at 9:00 PM during peak nesting and hatching seasons).

RECOMMENDATIONS OF THE MEETING

TO PROMOTE full implementation of the RESOLUTION, we recommend that the Tourism Development Corporation, in consultation with the Barbados Sea Turtle Project and the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and in collaboration with other local (e.g., Barbados Hotel and Tourism Association: BHTA) and regional (e.g., Caribbean Alliance for Sustainable Tourism: CAST) industry coalitions:

PROVIDE the hoteliers, villa rental agencies, Ministries and other relevant agencies in Barbados with a draft Sea Turtle Policy Statement to be adopted and implemented by the hotel and villa rental community nation-wide, with each establishment ensuring that its SOPs are revised as necessary;

PROVIDE the hoteliers and villa rental agencies in Barbados with standard guidelines and criteria for implementing the Sea Turtle Policy Statement; and

PROVIDE coastal hoteliers and landowners with emergency numbers for reporting sea turtle sightings and violations, and a calendar noting the nesting and hatching months of local sea turtle species.

PREFACE

Three species of sea turtle, the hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*) and green turtle (*Chelonia mydas*) are found in Barbados. In the case of the green turtle, only foraging (feeding) individuals have been reported. An estimated 10 leatherbacks nest each year, but the island hosts one of the largest nesting populations of endangered hawksbill turtles in the insular Caribbean. Sea turtles have been harvested for their meat, eggs and shell for hundreds of years in Barbados. A marked depletion in their numbers over the last 30 years led to the passing of national legislation in 1998 prohibiting their capture or sale.

The Barbados Sea Turtle Project (BSTP) at the University of the West Indies is the local Partner Organisation of WIDECAS [the Wider Caribbean Sea Turtle Conservation Network], and has been monitoring nesting sea turtle populations since 1992 when the "Sea Turtle Recovery Action Plan for Barbados" was completed. Monitoring projects actively encourage the participation of residents as well as visitors to the island. The sense of wonder generated in visitors who witness a turtle nesting or the emergence of tiny hatchlings onto the beach emphasises the significant potential that sea turtles have as attractions for tourists in Barbados.

Despite being marine animals, sea turtles must return to the land in order to lay their eggs, and it is to the same narrow strips of sand where people live, play, and conduct commerce that sea turtles come to reproduce. Although sea turtles spend very little of their lives on land, their activities there are critical to the creation of the next generation. The concentration of human activity on and adjacent to beaches in Barbados, particularly as a result of tourism development, has caused profound environmental changes that pose severe threats to the long-term survival of sea turtle populations. Indeed, from a conservation perspective, there is little point in protecting turtles from the pot if the adverse effects of human activities on the nesting beaches are not also addressed.

Hawksbill turtles prefer to nest on sheltered, leeward beaches with calm sea approaches. The west and southwest coasts of Barbados provide ideal nesting habitat. These coasts are also preferred as areas for human settlement and for recreation, and the concentration of hotels is particularly dense here. Thus the most critical nesting beaches for hawksbills are those where the beach environment is most significantly altered, and the beaches where the full value of sea turtles as tourist attractions have the most potential.

One distinctive and particularly damaging form of habitat alteration is "light pollution", defined as the introduction of artificially produced detrimental light into the environment. Sea turtle behaviors critical to successful reproduction are affected by light pollution; these behaviors include the selection of nesting sites by egg-bearing females and the safe return to the sea by the females and later their hatchlings. Characteristic behavior by sea turtles is to avoid artificial light, but in Barbados this can concentrate nesting in marginal habitat ill-suited for successful egg incubation.

*Night-emerging hatchlings that rely on natural light as a cue to locate the sea are attracted away from the sea by artificial lights. In Barbados, hatchlings from the **majority** of hawksbill nests laid on south coast developed beaches and a third of those on west coast developed beaches are disoriented by lights. If there were no human intervention, these hatchlings would succumb to attacks by predators, exhaustion, desiccation, or strikes by vehicles on nearby roads and parking lots.*

Hotels use beachfront lighting primarily to ensure the safety and security of their guests, as well as for aesthetic purposes. However, many hoteliers also recognise that visitors are increasingly sensitive about the environmental impact of their holidays on the fauna and flora of their destinations. If provided with practical and affordable solutions to light pollution problems that could be achieved with little inconvenience and without compromising safety or security, hoteliers and restaurateurs would be in a more informed position to minimise the impacts of their establishments on sea turtle nesting beaches.

This national workshop, **Sea Turtles and Beachfront Lighting: An Interactive Workshop for Industry Professionals and Policy-Makers in Barbados**, was the first of its kind in the Caribbean. It was designed to address problems (for sea turtles) posed by artificial shore-based lighting, with particular emphasis on the technologies that are available to solve these problems. The audience consisted of managers and owners (hoteliers, restaurateurs), local engineers and architects, Barbados Light & Power Company, industry representatives (TDC, BHTA), policy-makers (Town and Country Planning, Coastal Zone Unit, Department of Fisheries), manufacturers, and NGOs.

Invited Presenters included scientists with expertise in understanding, assessing and resolving light pollution problems on sea turtle nesting beaches and a hotelier who has successfully addressed the problem of minimising light pollution at a resort located adjacent to an important nesting beach in Florida. In addition to oral presentations, there were demonstrations of the types of lighting and light fixtures that are available on the market, discussions of how the problem has been solved in other places, and a field demonstration of how to conduct a lighting survey and assessment.

The workshop provided stakeholders with in-depth insight into this serious conservation issue and, most importantly, into how to effectively mitigate it. A Resolution was unanimously adopted whereby industry professionals pledged to develop a Policy Statement regarding the protection of sea turtles on hotel grounds, to revise Standard Operating Procedures to implement the Sea Turtle Policy Statement, to promote and facilitate reporting and protecting nesting turtles and hatchlings by hotels and other beachfront properties, and to ensure that funding is available to support annual training of staff responsible for actualisation of the Sea Turtle Policy Statement.

With the workshop's hosts, sponsors and collaborators dedicated to full implementation of the Resolution and the Recommendations of the Meeting, we are confident that this successful gathering will be the first step in ensuring that Barbados takes a leadership role in the Caribbean Region regarding mitigating the serious and pervasive threat that artificial beachfront lighting poses to endangered sea turtles.

*Julia A. Horrocks, Director
Barbados Sea Turtle Project*

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WELCOME

The Tourism Development Corporation is pleased to welcome you to the first Caribbean workshop on the effects of beachfront lighting on endangered sea turtles. **Sea Turtles and Beachfront Lighting: An Interactive Workshop for Industry Professionals and Policy-Makers in Barbados**, brings together a variety of stakeholders in our community, including managers and owners (hoteliers, restaurateurs), engineers and architects, Barbados Light & Power Company officials, Government policy-makers (e.g., Town and Country Planning, Coastal Zone Management Unit), and NGOs. We are very pleased that you have joined us today!

The Tourism Development Corporation recognizes that visitors are increasingly interested in the flora and fauna of their holiday destinations, as well as the impacts of their vacations on the environment. A great number of tourists visit the west coast daily to swim with green sea turtles and marvel when they get an opportunity to witness nesting turtles or emerging hatchlings. Other visitors participate in “turtle watches”, report turtle sightings, and appreciate the fact that sea turtle products are not sold in Barbados. These observations are testament to the significant potential that sea turtles have as attractions for tourists in Barbados. However, this is a potential that can only be realized if the species continue to survive and nest on these shores.

Light pollution from beachfront properties causes the deaths of thousands of hatchling sea turtles each year in Barbados, and is a major factor in slowing the population recovery of our depleted sea turtle populations. It is well known that only sea turtles hatched on Barbados’ beaches will return to Barbados as adults to lay eggs of their own. From this we can see that we alone are in charge of ensuring that a maximum number of our hatchlings make it safely to the sea.

The aim of the workshop is to ensure that the people who make decisions about the use of beach-front lighting for any category of establishment are made aware of the environmentally “friendly” or sustainable options available to them. In addition, we hope that our hoteliers, in particular, will learn how appropriate beachfront lighting can help their establishments tap into the growing market niche of environmentally aware tourists. Using the knowledge we gain today, as well as a variety of technical resources kindly provided by our workshop hosts and their colleagues, we hope that the nesting environment of Barbados will be transformed into one that welcomes sea turtles for many decades to come!

The TDC is happy to be the major sponsor of this exciting and timely initiative, which we believe is poised to contribute substantially to the sustainable development of Barbados’ tourism industry. We are proud that Barbados was selected to demonstrate how informed decisions regarding beachfront lighting can showcase the commitment of our hoteliers to the sustainable future of our country. We are grateful to the Glitter Bay Fairmont Hotel for the lovely setting of this event, and to the Barbados Sea Turtle Project and WIDECAST for organizing this event for our benefit. Finally, we are committed to implementing the decisions and recommendations of the workshop. We look forward to working with you all towards this end. Thank you, once again, for joining us!

*Natalie Rothwell, Executive Officer
John Bellamy, Chairman
Tourism Development Corporation*

ACKNOWLEDGEMENTS

Good morning! My name is Karen Eckert, Executive Director of the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), an international coalition of sea turtle scientists, educators, resource managers, and other experts. The network promotes and facilitates science-based conservation and management of six species of endangered sea turtles in the Wider Caribbean Region.

WIDECAST has Country Coordinators in more than 30 Caribbean States and territories, and for more than a decade our Country Coordinator here in Barbados has been Dr. Julia Horrocks, whom many of you know as a UWI professor of Biological Sciences, Founder and Director of the Barbados Sea Turtle Project, and co-host of this workshop. WIDECAST is proud to serve with the Barbados Sea Turtle Project as a co-host, and we see this workshop as the first of many collaborative exercises throughout the region, with the Barbados hotel and villa community taking the lead in designing and implementing “sea turtle friendly” lighting schemes.

It is impossible to convene an event such as this one without help. We are grateful to the Tourism Development Corporation for its sponsorship and major support for the workshop. We are also deeply appreciative of the Fairmont Glitter Bay and Royal Pavilion Hotels, who have given us this beautiful meeting room, our coffee breaks, lunch, cocktails this evening, and accommodations to our Presenters, and without whom we would not have been able to offer this informative day to you in such a lovely setting.

The United Nations Environment Programme, based in Kingston, Jamaica, is also a donor and supporter of the meeting through its Specially Protected Areas and Wildlife (SPA) Regional Programme. The Caribbean Alliance for Sustainable Tourism (CAST) has promoted the meeting, designed the Certificates of Participation, and assisted, along with its colleagues in the Barbados Hotel and Tourism Association (BHATA), with a number of important administrative details including registration. We are also grateful to the Florida Fish and Wildlife Conservation Commission, Ecological Associates Inc., and Disney Corporation for providing literature, demonstration lights, and technical resources to the workshop.

To everyone involved, and especially to the efficient and talented staff here at the Glitter Bay Hotel, we want to extend our gratitude. And to you, our participants, thank you for taking time out of your very busy schedules to join us! We are certain that you will find the day stimulating and thought-provoking. We trust that you will take every advantage of the experts here, the literature included in the Meeting Packets, and the information and technology on display.

We hope that you will ask lots of questions, and that you will return to your agencies and businesses with new ideas, fresh commitment, and sufficient information to ensure that ancient sea turtles and modern beachfront hotels can live peacefully together in the 21st century. We are very happy that you are all here. And now, without further ado, I give you Ms. Kelly Robinson, Executive Director of the Caribbean Alliance for Sustainable Tourism.

*Karen L. Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)*

OPENING REMARKS

Good morning friends and colleagues. It is a pleasure to be here and to see such staunch support for this workshop, which truly demonstrates and confirms the need for us to become more informed and proactive regarding this important topic. I want to thank the organizers – the Barbados Sea Turtle Project, WIDECAST, and the Tourism Development Corporation of Barbados -- for the opportunity to collaborate with them in organizing this workshop, which we hope will lead to similar events throughout the region.

It seems to me that the mix is ideal. Our tourism sector benefits from the technical expertise of the Barbados Sea Turtle Project and the larger WIDECAST network, and in return our environmental colleagues have the opportunity to recognize the positive contribution that we as enlightened hoteliers – although not necessarily “lighted hoteliers” – are making and can continue to make towards the protection of our surrounding and sustaining environment.

True success relies on collaboration, because as the organizers have so eloquently stated in the Draft Resolution, we are indeed aware that natural sandy beaches are essential to the survival of tourism in Barbados, as well as to the survival of our sea turtles. That is to say, we must all work **together** for our mutual benefit.

I immediately realized how important this workshop was after Karen Eckert called me. My previous position was as Environmental Coordinator for a 400-room hotel in the Dominican Republic. During that time we experienced two sea turtle “incidents”. In the first case there were no protocols of any kind to assist us in reducing the problem of disorientation to the turtles due to our beachfront lighting. In the second case, after taking steps to reduce beach lighting during nesting time, we organized a show on the beach and were dismayed to see that newborn hatchlings were heading towards our stage!

I can see now that there are solutions to these challenges, and it is my hope that we can participate with you in promoting these solutions throughout the industry. In looking through the excellent materials provided to us by our hosts, I am struck by the beauty of a poem in Witherington and Martin's “Understanding, Assessing, and Resolving Light-Pollution Problems”. The poem, entitled TRUST, reads in part: “Might we masters of the light adapt, forgo complete control, and lessen obsolescence lest our presence take its toll? To tread on earth with darkness soft leaves not the night asunder, and preserves the stars and moon aloft, and obsoleted wonders.”

I wish you well in this important gathering, and I leave with you a promise that you have the abiding commitment of CAST in tackling and resolving the conflicts we see between beachfront development and the survival of our ancient friends, the sea turtles. It also pleases me no end to announce that soon we will hire an Environmental Coordinator in conjunction with the Barbados Hotel and Tourism Association and PA Consulting. The Coordinator will work to implement CAST environmental programs in Barbados.

*Kelly Robinson, Executive Director
Caribbean Alliance for Sustainable Tourism (CAST)*

STATEMENT OF PURPOSE

Beachfront lighting presents a serious management issue in Barbados. Sea turtles are long-lived, often requiring two decades or more to mature and reproduce for the first time. The proportion of eggs that successfully produce hatchlings that survive to maturity is low, certainly less than 1 in 100 and more likely less than 1 in 1000.

Here in Barbados, as elsewhere, hawksbill sea turtles are characterized as depleted. The writing was on the wall 25 years ago when the commercial turtle fishery plummeted by more than 90%, based on landing weight, in the 10 years between 1963 and 1974. The last 20 years have seen a strengthening of legislation regulating the local sea turtle harvest, until a moratorium was adopted in 1998 that remains in force today.

But sea turtle survival is about more than not killing turtles. It has to be about recognizing complex linkages and the role that all of us play – not just hunters and fisherman. For example, many of you know that thousands of hawksbill hatchlings are killed every year as a result of beachfront lighting. Dark, quiet beaches, as well as healthy coral reefs and seagrass meadows, are essential to sea turtle survival.

In order for your populations to survive and flourish, every effort must be made to ensure that the young turtles successfully enter the sea. And this is our objective in gathering you here today. You were invited to attend this special session, sponsored by the Tourism Development Corporation, because each of you has decision-making authority, or represents someone with that authority.

We are fortunate to have the world's best experts here to talk with us today. They have every intention of helping you take those "first few steps" in hopes that you will continue the journey with commitment and passion until the sea turtles of Barbados no longer die because they are so confused by shore-based lighting that they cannot find the sea.

To assist you in your journey, long after the experts have left us, we have assembled a very comprehensive meeting packet that we hope will become a permanent fixture in your libraries – and a valuable decision-making tool. We also have materials both on display and for you to take with you.

The meeting itself is designed to be interactive. A series of technical presentations will be followed by a panel discussion to give you an opportunity to talk with the experts and to get your questions answered. Finally, you will be invited to review, discuss and adopt some decisions of the meeting, then join our speakers for a cocktail on the beach and a lighting assessment of our host hotel after dusk.

On behalf of the Wider Caribbean Sea Turtle Conservation Network, it is my sincere pleasure to be here. And it is now my further pleasure to introduce Dr. Julia Horrocks, Director of the Barbados Sea Turtle Project.

*Karen L. Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)*

SEA TURTLES AND BEACHFRONT LIGHTING IN BARBADOS

*Julia A. Horrocks, Director
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The purpose of this presentation is to provide some information on the status and distribution of sea turtles around Barbados, and discuss the threats posed to our sea turtles by beachfront lighting.

There are three species of sea turtles found around Barbados. Two occur in our waters year round – the green turtle (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*), and one, the leatherback (*Dermochelys coriacea*), is found here only in the breeding season. Green turtles can be commonly seen in Carlisle Bay, Consett Bay, and Foul Bay. More recently, green turtles have become an attraction at Mt. Standfast, where they are provisioned to enable visitors to swim with them. Green turtles do not nest in Barbados. We know from genetic analyses that our green turtles hatch out on beaches far from Barbados, with equivalent contributions from nesting beaches on Ascension Island, Florida, Costa Rica, and Aves Island/Suriname (the latter two, whilst positioned far apart, share a common genetic signature).

The other two species – the hawksbill and the leatherback – do nest in Barbados and are therefore affected by activities that occur adjacent to nesting beaches. Leatherbacks are the largest of all species of sea turtle. The approximately 10 females that nest in Barbados annually between February and July nest almost exclusively on east coast beaches from Pico Tenerife to Long Pond. These beaches are high wave energy beaches with little coastal development, and hence the problem of disorientation by lights rarely occurs. Occasionally, females make their nests on the south and west coasts. When this happens, hatchlings are disoriented by lights just as badly as our most common nesting species – the hawksbill.

Although hawksbills are the species most commonly seen nesting in Barbados, they are in fact a Critically Endangered species on a regional and global scale, largely as a result of over-exploitation for meat, eggs and shells. They prefer to nest on the leeward west and south coast beaches, exactly where many of Barbados' hotels are constructed. They seek out the few remaining quiet, dark and vegetated beach strips to lay their 4-5 nests per season, each of which contains about 150 eggs. A female nests at 2-3 year intervals, on average. Most adult females are only in Barbados waters for a few months every few years; unlike the juvenile hawksbill population which forages year round on our offshore coral reefs. Being the most common nesting species, it is the easiest species to harvest. The excessive harvest of nesting females over the years is the main cause of population decline around Barbados. It has been illegal to catch nesting females for 100 years, but it was not until 1998 that all types and sizes of sea turtles in Barbados' waters were protected.

Whilst poaching has declined since 1998, one threat to sea turtle recovery increases. There have been very dramatic changes in the coasts of Barbados in the last 20-30 years. Many of the changes have resulted in the deterioration of nesting beaches. In particular, beaches are narrower and the available area of dry sand needed by sea turtles for nesting is greatly reduced. Some reduction in beach width is

due to natural erosion, but much is due to poor building practices. Building too close to the high water mark and removing natural beach vegetation results in sand loss. Attempts to stem the loss of beaches through the use of breakwaters, groynes and sea walls, actually makes the problem worse in many cases or causes sand loss on adjacent beach stretches.

Two closely monitored nesting beaches (Needham's Point and Queen's Fort) support almost 50% of all the nesting on the south and west coasts of Barbados. It is no coincidence that these stretches are amongst the few dark, well-vegetated, quiet beaches left on these coasts. Even within the Needham's Point beach, one can see the impact of lighting on nest distribution, with much less nesting occurring on stretches in front of hotels compared to stretches without developments. In a great many cases there are wide sandy beaches in front of the hotels, but females are deterred from nesting by lack of vegetation and the presence of lights. Instead of using a beach where the nest can be safely located above the high water mark, many turtles avoid the lights and make their nests in sub-optimal habitats where the chance that their eggs will be lost is greater. The Queen's Fort beach is extremely narrow, and many nests must be collected and reburied by research staff if they are not to be lost to high tides.

Sea turtles use natural light at night to locate the sea. Hatchlings are particularly seriously affected by artificial light. Between 1998 and 2000, approximately 65% of south coast nests (n=329) and 33% of west coast nests (n=556) on lighted beaches suffered some degree of hatchling disorientation (Figure 1).

This amounts to tens of thousands of hatchlings. Without intervention, their fate is to die in the heat of the next day's sun, to be crushed by vehicles on roads they have attempted to cross, or to be attacked and killed by crabs, cats or other predators. Furthermore, an increasing number of nesting females each year wander for up to an hour before finding the sea after nesting (Figure 2).

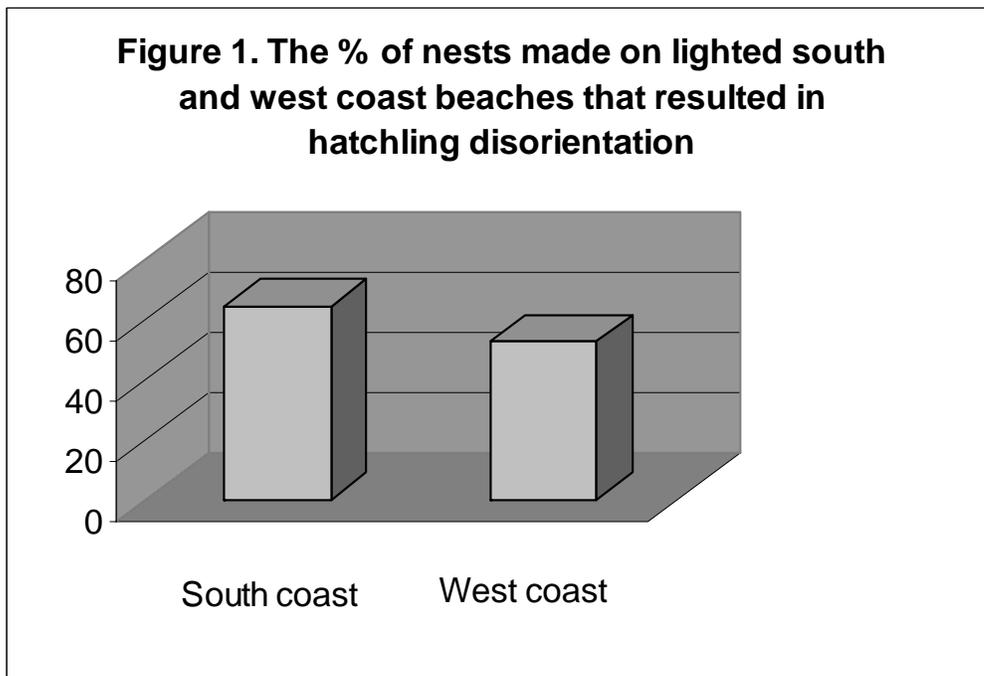


Figure 1

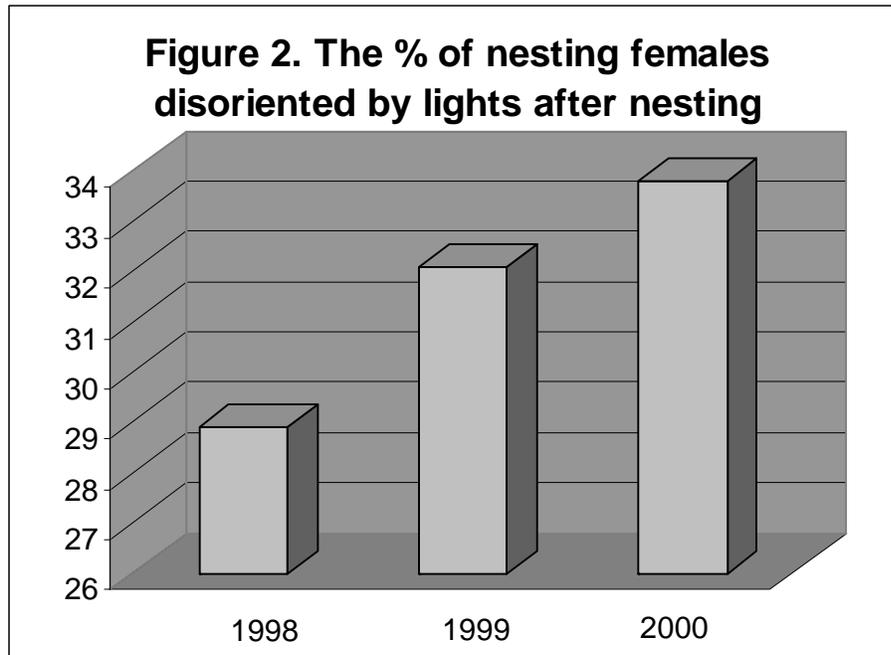


Figure 2

The Barbados Sea Turtle Project (BSTP) has worked with the hotel community to mitigate lighting problems for a number of years. At the beginning of each season, information on sea turtles is provided to the hotels and restaurants along the beach. This includes information on what to do if nesting or hatching sea turtles are seen, and how to make the beachfront “sea turtle friendly”. Hotels are encouraged to call the 24-hr Sea Turtle Hotline (Tel: 230-0142) to report nesting and hatching – and when disorientation occurs, BSTP personnel can assist in ensuring that the hatchlings reach the sea safely. This is achieved through the cooperation of hotel staff and often with the participation of visitors. Many security staff have a lot of experience collecting hatchlings, and their assistance significantly reduces predation by crabs until BSTP personnel can reach the location. Some hotels will temporarily turn off problem lights to facilitate the release of disoriented hatchlings, but oftentimes hatchlings will have to be taken along the beach to the nearest dark area for release.

Cages positioned over nests are used on some beaches. These serve the dual purpose of reducing trampling of the nest and also to restrain hatchlings from running towards the lights upon emergence. Of course this also means that these nests must be closely watched to ensure that hatchlings are released immediately upon their emergence at the sand surface.

Despite our best efforts at mitigation, even when we manage to get hatchlings safely into the sea, we know that hatchling viability (i.e. chance of survival) has likely been compromised. Hatchlings have had to use up finite energy stores running around lights, instead of using it in their swim out to sea. This can spell the difference between life and death for a tiny hatchling. Clearly, there is a need for all of us to come together to solve the problem of beachfront lighting for sea turtles.

I want to conclude by saying that now – the year 2000 – is the time to pay serious attention to the lighting problem. If we do not address this issue, conservation efforts such as the moratorium on sea

turtle capture will be undermined and recovery of this endangered species hindered. Hatchlings are the breeding adults of the future. We have stemmed the deliberate killing of severely depleted turtle populations for food and shells, but have not yet faced the challenge of reducing the accidental killing of turtles that occurs as a consequence of beachfront lighting. Hopefully, by the end of today's discussions, we will have the information we need to make positive steps towards solving this problem also.

BEACHFRONT LIGHTING: WHAT'S THE PROBLEM?

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Artificial lighting that is visible from sea turtle nesting beaches is known to deter sea turtles from nesting and to misdirect and kill the hatchlings that emerge from their nests. As properties near nesting beaches become developed with homes, hotels, and restaurants, the potential for these detrimental effects from wayward light would be expected to increase. Yet, of the many effects of human development, effects from artificial lighting may be among the most easily mitigated.

In this summary I will offer answers to some commonly asked questions about the effects of beach lighting on sea turtles, and provide methods by which light can be easily managed to protect sea turtles.

Commonly Asked Questions

What effect does artificial lighting have on sea turtles?

Nearly all of the sea turtle activity on nesting beaches takes place at night. Nesting females come ashore to nest at night and the coolness of night prompts hatchlings to emerge from their nests and run to the sea. Night is also when our ability to alter the environment becomes profoundly conspicuous... by the way we artificially light our world. This artificial light interferes with the ability sea turtles have to use information from natural light at night. This information indicates to sea turtles where and when they should nest and which way to travel to reach the sea.

Studies have shown that sea turtles are deterred from emerging to nest on beaches where artificial lighting is most visible. Their nesting attempts are often abandoned in the water, rather than on the beach, so that the detrimental effects of lighting are not necessarily revealed by abandoned nesting tracks observable on the beach. It is not certain why sea turtles tend to shun artificially lighted beaches, but it may be that bright lighting tells a turtle that she has mistakenly begun her nesting attempt in daylight.

Despite the deterrence of artificial lighting for nesting turtles, some turtles do nest on lighted shores. The effects of lighting on hatchlings emerging from these nests can be lethal. Hatchlings emerging from their nests at night depend upon subtle brightness cues to lead them safely to the sea. Artificial light sources attract hatchlings and lead them away from the ocean where the small turtles succumb to dehydration, exhaustion, or predators. Adult turtles returning to the sea from nesting can also be misdirected by shore-based lights in a similar way.

Why not light the beach more, in order to keep turtles safely away?

Sea turtles need to nest somewhere. But even if the number of dark beaches was infinite and sea turtles always had an opportunity to go "somewhere else", brightening a beach further to keep away nesting

turtles will not save their hatchlings. This is because it takes more light to frighten away nesting turtles than it takes to misdirect hatchlings. A few turtles will nest even on the most brightly lighted beaches and many will nest on beaches too bright to allow their hatchlings to escape.

If hatchlings are not misdirected by the moon, why do artificial lights harm them?

It is true that on unlighted beaches, regardless of moon phase or moon position, hatchlings move unerringly from nest to sea. Although hatchlings tend to move in the brightest direction, they also rely on shape cues associated with the shoreward dune to determine the seaward direction. These additional cues help hatchlings find the sea even when the ocean is not the brightest direction (such as when the full moon is shining brightly over the land).

However, there is an important difference between light from the moon (and other celestial sources) and light from artificial sources. The difference is in how light from these sources reaches a hatchling. Celestial light sources are bright but distant and their light reaches a hatchling both directly and indirectly as it is scattered in the atmosphere and reflected from clouds and landscapes. This indirect light helps to moderate the brightest direction and to provide visual cues other than brightness.

Artificial lighting, in contrast, produces little moderating indirect light. Artificial sources appear bright because of their proximity and the light fields they produce are highly directed. In essence this means that they have a lot of glare. Lights on beaches do not misdirect hatchlings because they are simply the brightest direction, but because they are overwhelmingly the brightest direction. Under these exaggerated or "supernormal" conditions, hatchlings seem to rely exclusively on brightness cues and will struggle to reach an artificial brightest direction until they die.

How bright can an artificial light source be without harming sea turtles?

Unfortunately, this is a complicated assessment. The harm a light source can cause will vary with its color and wavelength, where it is positioned, the amount of visible structure of the dune, the level of ambient light and, likely, other characteristics that are yet to be fully understood. Fortunately there is a simple rule that one can use to determine whether a given light source can harm sea turtles that use a nesting beach. If an observer located anywhere on the beach can see light that is produced by the source, then that light can harm sea turtles. Even dim lighting can harm turtles on the darkest nights of the month.

My neighbor has lights that shine on the beach. Why should I darken mine?

Although it is important to enlist help from all beachfront residents in order to completely protect the turtles that use the beach, it is also true that every little bit helps. If only some residents and business owners darken their portion of beach, at least hatchlings on those stretches or the hatchlings that emerge on the brightest moonlit nights will be able to find the sea. The darker a beach becomes, the more hatchlings will reach the water. Moreover, since turtles are likely to select those darker areas of the beach, the benefits (measured in the number of turtles coming ashore and the number of hatchlings later emerging) accrue directly to the hotel or other beachfront property which invests in "turtle friendly" lighting.

Will lighted barges offshore work to attract hatchlings off lighted beaches?

Apart from being an expensive and complicated feat of engineering, this proposal would not be expected to produce benefits for sea turtle conservation. If there were any effect, it would be that hatchlings on beaches adjacent to those with lighted barges would be misdirected. If hatchlings were attracted to the lighted barges, they may get no farther in their journey. The lights would also attract predatory fish that would consume many of the hatchlings reaching the barge.

How can sea turtle conservation justify turning off lights that are needed for human safety and security?

Thankfully, there is no need to abandon human safety for sea turtle conservation efforts. The key to protecting turtles from artificial lighting is not to prohibit light but to manage it. Light management is the process of getting light where it is needed most and keeping light away from areas where it can do harm. Below, I list some methods for managing light.

Light Management on Sea Turtle Nesting Beaches

Turn off unnecessary beach lighting. A large part of successful light management is turning off lights that are not necessary. This non-essential lighting includes decorative lighting and lights that illuminate areas where there are no people in need of safety or where there are no goods in need of security.

Think about timing. Although the most effective alterations to lighting are permanent, temporary seasonal alterations can also be effective. The critical period for light management alterations is throughout the nesting and hatching season and, during this period, throughout each night. Although there are peaks of nightly nesting and hatchling activity, this activity can span the entire night. Representatives of the Barbados Sea Turtle Project can help you define the months where nesting and hatching might be expected to occur on your beach.

Limit duration. The more momentary a light source is (i.e. the shorter the time the light is turned on), the smaller its effect on sea turtles. Motion detectors are the best way to limit the period that a light source is on. These switches turn lighting on only after the unit is approached and work only with incandescent lamps.

Use good light control. Light control involves controlling the direction of lighting. Good light control can allow a property owner to increase the brightness on his or her property without affecting the beach. Lowering lights is a good way to hide them from the beach. Lights on tall poles can be seen from great distances, but low-level lighting might not be seen at all from the beach. Shielding is also useful. The best shields are opaque, durable, and attached to a fixture in a permanent way. Aluminum flashing sheets make good light shields. Recessing lights into eaves is also a good way to hide them; many lights are specifically designed for this. Redirecting also helps. The best directed light sources are well focused and point down and away from the beach.

Use light screens. Sometimes it is difficult to remedy a light at the source. Some lighting might even be considered to be a non-point-source problem, such as the glow from a distant city. One way to lessen the effects of non-point-source light is to screen it from the beach. Although artificial structures can do this, the best method may be to simply allow dune vegetation to grow or to utilize decorative landscaping, providing a natural light screen.

Substitute long-wavelength light sources. Because even the best light-control techniques may allow some light to reach the beach, it is beneficial to use sources that emit wavelengths that least affect sea turtles. There is evidence that hatchling loggerheads, green turtles, hawksbills, and olive ridleys are less attracted to yellow and red light than to light composed of shorter wavelength green and blue. For this reason, a pure-yellow source known as low-pressure-sodium vapor (not to be confused with **high**-pressure-sodium vapor) may be among the least harmful commercial light sources. Yellow "bug lights," the incandescent lamps advertised to not attract insects, are a cheaper alternative but are not a pure a yellow source.

Most lamps that are tinted red can fade and emit some short-wavelength light. However, some red sources are good alternatives, such as red light-emitting diodes (LED's), and the old-fashioned true neon tubes (not to be confused with colored-fluorescent tubes). None of these long-wavelength light sources alone should substitute for ways to keep light off the nesting beach. Each can be harmful to sea turtles if used without proper light management.

For additional detail, please refer to the lighting manual (Witherington and Martin, 2000) which has been included in your meeting packet. The manual outlines the problem of lighted nesting beaches in greater detail and presents solutions that include ratings and contact information for different commercial light sources.

Literature Cited

Witherington, B. E. and R. E. Martin. 2000. Understanding, Assessing, and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches. Second edition, revised. Florida Marine Research Institute Technical Report TR-2. 73 pp.

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MAKING INFORMED CHOICES: LIGHTING TECHNOLOGIES

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We have heard today about the detrimental effects that artificial light may have on sea turtles. My talk will focus on light management techniques that are useful in preventing these harmful effects.

What is light management? It is the modification of artificial light in order to prevent or reduce light pollution. "Light pollution" may be defined as artificial light that causes an undesirable effect. But light pollution is not just a problem for sea turtles, and the benefits of light management are not restricted to sea turtles.

Often light management is aimed at reducing a specific type of light pollution. For example, roadway lights are sometimes shielded so that they don't illuminate residential areas and disturb people who are trying to sleep at night. Lights associated with roadways and adjacent commercial areas may also cause problems for drivers. The glare from some lights can be quite annoying and make it difficult to see. Fortunately, various types of fixtures have been developed to illuminate highways, parking lots and commercial areas while minimizing glare. These lights are directional; that is, they can be aimed so that light only reaches specific areas. Good roadway light management plans mandate the use of directional fixtures to reduce glare. Since glare makes it more difficult to see road signs, pedestrians and other cars, safety is increased when glare is reduced. A number of cities and counties in the U.S. have recognized the importance of good light management and passed laws regulating outdoor lighting.

Some large metropolitan areas have developed light management plans to reduce skyglow (the glow of lights scattered by mist and clouds). This type of light pollution is caused by non-directional light fixtures that allow light to escape in all directions and by directional fixtures that are aimed upwards. Skyglow is a problem because it interferes with astronomers' ability to see the stars. However, the concern over skyglow is not restricted to astronomers. Dark skies are considered an important resource in many U.S. National Parks, for example, and there has been an increased effort to reduce skyglow in these areas. The concern over skyglow is not restricted to the U.S. The International Dark-Sky Association (IDA), which has over 3,900 members in 70 countries, promotes light management to preserve the beauty of the night sky. The IDA points out that the benefits of properly managed light include energy conservation, as well as *improved safety and security*.

Some hotels and restaurants unknowingly practice light management when they choose directional fixtures to create an aesthetically pleasing atmosphere. These fixtures tend to focus the light and minimize the potential for light pollution. One form of light pollution that may be reduced is glare. Since glare may decrease a person's ability to negotiate stairs or see obstructions along walkways, safety of guests and employees is increased when directional fixtures are used. A reduction in glare also makes it easier to discern intruders, thereby increasing security.

In some cases light management is necessary to prevent lights from having a detrimental effect on wildlife. A Toronto organization, Fatal Light Awareness Program (FLAP), is working to publicize the detrimental (often fatal) effects of artificial lights on migratory birds. Birds become confused or blinded by the glare from artificial lights and end up crashing into windows, walls, floodlights and even the ground. A special report published by the World Wildlife Fund and FLAP (Ogden, 1996) not only describes the nature of the problem, but also offers a number of recommendations for resolving it. Light management is an essential component.

Many coastal communities around the world manage lights so they won't have a detrimental effect on sea turtles. Blair Witherington has described how lights affect sea turtles. There is a great deal of background information on this subject, which concerns the biology of sea turtles, in the manual (Witherington and Martin, 2000) available in your meeting packets. In my presentation I will focus on the many alternatives that are available to minimize the detrimental effects of artificial light on sea turtles.

The ultimate objective of a light management plan to protect sea turtles is to keep the light off the beach. This objective may be achieved by using the following four-part strategy:

1. Put the light only where it is needed. The source of light (i.e. the lamp or bulb) should not be visible from the beach and the source of light should not directly or indirectly illuminate the beach.
2. Use the minimum amount of light necessary to accomplish the task. This reduces the potential for illuminating the beach indirectly through reflected light or skyglow.
3. Use the light only when it is needed. This minimizes the amount of time that a turtle may be affected by a light.
4. Minimize light that is directed upwards. This will reduce the potential for skyglow.

In many light management plans, recommendations are also made to utilize light sources with spectral properties (colors) that are minimally disruptive to sea turtles. These light sources (including low-pressure sodium vapor lighting, yellow bug lights, red light-emitting diode lighting, and true neon tubes) were mentioned by Blair Witherington. While these lights are less disruptive than other commonly used lighting sources, they are not invisible to sea turtles and the four-part strategy [above] should still be used with them.

Before I describe the alternatives for keeping light off the beach, I will briefly explain how to evaluate lighting to determine if modifications are necessary. The procedures I will describe may be used to evaluate a single facility where the lights and window coverings may be controlled by the evaluator. In cases where multiple facilities must be evaluated, it may be necessary to modify the procedures. In this case, please refer to the section on Lighting Inspections in Witherington and Martin (2000).

Lights should be evaluated on dark, moonless nights. This is when lighting problems will be most evident. All lights should be evaluated. In some cases, one or two particularly bright lights may make it difficult to evaluate other dimmer lights, so it may be necessary to temporarily turn off the brighter lights when evaluating the other lights. Interior lights should be evaluated with the window coverings (i.e., curtains or blinds) fully opened and fully closed. In the fully closed position the effectiveness of the window covering may be evaluated. In the fully opened position, the interior lights may be evaluated.

To properly evaluate lights, they should be viewed from all positions on the beach. Often lights that cannot be seen from low on the beach are visible from high on the beach and vice versa. Also, lights that cannot be seen from the beach directly in front of a facility may be visible from other positions up or down the beach.

For each light fixture, the following should be determined:

- Is the source of light visible from the beach?
- Are there reflective surfaces around the fixture, and if so do they broadcast light toward the beach?
- Does the light illuminate the beach?
- How extensive is the illumination? Is it visible from only one location or is it visible from a wide range of locations?

Based on this evaluation, a light management plan is developed and recommendations are made for correcting each problematic light fixture. A variety of options may be available for solving each lighting problem. I will first provide options for properly directing lights, then I will address ways to minimize illumination.

In some cases light management can be as simple as aiming the light away from the beach. This is sometimes the option of choice for spotlights and floodlights. This fix is especially effective if the spotlight or floodlight is hooded. The hood better focuses the light and decreases the chance that it will be visible from the beach.

One of the most often used means of preventing light from illuminating the beach is to apply a shield to the fixture. In some cases shields may be available from the manufacturer of the light fixture, and in other cases it may be necessary or desirable to fabricate a shield. When choosing or fabricating a shield it is important to remember that the shield should block light from all locations on the beach. This often requires that the fixture be shielded on three sides or in an arc of at least 180°. Also, if the fixture is close to the beach or at a high elevation, it will require a deeper shield than a fixture that is relatively low or located at a greater distance from the beach. In some cases, though, either because of the fixture type or its proximity to the beach, shielding may not be practical or effective.

If the fixture cannot be adequately redirected or shielded to keep the light off the beach, sometimes reducing the mounting height is the answer. This is particularly effective if there is a dune, vegetation, or built structure between the fixture and the beach. In some cases, a combination of shielding and reducing the mounting height is required.

If reducing the mounting height doesn't work, then sometimes repositioning the fixture does. For example, the fixture may be moved behind a natural barrier (dune or vegetation) or artificial structure (wall, building, fence, etc.). The intent is to block the light from the beach.

However, in some cases it may be more practical just to replace the problematic fixture with one that lends itself to good light management. And certainly in the case of new construction, it is much more practical to install appropriate fixtures to begin with rather than having to retrofit fixtures in the future. There are numerous directional fixtures that can be used for a variety of applications. Specifications and illustrations of some of these fixtures are given in Appendices D, E and F of Witherington and Martin (2000). More information is available on the IDA's website (<http://www.darksky.org>) and on numerous

lighting company web sites. I will discuss several of the fixtures that we recommend, some of which are on display at this workshop, and will use the terminology of Witherington and Martin.

Low-mounted, louvered bollard fixtures are ideal for lighting walkways, pools, patios, entranceways, parking lots and other areas near the beach. They are excellent replacements for globe lights and the various types of decorative lights that allow light to escape in all directions. In contrast, a bollard with the appropriate louvers prevents light from projecting upward. But many bollards, if not properly louvered, will allow light to escape in all directions. While the low mounting height of most bollards may allow light to be shielded from the beach by dunes and/or vegetation, bollards that allow light to project upward may contribute to skyglow and indirectly illuminate the beach.

Likewise, low-level tier lighting may sometimes be used where dunes, vegetation (landscaping) or decorative walls block the light from the beach. However, most tier lighting does allow light to project upward, so if numerous fixtures are used they may contribute to skyglow and indirectly illuminate the beach.

Another type of lighting fixture that we often recommend to replace non-directional fixtures is downlighting. These lights lend themselves to good light management because they are directional and direct the light downward, hence the name. Downlighting fixtures come in an assortment of shapes and colors and may be mounted on walls, ceilings or poles or even hung from cords. They are excellent replacements for wall-, ceiling-, and pole-mounted globe lights and other non-directional fixtures. Downlights are used along hallways, near doorways, along walkways, on balconies and porches, and around pools and patios.

There are several things to look for when choosing downlighting. The lamp should be sufficiently recessed so that it will not be visible from the beach. This will, of course, depend on the height of the fixture and its distance from the beach. Also, the interior surface of the fixture should be non-reflective. In some cases, matte-black non-reflective baffles are available. Some fixtures that appear to be downlights also have an upward component. Fixtures that allow light to be projected upward are less effective in managing light since they may contribute to skyglow.

A variety of downlights may be recessed into the soffit under eaves or recessed into ceilings. These are often effective replacements for floodlights around the outside of a building, but may also be used along hallways, at entranceways, and on porches and balconies. Recessed, ceiling downlighting is often also used for interior applications. As with other downlighting, the lamp should be sufficiently recessed so it is not visible from the beach and the interior surface should be non-reflective.

In high-elevation applications or applications very near the beach, it may be necessary to use a different type of fixture. In this case, recessed, louvered, step lighting may be the preferred alternative. Because step lighting is typically mounted fairly low and the louvers direct the light down, this fixture may be effective in lighting balconies near the beach if there is a low opaque wall on the seaward side of the balcony (see p. 56 of Witherington and Martin, 2000). Step lighting may also be used along hallways, stairwells, on the landward side of beach access ramps, and along walkways. As with all directional lighting, insure that step lighting is positioned so that the light is directed away from the beach.

Another type of lighting that has been used to illuminate walkways, decks and the landward sides of beach access ramps is linear tube lighting. The lighting is usually recessed in stairs or handrails. Because

the directional suitability of this type of lighting is only fair to poor, particular care must be taken to insure that the beach will not be illuminated through its use. Low-wattage strips should be used sparingly in recessed areas and they should not be used where light will be reflected toward the beach.

A fixture that may be appropriate for parking areas, roadways, and other outdoor areas is the cut-off fixture. These come in a variety of shapes, sizes and colors and are most often seen in parking lots. The term "cut-off" refers to the fact that these fixtures have a cut-off angle of 90° or less. The cut-off angle is the angle between a vertical line through the fixture and the first line of sight at which the source of light is no longer visible. So cut-off fixtures eliminate uplight. Furthermore, most cut-offs are compatible with a number of different reflectors that allow light to be directed to specific areas. Though these fixtures are directional, they are often mounted on tall poles and used with high intensity lamps. For these reasons, we recommend that cut-off fixtures generally not be used within 50 meters of a nesting beach or where they are visible from a nesting beach. However, these fixtures are preferred to less directional fixtures such as globe-style, cube-style and cobra-head fixtures. And they may be used closer to nesting beaches when used with the optional shields, mounted on low poles and outfitted with some of the lower intensity lamps.

It should be mentioned that there are fixtures that look like cut-off fixtures, but that have cut-off angles greater than 90°. These fixtures usually have a lens which projects below the opaque sides of the fixture. These lights allow light to project upwards, may contribute to skyglow, and are **not** appropriate for use near sea turtle nesting beaches.

Another fixture type that is commonly used for exterior applications is the floodlight. Floodlights are used to illuminate parking lots, recreation areas, walkways and signs. Since most floodlights are directional, they may be appropriate for certain applications, particularly if they are directed away from the beach and downward. Optional hoods available for some floodlights allow even better light management. But because floodlights are usually equipped with high-intensity discharge lamps, particular care must be taken to insure light is not reflected upwards or towards the beach.

A fixture that may not always be considered when developing a light management plan is the sign. For many businesses a sign that is visible at night is essential. For the purposes of light management it is better to use a low monument sign that is lighted from above than a sign that is lighted from within and mounted on a pole. Signs that are lighted from within broadcast light in all directions and are made even more problematic when elevated on tall poles.

Before I leave this discussion of fixture types, I should mention that there is no single fixture that will solve all lighting problems related to turtles. It almost always takes a combination of different fixtures (all properly aimed, shielded and positioned) to keep the light off the beach.

Thus far my comments have focused on exterior lights. However, an effective beach lighting management plan must also take into account interior lighting. Interior lights from buildings that are close to the beach, very tall or have large beachfront windows pose the greatest potential threat to sea turtles.

The main management tool for solving interior lighting problems is the proper window covering. Opaque curtains or blinds that completely cover windows visible from the beach are very effective in keeping light off the beach. However, the covering must be closed every night, all night, throughout the nesting and

hatching season, in order to work. This may be the responsibility of a coastal resident, hotel guest, or business owner. In all cases, it will be necessary to establish a method of educating and reminding the responsible party of the importance of keeping the windows covered at night.

Fortunately, many organizations have developed attractive door hangers, flyers, and other informational materials that are helpful in reminding people to draw their curtains and practice other forms of light management. Most people, when made aware of the detrimental effects of artificial lights on sea turtles, enthusiastically cooperate.

In addition to window coverings, there are several other means of minimizing the potentially detrimental effects of interior lights. Window tinting may be used on windows facing the beach. This will reduce the intensity of light reaching the beach from interior fixtures. Tinting that achieves an inside-to-outside light transmittance value of 45 percent or less is recommended. To further minimize beach lighting from interior lights, lamps and other moveable fixtures should be positioned so they are not visible from the beach.

Another option for shielding both interior and exterior light from the beach is to plant a vegetative buffer. Though a vegetative buffer may be very effective, it may be necessary to erect an artificial light screen such as a fence until vegetation becomes tall enough and thick enough to block the light. When installing artificial light screens, special care should be taken to insure that the light screen itself will not interfere with nesting turtles.

When developing a light management plan for a sea turtle nesting beach it is important not only to look at ways of properly directing light, but to also look at ways of reducing illumination to the minimum necessary for each task. The most obvious means of minimizing the illumination emanating from a fixture is to reduce the wattage of the lamp. And this is very effective in many cases. However, the minimum acceptable wattage varies depending on the type of fixture and for many fixture types (including downlighting, floodlights, and cutoff fixtures), the model. Care should be taken to select fixtures that will allow the minimum illumination necessary to accomplish the task. In some cases, illumination may be appropriately controlled by means of a dimmer. If a particular fixture is used for various tasks with different lighting requirements, then a dimmer may be used to adjust the light to the minimum necessary for each task. In other cases where multiple fixtures are used to illuminate a particular area (e.g., a hallway, a patio, a parking lot, a dining room) it may be possible to simply reduce the number of fixtures.

Finally, some options for minimizing illumination relate to the strategy of only using a light when it is needed. The most obvious option is to simply turn a light off when it is not needed. However, since this responsibility may fall on the shoulders of a hotel guest who is not familiar with sea turtle issues, an educational program will help. Once again, door hangers, flyers and other educational materials will help encourage people to turn off unnecessary lights. Where lights are routinely only required for a certain period of time, it may be useful to install timers so lights will be automatically turned off when they are not needed. Another tool that may be used to limit lighting to when it is needed is the motion detector. Lighting connected to a motion detector only comes on when the fixture is approached, and then switches off after a set time following the last detected motion. So the light is only on when it is needed for safety or security.

Through the use of these and other options it is possible to manage light so that it does not have a detrimental effect on sea turtles. But this is not the only benefit of properly managed light. It often

results in energy conservation, which translates to cost savings. By reducing glare, safety and security are improved and the appearance of the property is more aesthetically pleasing. Properly managed light also preserves the night sky. For resort areas, this provides another amenity for guests. And finally, managing lights for the benefit of sea turtles provides good fodder for public relations and may be useful in promoting an area to tourists.

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MAKING A DIFFERENCE: COMMITTING TO LIGHTING ALTERNATIVES

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When The Disney Vacation Club decided to expand and build a resort on the beach, they wanted a location that would be appealing to guests yet still close to Orlando. Disney had never built a resort away from their theme parks and they wanted it to be a very special place in a relaxing environment that would really attract guests.

The Disney Imagineers flew over the state of Florida in search of the perfect spot. They not only looked at all of the beaches but also the surrounding areas. When they saw Vero Beach, they fell in love with the small city and its natural habitat. The property was on a barrier island that had the ocean on one side and the Indian River Lagoon on the other. The lagoon is unique because it is home to thousands of species of marine life, including juvenile sea turtles, dolphins and manatees. The area, which was fairly undeveloped, would be a beautiful spot to build their first offsite vacation club resort.

Now that they had a location, a lot of thought was put into the design and "themeing" of the resort. The resort was designed to appear as though it had been built almost a century ago, surrounded by lush vegetation. This meant that the resort needed to fit into the natural environment and not only protect it, but enhance it as well.

This area of Vero Beach is also unique because it is adjacent to The Archie Carr National Wildlife Refuge, which is the largest sea turtle nesting area in the Western Hemisphere for the loggerhead sea turtles. Green and leatherback sea turtles, both classified as Endangered in the U.S., also nest on the beach at the resort. The importance of this nesting beach played a large part in how the resort would be designed.

The developers chose not to clear-cut the land or the natural dune vegetation. They moved 25 large oak trees and replanted them in an effort to keep the environment as undisturbed as possible. Trees and plants that were unable to be reused onsite were donated to a local environmental project. Native species were planted according to the Habitat Management Plan. Even the color of paint used on the outside of the resort blended in with the natural habitat.

The citrus groves in the area and the history of sunken treasure ships offshore added to the themeing of the new resort. The other theme they decided to include was the environment. Once that decision was made, interior designers used those three themes in their designs and even included a mural behind the front desk that is a combination of sea turtles, treasure ships and citrus trees.

The Disney developers also made other efforts to ensure the protection of the endangered and threatened sea turtles. Lighting was of particular concern, and the following specific measures were taken:

- Special lighting along the pathways and boardwalk was selected so that there was not any light shining onto the beach.
- Exterior lights do not face the ocean. What little exterior lighting we have is slanted so as not to shine east towards the ocean.
- The promenade has muted amber lights, which are also more effective in keeping mosquitoes away and in enhancing the general atmosphere.
- Tinted windows were installed in the Inn Rooms and Vacation Homes on the ocean so that lights would not disturb the nesting turtles.
- Window treatments were designed with a special lining to block out the interior lights when closed.

The Resort had special "Sea Turtle Protection Area" signs posted on their boardwalk, cautioning guests to not disturb the turtles or their nests.

Our commitment did not stop with planning and design. After we opened, the resort guests were asked to close their specially lined drapes in the evening to further ensure that their lights would not disturb the sea turtles or their young. Tent cards have been placed in all of the rooms to provide guests with helpful hints to further protect the turtles and the dune area. Special "Do Not Disturb" door hangers are placed on patio doors that face the ocean.

The resort's in-house television Information Channel carries a special message to its guests on the importance of keeping the beaches dark and undisturbed during the nesting and hatching seasons and not to ever use a flashlight on the beach.

Turtle nests on the resort beach are marked with placard signs, designating these as areas where guests are to avoid placement of a chair or umbrellas. These signs also serve as a reminder to our guests of this unique nesting area.

The resort does not sell balloons or use them during celebrations, so that they can not accidentally end up in the ocean to be consumed by a turtle. This is explained to the guests so that they understand the importance of a litter-free beach. Every quarter we sponsor beach clean-ups. We invite our guests to take part in these coastal clean-ups and we give away small prizes for those who participate. We also educate them on the hazards of monofilament fishing line and other debris, including plastic bags, which are very hazardous to sea turtles.

The Gift Shop also has a great selection of books about sea turtles, from children to adults and has an assortment of environmental items from sea turtle sculptures to magnets.

In addition to these steps, the Resort has continually provided information to educate its employees and guests on sea turtles and their habitat. This has been very successful because of the partnership we have with the people in our area that are sea turtle experts. For example, Dr. Blair Witherington of the Florida Fish and Wildlife Conservation Commission conducts yearly "nest indexing training". And the manager of the Archie Carr National Wildlife Refuge, Mr. Paul Tritaik, has volunteers and technicians work with our employees to educate them on ways they can help the Wildlife Refuge and the turtles.

Park Rangers from the nearby Sebastian Inlet Florida State Park recognized our need to provide more information to our guests, who were always asking us about the sea turtle signs and notices around the resort. Our Guest Services desk had numerous requests from guests who wanted more information about the sea turtles. The Park Rangers answered our calls and due to so many requests, they have made it possible for us to have Turtle Walks at our resort each year. Twice a week during the two peak months of the nesting season (June and July), Park Rangers take guests on the beach to see a nesting turtle. They also have a slide presentation once a week that provides information for those not able to go on a walk.

When the Turtle Walk program started it an immediate success. People would find out about it through their friends or sometimes from the Internet. Some travel to Disney's Vero Beach Resort specifically for this reason. The Turtle Walks are so popular that we have to hold a lottery every morning to see which guests will be able to participate! Since the number of participants on the Turtle Walk is controlled and permitted by the State of Florida, not everyone is able to attend.

The employees at the resort volunteer every year to be the scouts on the Turtle Walks. Everyone here anxiously anticipates the arrival of our sea turtle guests. When our scouts are on the beach looking for turtles for the Park Rangers, they also hand out flyers to people they encounter on the beach. The flyers remind people that the turtles are Endangered and show them how to help protect them instead of disturbing them.

The Caribbean Conservation Corporation has also helped us develop an educational daytime program for the children at the resort who want to learn more about the sea turtles. This morning program runs through the nesting and hatching seasons and lets the children at the resort explore the beach looking for turtle tracks, and lets them identifying the species and help mark the nest. They will also look for a hatchling emergence later in the season and sometimes help a permitted wildlife technician inventory the nest. The program includes the "adoption" of a turtle. They are then able to track the adopted turtle's movements on the Internet. This program is so interesting that we often have adults join in.

The more information and programs we provide for our guests and their children, the happier they are . . . and of course the more likely they are to return. We often have children and their parents call us from their homes to ask us to send them more information so that they can do a report for school.

I have always felt fortunate to live and work in an area that has sea turtles nesting on the beach and living in the lagoon. They are beautiful and fascinating gentle creatures. We should never take for granted that they will always be here and should always do whatever we can to protect their habitat. This not only includes how we control the lights on the beach, but also the education that we are able to provide. Working for Disney has given me the opportunity to help educate our employees and guests about the sea turtles.

When we are providers of this information it is greatly appreciated. I have never heard anyone complain about the steps that we take and ask our guest to take to protect the sea turtles. The comments I do hear, especially after a Turtle Walk, are, "What a wonderful experience this has been" and "I will remember this for the rest of my life". I also hear our guests say that they will be back again next year for the turtle season and I think that is something that every resort manager wants to hear!

PANEL AND OPEN FORUM

Panel [in alphabetical order]:

- Julia Horrocks (Barbados Sea Turtle Project)
- Denise Leeming (Disney Vero Beach Hotel)
- Erik Martin (Ecological Associates)
- Natalie Rothwell (Tourism Development Corporation)
- Sue Springer (Barbados Hotel and Tourism Association)
- Blair Witherington (Florida Fish and Wildlife Conservation Commission)

The two-hour Open Forum was lively with questions and the sharing of experiences. Many queries reflected interest on the part of hoteliers in having a beachfront lighting survey and assessment done for their property. There were several specific questions about fixtures and positioning, many of which the Hosts hoped would be further clarified during the early evening field demonstration.

Sports lighting (e.g. evening tennis court lighting) and security lighting were the first topics to be addressed. Both are problematic, and both could benefit from current technologies which not only offer “turtle friendly” alternatives but also offer collateral advantages, such as real energy savings over short periods of time.

In the case of sports lighting, it was noted that courts and other sports venues are typically lit whether or not there are players present. It was also noted that some court lighting is on all night, long after any reasonable expectation of recreational play. One solution is to install a timer so that lighting is only on during a specified period, not all night. Another solution is to ask guests to register (using sign-up sheets) to play so that lighting can be programmed accordingly. Finally, lighting might remain off unless a guest asks that a court be illuminated. In any case, lights should be downlit; that is, “wasted” lateral and upward directed light should be avoided using shielding.

In the case of security lighting, motion detectors offer real advantages. In this case lighting is only present when an intruder trips a sensor of some type; that is, lights automatically switch on when someone walks into a particular field. A few hoteliers spoke of incidents where guests had been hassled, and in some cases harmed, by intruders, typically near the beach. Their response had to be to flood the area with light, but the only result was a soaring electrical bill and **diminished** security. Why? Because while security staff sit in a lit “fish bowl”, blinded by the bright lights and unable to see beyond them, potential intruders enjoy the advantage of staying in the shadows.

By installing lights directed to fill particular property fields, and then putting these lights on motion detectors, light can be instantly produced when an intruder crosses into that space (field). The effect is to freeze an intruder in his tracks, giving security personnel the advantage of surprise. The point was also made that these measures not only dramatically increase security, but they also provide significant energy savings (a potential competitive advantage with electricity running at \$0.38 per kilowatt hour).

The International Dark-Sky Association has as its mission, “To preserve and protect the nighttime environment and our heritage of dark skies through quality outdoor lighting.” It was noted that their webpage (<http://www.darksky.org/>) offers valuable insight into mitigating specific challenges, such as

sports or security lighting, and participants were invited to visit that website for a wide variety of Internet-based resources and references.

The discussion turned to the “new tourist”, and the point was made that Barbados is developed for the “old tourist”. The new tourist is more eco-oriented, more willing to support local conservation issues. “The faster we shift our paradigm, the more sustainable our future will be.” The discussion then turned again to the bottom line, and the importance of budgeting and planning when creating a sustainable future. The positive budgetary effect of targeting lighting resources so as to use light only when and where it is needed should not be underestimated.

During these transition years between “old tourism” and the “new tourism”, how are we presenting ourselves? How do we stand out? How do we ensure that people continue to select Barbados as a travel destination, with so many other choices available to them? Perhaps most importantly, “Is our perception of tourism really what the tourist wants?” Are we emphasizing recycling, locally produced products, landscaping appropriate to our climate, and a general respect for nature?

We are all aware of the “bad examples”, such as Jamaica with 70%-plus dead coral. What are **we** using as a model? What are we learning? Are we adapting? Are we fully utilizing new information, such as this workshop has so effectively provided to us? What about the regulatory framework? Is it sufficient? Is it enforced?

Participants agreed that the Planning Department needs to be more consistent and to provide follow-up. There are “good things in writing”, but little or no enforcement. We need to guard against “money talking”, buy-offs, and selective enforcement, especially as it related to pollution and effluent discharges. Lighting is part of this larger picture, we should have standards and those standards should be enforced. We can set an example, those of us in this room, but we cannot do everything ourselves. The Planning Department should take into account these lighting issues during permitting processes and the review of development plans.

Panel members noted that a model Lighting Ordinance is included in Witherington and Martin’s technical manual, “Understanding, Assessing, and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches.”

Can a hotelier manage this program in the absence of local consultants? Yes! There are local resources available, such as the Barbados Sea Turtle Project and the Environment Officer at BHTA. In addition, there are websites deigned to accept input on your particular requirements and then respond with specific recommendations, as well as sites that offer other important information on lighting and light management. Some examples include:

<http://www.diversifiedlighting.com/manufacturers.htm>

--an exhaustive list of lighting manufacturers by the lighting products they sell

<http://www.darksky.org/fixtures/manuf.html>

--a long list of manufacturers who make effective light-managed fixtures

<http://www.spauldinglighting.com/> and <http://www.qualitylighting.com/>

--two examples of companies that offer online lighting consultation, and

<http://www.darksky.org/>

--as already noted, an excellent site with abundant general information on light management.

The lighting manual by Witherington and Martin is also an excellent and very readable resource.

Whilst there are certainly technical aspects of conducting a lighting assessment of any particular property, **anyone** can undertake a basic survey which can substantially reduce the lighting threat to sea turtles and their young. Stand on the beach at night. What do you see? Take each light, one at a time, and evaluate it! Is it really needed? Can you save money (or increase the effectiveness of the light, such as for security purposes) by associating it with a timer or a motion detector? If use of the light cannot be avoided, can it be lowered or shielded or re-directed so that it does not shine on the nesting beach? (Remember, if you can see the light from the beach, so can the turtle.)

In addition to evaluating your own lighting portfolio, think about “light trespass” from neighboring facilities and work collaboratively to minimize it. “This is a very interesting point, I never thought of light as ‘pollution’ before! Or of light itself as being something that can trespass, unwanted, onto my property.”

Again the discussion turned to what makes Barbados unique. Barbados has “natural lighting”, have we forgotten? We have stars, we have fireflies. When is the last time we sat and watched a firefly? Do we value our natural lighting? Are we incorporating **it** into our hotel offerings? People come to **our** island, to **our** environment, and we should structure their visit so that tourism doesn’t diminish **our** quality of life!

We don’t cater to global, uniform packages. We have Barbados, no one else does. Let us enjoy our night creatures, our sea turtles, our fireflies. We know that we use too much light, we know that we spend too much for it, and now we know that it harms an important part of our natural heritage. What will we do if we lose our sea turtles? They are themselves an invaluable tourist attraction, many of us have seen this first-hand. But they are also part of what it means to be in Barbados, and what if we ruin this for our children?

Wrap-up: *Sue Springer, Barbados Hotel and Tourism Association* – I want to say “congratulations” to all our speakers, hosts and participants! Thank you so much for this very informative and interactive session. It occurs to me that we really are our own worst enemies. What will happen to our home, to our pride, if we don’t give a sustainable future some thought? Thank you for your interest, and for your attendance today. We look forward to working together with you on this important issue, and with the Barbados Sea Turtle Project as well. And to guide us in our future direction, let us move forward in the agenda to discussion of the Resolution and any recommendations which you would like to see come out of this workshop.

[**Note:** The Resolution was passed unanimously, along with a number of Recommendations. These are printed at the beginning of this Proceedings volume.]

*Karen L. Eckert (WIDECAST)
Discussion Moderator*

CLOSING REMARKS

We are all familiar with the adage that a journey of one thousand miles begins with a single step. I believe that the Barbados Sea Turtle Project and all of our meeting sponsors and collaborators have done an excellent job of designing a workshop to help you take those first few steps – and to give you the information you need to continue the journey long after the experts have gone home.

There are so many things in our daily lives over which we have little control. Isn't it wonderful to know that we can, each of us, personally, make an important contribution to the survival of Barbados' sea turtles? This is one conservation "problem" that can be solved! Moreover, the solution provides important additional advantages, including increased sea turtle nesting and hatchling survival (which brings with it potentially lucrative "Turtle Watching" potential), reduced utility costs, a more efficient physical plant, a more progressive tourism product, and an enlightened respect for the natural environment that sustains us all.

On behalf of members in more than 30 Caribbean nations and territories, it has been our sincere pleasure to participate in this workshop. Through our partnership with the Barbados Sea Turtle Project, we look forward to continuing to assist you in any way we can. In particular to keeping your industry representatives, such as the Tourism Development Corporation and the Barbados Hotel and Tourism Association, informed as to the latest developments on these important issues.

It is clear that Barbados will become an industry leader in the area of progressive beachfront lighting, and we look forward to carrying your example to others throughout the region. With that I invite you all to join us for cocktails on the terrace, to be followed by an early evening demonstration with Erik Martin and Blair Witherington on how to conduct a Lighting Survey and Assessment, to be held here at the Glitter Bay Fairmont Hotel. Thank you.

*Karen L. Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)*

EPILOGUE

Since convening **Sea Turtles and Beachfront Lighting: An Interactive Workshop for Industry Professionals and Policy-Makers in Barbados** at the Fairmont Glitter Bay Hotel in 2001, the Barbados Sea Turtle Project has continued to provide lighting assessments to hotel and real estate managers, as well as to advise government agencies on appropriate lighting for new beachfront properties.

The issues of safety and security of guests continue to concern the hotel sector. Despite the fact that there are viable lighting alternatives that can meet both security and conservation goals, the perceived issues of guest security have been a major impediment to light reduction on Barbados' beaches. In most cases hotels have been more flexible in reducing lights used purely for aesthetic purposes, although there are notable exceptions where aesthetic lighting has remained or has even been increased despite our best efforts.

Security issues notwithstanding, an increasing number of hotels have made significant adjustments to their lighting using the resources provided by the Workshop as a guide. These hotels are benefiting from their investment in a variety of significant ways, including reduced electrical costs, favorable environmental reviews, creative and eco-friendly guest relations, and, not insignificantly, the continued nesting by endangered sea turtles on their beaches. Importantly, there has been no increase in crime or accidents at any of these properties.

Hotels that have changed exterior lighting fixtures and/or balcony lights to low pressure sodium lighting or yellow "bug lights" include Coconut Court Beach Resort, Southern Palms Beach Club, Casuarina Beach Club and Asta Beach Resort. Southern Palms has also reduced the wattage by 40% on their spotlights. With the benefit of the lush vegetation surrounding the hotel, Casuarina Beach Club has successfully shielded its lights from the beach completely. Several of these hotels have obtained or are in the process of obtaining the prestigious Green Globe certification (<http://www.greenglobe21.com/>), but alterations to beachfront lighting to conserve sea turtle nesting habitat go above and beyond what is required to meet Green Globe goals.

Coconut Court Beach Hotel has adopted policy statements that deal specifically with turtle-friendly lighting. These statements are present in their environmental policies: "Conserving our natural resources by minimizing our negative impacts through education, by example and sustainable management" and "Protecting and enhancing all ecosystems wherever possible". The Environmental Briefing for the hotel, delivered to guests upon arrival clearly states, "Coconut Court beach is a turtle nesting area. Please turn off your lights when not in use." Guests have been very responsive, cooperative and eager, and many plan to return during nesting season to witness activity. Guests routinely commend the hotel for adopting the above-mentioned initiatives.

A formal Sea Turtle Policy Statement has not been adopted at Asta Beach Resort, but there is internal agreement "to minimise the negative impact on our surroundings through the protection of wildlife in the immediate vicinity." Changing all beachfront lighting was a priority action. Guests are informed of the hotel's commitment to sea turtles by way of notice-boards in the activities area and on the beach, notices in rooms, and announcements at the Manager's cocktail party. Guests show a lot of interest in the turtle programme, and respond positively to the hotel's efforts.

As a Green Globe Hotel, Casuarina Beach Club has always considered the conservation and the protection of ecosystems and their inhabitants of prime importance. The protection of the hawksbill population, as well as green turtles feeding offshore, is part of the hotel's Mission Statement that is posted in the lobby of the hotel. Lighting throughout the hotel is energy-efficient and beach lighting has been installed with a view to protecting the beach ecosystem. Guests are continually informed about turtles and the lighting issue. The hotel reports that guests "are both surprised by the information and always pleased by the hotel's efforts."

Now that Barbados has examples of distinguished and profitable hotels making successful changes in lighting policies without compromising safety or other industry standards, more hotels have signaled their intention to make necessary adjustments to reduce lighting on their beaches. In many cases these hotels are entering planned renovation phases, which will now include changes in beachfront lighting. These include Almond Beach Resort and Southern Palms Beach Club. Barbados Sea Turtle Project staff members have been working with these hotels to emphasise the value of reducing light pollution following the renovations, and we look forward to the results!

The Barbados Sea Turtle Project has also assisted the new Hilton and Savannah hotels, both located on the most densely populated stretch of hawksbill nesting beach in Barbados, to minimise their lighting impacts on the beach. The Hilton hotel, which is still under construction, has a great opportunity to be the flagship for the standards that other hotels adjacent to sensitive nesting habitats, both in Barbados and throughout the Wider Caribbean, should strive for.

In 2003, the Barbados Sea Turtle Project and WIDECAS, in collaboration with the Barbados Hotel and Tourism Association and local hotels already implementing aspects of the Resolution adopted at the Workshop, will be actively working to encourage the wider hotel community in Barbados to formalise a Sea Turtle Policy Statement and standard guidelines for implementation of the Policy. Funds will then be sought to hold a half-day training session for Security staff to assist in implementation of the Policy.

As we move forward in Barbados with the goal of ensuring the survival of sea turtles, we are proud of the efforts made by the commercial hotel sector to protect the most vulnerable life stages of our sea turtles – the egg-bearing females and newborn hatchlings -- which need from us only a fair chance to get to the sea, at which point their real struggle for survival begins.

*Julia A. Horrocks
Karen L. Eckert*

APPENIDX I

Sea Turtles and Beachfront Lighting: An Interactive Workshop for Industry Professionals and Policy-Makers in Barbados

Hosted by the Barbados Sea Turtle Project and Wider Caribbean
Sea Turtle Conservation Network (WIDECAST)

Sponsored by the Tourism Development Corporation of Barbados

Fairmont Glitter Bay Hotel

- 13 October 2000 -

AGENDA

- 10:00 Welcome
Natalie Rothwell, Executive Officer
Tourism Development Corporation
- 10:10 Acknowledgements
Dr. Karen Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)
- 10:20 Opening Remarks
Ms. Kelly Robinson, Executive Director
Caribbean Alliance for Sustainable Tourism (CAST)
- 10:30 Statement of Purpose
Dr. Karen Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)
- 10:45 Sea Turtles in Barbados
Dr. Julia Horrocks, Director
Barbados Sea Turtle Project

11:30 Beachfront Lighting: What's the Problem?
Dr. Blair Witherington, Research Scientist
Florida Fish and Wildlife Conservation Commission

12:30 Lunch

3:30 Making a Difference: Committing to Lighting Alternatives
Ms. Denise Leeming, Assistant Manager
Disney's Vero Beach Resort (Florida)

14:15 Making Informed Choices: Lighting Technologies
Mr. Erik Martin, Scientific Director
Ecological Associates, Inc.

15:00 Juice / tea break

15:30 Questions and Answers - Panel Discussion

17:00 "Conservation Declaration" and Decisions of the Meeting
Ms. Susan Springer, Executive Vice President
Barbados Hotel and Tourism Association

17:45 Closing Remarks
Dr. Karen Eckert, Executive Director
Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

18:00 Cocktails

Field Demonstrations: Conducting Lighting Surveys and Assessments

Dr. Blair Witherington, Research Scientist
Florida Fish and Wildlife Conservation Commission, and

Mr. Erik Martin, Scientific Director
Ecological Associates, Inc.

APPENDIX II

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APPENDIX III

SPEAKER BIOGRAPHIES [in alphabetical order]

Dr. Karen L. Eckert received her Bachelor's Degree in Biology with Highest Honors from Principia College in 1980, and later a Certificate in Global Policy Studies (1987) and a doctorate in Zoology (1988) from the University of Georgia. Her Dissertation was entitled, "Nesting Biology of the Leatherback Sea Turtle, *Dermochelys coriacea*". She has been active for more than two decades in the fields of sea turtle research and international conservation policy. She is currently Executive Director of the Wider Caribbean Sea Turtle Conservation Network (WIDECAS).

For her work as Executive Director of WIDECAS, Dr. Eckert was inducted into the "Global 500 Roll of Honour for Environmental Achievement" by the United Nations in 1994. UNEP has characterized her as "one of the most important figures in conservation and grassroots community empowerment in the field of endangered species in the Wider Caribbean Region." In 1996 she was selected for a prestigious 3-yr Pew Fellowship in Marine Conservation, which specifically recognized WIDECAS's efforts to restore depleted sea turtle populations and promote sustainable coexistence between Caribbean peoples and their marine resources.

In addition to her work with WIDECAS, Dr. Eckert's personal research has taken her throughout the Western Atlantic, and into the Mediterranean Sea, Eastern Tropical Pacific, and Southeast Asia. She is a valued consultant to many governments and intergovernmental and non-governmental organizations. She has published numerous scientific and general interest articles, technical manuals, and policy documents. She is a member of the U.S. Pacific and the U.S. Atlantic/Caribbean Sea Turtle Recovery Teams, as well as the Marine Turtle Specialist Group of the IUCN Species Survival Commission. She served as Senior Editor of the Marine Turtle Newsletter, a scholarly periodical with subscribers in more than 100 nations, for ten years (1988-1997).

Dr. Julia A. Horrocks is a Senior Lecturer in Biology at the University of the West Indies (UWI). She earned her Ph.D. in the behaviour of green monkeys, *Cercopithecus aethiops sabaeus*, from UWI in 1985. During a post-doctoral year at McGill University (Canada), which she spent at Bellairs Research Institute in Barbados, she became interested in the biology and conservation of endangered sea turtles. She established the Barbados Sea Turtle Project in 1987, now located in the Department of Biological and Chemical Sciences at UWI, and became WIDECAS Country Coordinator for Barbados in 1988. The Barbados Sea Turtle Project has been implementing the recommendations of WIDECAS's "Sea Turtle Recovery Action Plan for Barbados" since it was published by the UNEP Caribbean Environment Programme in 1992.

Dr. Horrocks is a valued consultant to Caribbean NGOs and governments, and has participated in the development of Sea Turtle Recovery Action Plans for other Caribbean states. She is Coordinator of WIDECAS's Caribbean Marine Turtle Tagging Centre (also located at UWI), a member of WIDECAS's Scientific Advisory Board, and a member of the World Conservation Union (IUCN) Marine Turtle Specialist Group. She is Chair of the CITES Scientific Authority and the Biodiversity Committee in Barbados, and a member of the Regional Steering Committee for GEF/SGP in the

Eastern Caribbean. She has authored dozens of books, management and technical reports, peer-reviewed scientific articles, and popular articles.

Ms. Denise Leeming is Human Resources Manager at Disney's Vero Beach Resort. She also serves as Guest and Employee Excellence Manager and Environmental Team Leader at the Disney Corporation. She recently (1997) received the prestigious "Partners in Excellence Award" from Disney, a lifetime service award given to only 3% of Disney employees. She is also a recipient of the Environmental Award from Disney (2000).

Upon joining the Disney's Vero Beach Resort opening team in 1995, Ms. Leeming initiated a Sea Turtle Awareness Program. Today that program includes educational opportunities for visiting guests with a special focus on activities for children. These programs include sea turtle nest identification and marking, and a Sea Turtle Adoption Program in partnership with the Caribbean Conservation Corporation. She also coordinates the volunteer programs at her resort, which match employees to opportunities for service in their local community. Resort employees also volunteer as guides on the sea turtle walks conducted by Sebastian Inlet State Park rangers and the Caribbean Conservation Corporation.

Ms. Leeming is involved in all aspects of the resort's conservation efforts and environmental awareness initiatives. Moreover, her love of nature and commitment to excellence is reflected in her service to her community, and as a Volunteer for the U.S. Fish and Wildlife Service at the Archie Carr National Wildlife Refuge and Pelican Island Wildlife Refuge (where she is a Board Member) in Florida.

Mr. R. Erik Martin is Scientific Director for Ecological Associates, Inc., an environmental consulting company based in Jensen Beach, Florida. Mr. Martin earned his undergraduate degree in Biology from Florida State University. He has over 30 years of professional experience in the field of marine biology and over 20 years of experience conducting sea turtle research and conservation projects.

Mr. Martin has managed and participated in numerous sea turtle protection programs associated with beach nourishment, dune restoration and other coastal construction projects. He has conducted lighting inspections and prepared beachfront lighting evaluation reports for various cities and counties in Florida, including co-authoring the Beach Lighting Management Plan for Broward County, Florida. Under contract to the State of Florida he conducted a comprehensive lighting evaluation of the Mayport Naval Station. He also co-authored a report to the U.S. federal government concerning the potential effects on endangered sea turtles of a proposed coastal resort development in Puerto Rico.

Mr. Martin has served on environmental and natural resource advisory committees for local governments and is a member of the World Conservation Union's Marine Turtle Specialist Group. He has authored numerous technical reports and scientific articles on sea turtle biology and conservation.

Dr. Blair E. Witherington is a research scientist with the Florida Fish and Wildlife Conservation Commission's Marine Research Institute. He earned undergraduate and Master's degrees in Biology from the University of Central Florida, and a Ph.D. in Zoology from the University of Florida at Gainesville. His Dissertation was entitled, "Sea-finding behavior and the use of photic orientation cues by hatchling sea turtles". He has studied sea turtles for nearly two decades, during which time he has developed a unique expertise on how sea turtles respond to light and in the problem of photo pollution for sea turtles and their young.

In addition to serving as an expert throughout Florida and the USA, Dr. Witherington has been a consultant on light pollution and sea turtle conservation problems for the Ministry of the Environment in Greece, the Sea Turtle Association of Japan, the Government of Puerto Rico (Vieques Island), and Tortuguero National Park in Costa Rica. He has also advised on lighting plans for coastal residents, hotels, restaurants, condominiums, and military facilities.

For his application of research to sea turtle conservation, Dr. Witherington has received State awards in excellence in science and cooperation in science. He is a member of the Marine Turtle Specialist Group of the IUCN, Steering and research committees for the Carr Refuge Working Group (Florida), U.S. Loggerhead Sea Turtle Recovery Team, U.S. National Marine Fisheries Service "Turtle Expert Working Group", and Board of Directors of Friends of the Archie Carr Refuge. He also serves as past President on the Board of Directors of the International Sea Turtle Symposium, and he holds an appointment of Adjunct Assistant Professor in the Department of Zoology, University of Florida. He has authored 40 scientific publications, monographs, and book chapters, and is an editor of a book on the Loggerhead Sea Turtle.

APPENDIX IV

CONTENTS OF THE MEETING PACKET

Meeting documents

- Agenda and List of Participants
- (Draft) Resolution and Recommendations
- (Draft) Lighting Guidelines for Hotels (CAST/WIDECAS T document)

Technical materials (lighting)

- Witherington, B. E. and R. E. Martin. 2000. Understanding, Assessment, and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches. Second Edition, Revised. Florida Fish and Wildlife Conservation Commission, Marine Research Inst. Tech. Rept. TR2:1-73.
- Ecological Associates, Inc. 1998. Coastal Roadway Lighting Manual: A Handbook of Practical Guidelines for Managing Street Lighting to Minimize Impacts to Sea Turtles. Prepared for Florida Power and Light Company, Juno Beach, Fla. 71 pp.
- Model lighting regulations

Technical materials (sea turtles)

- Horrocks, J. A. 1992. WIDECAS T Sea Turtle Recovery Action Plan for Barbados (K. L. Eckert, Editor). UNEP Caribbean Environment Programme Technical Report No. 121-61.
- Meylan, A. B. and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as Critically Endangered on the 1996 IUCN Red List of Threatened Animals. *Chelonian Conservation and Biology* 3(2):200-224.
- Meylan, A. B. 1999. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean Region. *Chelonian Conservation and Biology* 3(2):189-194.
- Meylan, A. B. 1999. Status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean Region. *Chelonian Conservation and Biology* 3(2):177-184.
- Richardson, J. I., R. Bell and T. H. Richardson. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. *Chelonian Conservation and Biology* 3(2):244-250.
- A selection of BSTP reprints.

General public awareness materials

- "Sea Turtles of the Caribbean", WIDECAS T leaflet
- "Lights Out!", SCWMRD bumper sticker
- "Sea Turtles and Lights", Florida Power & Light brochure
- Switchplate stickers (WIDECAS T)
- Conservation magnets, bookmarks, posters (BSTP)

Sponsor / collaborator information

- "What is WIDECAS T?"
- CAST Annual Report
- TDC Annual Report
- UNEP / SPAW leaflets

APPENDIX V

STANDARD GUIDELINES FOR SOLVING PROBLEMS CAUSED TO NESTING AND HATCHING SEA TURTLES BY ARTIFICIAL BEACHFRONT LIGHTING

Prepared by the Caribbean Alliance for Sustainable Tourism (CAST) and
the Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

DRAFT - October 2000

Light management tactics include selecting some lights to be turned off, controlling light so that the level reaching the beach is minimized, and ensuring that the light that does reach the beach represents wavelengths (color) that are least disruptive to sea turtles. Egg-bearing sea turtles and their young are profoundly influenced by light. Females can be dissuaded from nesting by brightly lit beaches and hatchlings emerging from their nests are confused and disoriented by beachfront lighting, which often leads them away from the sea and toward an untimely death by predators, desiccation or vehicle contact. By making informed decisions, coastal property owners can participate meaningfully in the conservation of critically endangered sea turtle populations throughout the Caribbean Region.

How to Choose an Alternative Light Source

A sound strategy is to reduce the effects of lighting sources on sea turtles by manipulating both intensity and color. A general rule is to use as few lights as practical in order to achieve the desired result(s). For lighting applications that are deemed essential, long-wavelength light sources (e.g., LPS lights, "bug lights") should replace more disruptive light sources and intensity should be reduced by using lamps of minimal wattage housed within well-directed fixtures aimed downward and away from the beach. Long-wavelength light sources are not a panacea for solving beach lighting problems and are best used in conjunction with methods to control the distribution of light, such as those listed below.

Remember to "check your work"! By standing on your beach at night, you can assess whether or not you have effectively eliminated light pollution in nesting areas. Remember this simple rule: If you can see the light, the turtle can see the light.

Effective Methods for Managing Light

Turn Off Problem Lights

Turning off lights will result in energy savings, as well as sea turtle conservation. Start by identifying those light sources that can be switched off or eliminated, either entirely or seasonally during periods of nesting and hatching. Unnecessary light sources may include the following:

- ✓ Light sources illuminating areas that require no security.
- ✓ Light sources illuminating areas that are vacant or where there is no foot traffic.
- ✓ Decorative lighting.
- ✓ Balcony lighting.
- ✓ Light sources that provide more than adequate illumination for a particular function. Light illuminance levels necessary for safety and security are rather low (0.2 –1.0 foot-candles or 2-11 lux).

Lighting that is necessary for safety or security can be used only when needed, such as during early evening hours, and switched off the remainder of the night. Motion detectors are particularly useful for security lighting, and are only illuminated when an intruder approaches the property.

Minimize Beach Lighting from Outdoor Sources

- ✓ Lighting does not need to be extinguished year round, only during the nesting-hatching season.
- ✓ Reduce the wattage of problem lighting.
- ✓ Substitute luminaries that are better focused so that light can be concentrated where it is most needed. In other words, change light fixtures to a more directional style as an efficient and permanent solution. Luminaries should not be directed onto the nesting beach or onto any object visible from the beach.
- ✓ Recess luminaries into roof soffits. Recessed lights are more directional.
- ✓ Lower pole-mounted luminaries or use low-mounted luminaries with louvered, bollard-type fixtures as a substitute for pole-mounted lighting. The lower a light source is mounted, the smaller the area it will illuminate.
- ✓ Redirect luminaries *away* from the nesting beach.
- ✓ Reposition luminaries to take advantage of natural light screens, such as vegetation and other landscaping.
- ✓ Install timers to switch off lighting when it is no longer needed, such as late in the evening.
- ✓ Install motion detector switches to ensure that lighting is utilized only when needed. Note: Motion detectors can be used only with incandescent lighting (yellow bug-light bulbs work well with motion detectors).
- ✓ Install visors or louvers to stadium lighting.
- ✓ Replace conspicuous lighting on beach access ramps with hidden, walkway-only lighting. A good way to hide ramp lighting is to use small light sources within flexible plastic strips.

- ✓ Reposition conspicuous balcony lighting to illuminate the balcony only, and direct the lighting away from the beach.
- ✓ Plant native dune vegetation as a light screen. To be most effective, vegetation should be near the crest of the dune closest to the beach. Salt-tolerant, bushy and densely leafed native plants are the most suitable.

Minimize Beach Lights from Indoor Sources

Indoor lighting from buildings that are close to the beach, are very tall, or have large seaside windows causes the greatest problem for sea turtles. The unwanted effects of indoor lighting can easily be eliminated without compromising the intended function of the lighting by doing the following:

- ✓ Turn off lights in rooms that are not in use.
- ✓ Relocate moveable lamps away from visible windows.
- ✓ Close opaque curtains and blinds after dark and tint windows visible from the beach. Window-tinting treatment should reduce visible light from the inside to 45% or less, and can also reduce cooling costs and mitigate hurricane damage.
- ✓ Design public awareness materials (door hangers, room notices) to alert guests to lighting rules and regulations. Assure them that their careful attention to detail will significantly help the survival of baby sea turtles which are depleted and endangered in our region.

Use Alternative, Long-Wavelength Light Sources

Ensure that any light that reaches the beach has spectral properties that make it minimally disruptive to sea turtles. Remember that this EXCLUDES short-wavelength (ultra violet, violet, blue, and green) light, which should never be visible from a nesting beach! Recommended long-wavelength light sources include:

- ✓ **Low Pressure Sodium Vapor** lighting is the least disruptive to sea turtles among commonly used, commercially available light sources.
- ✓ **Yellow Filters and Bug Lights** are tinted yellow to reduce the emission of insect-attracting short-wavelength light and are also minimally disruptive to sea turtles. "Bug lights" are a poorer alternative to LPS lighting, but are less expensive (at least initially) and are more widely available than LPS lighting. Amber or yellow filters installed in light fixtures vary greatly in their effectiveness and some may fade over time. Yellow, dichroic "long pass" filters excluding wavelengths below 520 nm are recommended. They generally do not degrade with time (but can degrade with high heat).
- ✓ **Red Light-emitting Diodes (LEDs)** are too small to light large areas but can be used for walkways and steps. The red light from LEDs is probably one of the light sources least visible to sea turtles and has the added benefit of not degrading the night vision of people visiting the beach. Green and amber LEDs are much less preferred than red.

Use Light Screens and Enhance Dune Profiles

Whether by providing visual cues, blocking light, or both, enhancing the silhouette of the dune (the buffer zone between the beach and any built properties) can reduce lighting problems. Methods include the following:

- ✓ Plant native vegetation on the dune.
- ✓ Erect artificial light screens on the dune where immediate, short-term light blocking is needed. Artificial screens should be positioned so that they do not impede nesting by sea turtles.
- ✓ Fill in and replanting dune-cuts, pathways, and washed out areas. Mis-oriented hatchlings and adult turtles often exit the beach through these lighted gaps in the dune.
- ✓ Provide emerging hatchlings shielded pathways from the nest to surf.

Source: Adapted from Witherington, B. E. and R. E. Martin. 2000. Understanding, Assessing, and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches. Second Edition, Revised. Florida Fish and Wildlife Conservation Commission, Marine Research Institute Technical Report TR2:1-73.

Important Operational Aspects of a Sea Turtle Conservation Program for Caribbean Hotels

Establishing a turtle conservation program in the hotel can be rewarding and fun. Guests will be fascinated with these beautiful Caribbean giants and ongoing monitoring of sightings will help to protect them from extinction.

The hotel should have a policy statement regarding the protection of turtles within their immediate area. This Sea Turtle Policy Statement should be supported by Standard Operating Procedures (SOPs) for reporting and protecting nesting turtles and hatchlings. Staff in departments responsible for the actualization of the Policy should be trained annually. These departments may include Sports and Activities, Water Sports, Security, Grounds, and Maintenance.

In addition to the Sea Turtle Policy Statement and SOPs, the hotel should maintain additional important information, including emergency numbers (e.g., NGOs active in sea turtle conservation and care, National Aquarium, departments of Fisheries or Wildlife, Coast Guard) and a calendar of nesting and hatching months for Caribbean sea turtles. Information regarding the sale of items made from protected animals, including all species of sea turtle, should be included in the Guestroom Directory and the hotel should ensure that no items made from turtle shell are sold in onsite gift shops. [**Note:** The Convention on International Trade in Endangered Species of Wild Fauna and Flora, popularly known as CITES, prohibits the transport of sea turtle products across national borders.]

A local environmental organization may be able to provide assistance in establishing and maintaining a turtle conservation program. Helpful tools that the hotel could request from such an NGO may include visual aids for identification of the variety of Caribbean sea turtles or on-site training on sea turtle protection. The Wider Caribbean Sea Turtle Conservation Network (WIDECAST) has member organizations throughout the Caribbean; these groups can often provide assistance and educational materials to hotel management. For more information, visit <http://www.widecast.org>. The Caribbean Alliance for Sustainable Tourism (CAST) also has materials on hand to assist hotels in this area. For more information, visit <http://www.cha-cast.net>.

It was agreed that it would be useful to identify or develop the following, and to make them available to member hotels through CAST:

- Example of a sea turtle protection policy for a hotel;
- Protocols for what to do in case of a sea turtle sighting;
- Audio-visual materials to assist in the case of a sighting;
- Sample inventory sheet to document and report sea turtle sightings; and
- List of Caribbean organizations working towards sea turtle conservation.



WIDECAST

Wider Caribbean Sea Turtle Conservation Network

“Working together to build a future where all inhabitants of the Wider Caribbean Region, human and sea turtle alike, can live together in balance.”

The Wider Caribbean Sea Turtle Conservation Network (WIDECAST) is a volunteer expert network and Partner Organization to the U.N. Environment Programme's Caribbean Environment Programme. WIDECAST was founded in 1981 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's vision for achieving a regional recovery action plan has focused on bringing the best available science to bear on sea turtle management and conservation, empowering stakeholders to make effective use of that science in the policy-making process, and providing a mechanism and a framework for cooperation within and among nations. By involving stakeholders at all levels and encouraging policy-oriented research, WIDECAST puts science to practical use in conserving biodiversity and advocates for grassroots involvement in decision-making and project implementation.

Through information exchange and training, WIDECAST promotes strong linkages between science, policy, and public participation in the design and implementation of conservation actions. The network recommends standards for range state adoption, develops pilot projects, provides technical assistance, supports initiatives that build capacity within participating countries and institutions, and promotes coordination among Caribbean countries in the collection, sharing and use of biodiversity data. Working closely with local communities and resource managers, the network has developed standard management guidelines and criteria that emphasize best practices and sustainability, ensuring that current utilization practices, whether consumptive or non-consumptive, do not undermine sea turtle survival over the long term.

With Country Coordinators in more than 30 Caribbean States and territories, WIDECAST has been instrumental in facilitating complementary conservation action across range states, strengthening and harmonizing legislation, encouraging community involvement, and raising public awareness of the endangered status of the region's six species of migratory sea turtles. Country Coordinators are drawn from both the governmental and non-governmental sectors, and must have sea turtle research and/or management experience and responsibility.

WWW.WIDECAST.ORG