IUCN Lighting Mission to DPCL, March 2008

March 20-27, 2008

The following represents a summary of key activities and discussion points during the recent IUCN mission to India (as part of the greater IUCN / DPCL agreement) to address the environmental mitigation efforts related to lighting and potential impacts to turtles. The Mission was conducted between March 20 and 27, 2008, headed by Dr. Nicolas J. Pilcher, Co-Chair, IUCN SSC Marine Turtle Specialist Group, along with Blair Witherington, Florida Fish and Wildlife Conservation Commission and IUCN SSC MTSG Member, and Erik Martin, Scientific Director of Ecological Associates, Inc. and IUCN SSC MTSG Member. The objectives of the Mission were to assist DPCL with the design of a lighting plan to minimise the emitted light and potential downstream impacts to nesting adult turtles and emerging hatchlings at the Gahirmatha mass-nesting site. The team travelled to India from various points in the world and convened in Mumbai on March 19th, arriving in Bhubaneswar on the morning of March 20th. A few days earlier Dena Dickerson had arrived and travelled directly to Dhamra to follow-up on dredging activities. Her visit overlapped the lighting mission, but concentrated entirely on ensuring the draghead deflector was working properly, and to further train the observers in NOAA reporting standards. Our thanks also go to MTSG member Kellie Pendoley for drafting the Impacts of Lighting on Turtles document. Following completion of the lighting mission, a series of key documents was prepared for DPCL to guide in the design and implementation of lighting mitigation efforts (copies attached).

20 March 2008

Meetings at DPCL HQ (1500) to introduce IUCN team and bring all up to speed on progress, project objectives, and operations.

Present:

Anjani Kant, Deputy GM, DPCL
Mayukh Sinha (EA to CEO, DPCL)
Biren Bhuta (Dhamra Project Manager, IUCN)
Erik Martin (IUCN)
Blair Witherington (IUCN)
Nicolas Pilcher (IUCN)

Meeting notes:

- Following general introductions, we had a briefing by A. Kant on basic details of the project, followed by another briefing on environmental issues related to the project. These included details on the actual development, owner partnerships, environmental variabla (Dham t. .003ro5ng prhi0 -.7

21 March 2008

Meetings at DPCL HQ (1000) to highlight impacts of lighting on turtles and potential mitigation efforts with DPCL and sub-contractor engineers.

Present:

Santosh Mohapatra (CEO, DPCL)
Anil Kumar Kar (GM, DPCL)
Anjani Kant (Deputy GM, DPCL)
N. Nalinakshan (Consultant, Scott Wilson)
K. Kannan (Engineer, LNT)
Rama Krishna Raju (Manager-Projects ABB)
C. Kannan (Manager-Design ABB)
Mihir Das (Engineer DPCL)
Suvendu Das (Engineer DPCL)
Biren Bhuta (Dhamra Project Manager, IUCN)
Erik Martin (IUCN)
Blair Witherington (IUCN)
Nicolas Pilcher (IUCN)

Meeting notes:

- Following general introductions, N. Pilcher gave a brief introduction of IUCN's role and the objectives of the mission.
- Blair Witherington then provided an introductory talk on the impacts of artificial light on turtles and their conservation (light can be good, can be bad, and needs containment).
- A good series of questions arose as to what mechanisms exist to attract hatchlings away from the glare provided by the port.
- Erik Martin then provided a comprehensive look at what light management options existed, particularly to reduce sky glare.
- Questions were then addressed related to light management options and opportunities.
- CEO highlighted the requirements by DG Dock Safety – to find out bylaws and regulations, and noted that a series of India standards needs to be adhered to.
- Blair then reviewed some practical options for the actual port light requirements and potential mitigation options.
- Following this the engineers displayed a graphic of the port layout, and discussions were held on possible lighting options.

Key points:

- Much of the storage areas will be covered, with little emitted light.
- Pathway lights can go up on the conveyors to minimise light to atmosphere.

Evening visit to the Dhamra port site to inspect construction lighting

In the evening, the team visited the port site to look at lighting impacts from preliminary construction activities. Several lights were found to create unnecessary glare and the IUCN team suggested that this evidence would be a good way to slowly bring the consultants and engineers on board with the issues of lighting. It was felt by the IUCN team that if the construction gangs could adhere to lighting provisions then the subsequent port operations would already be on the right footing.

24 March 2008

Offshore visit to the Dhamra port site

Erik Martin, Blair Witherington, Nicolas Pilcher, Biren Bhuta and Amlan Dutta. A hired trawler was used to visit the Port site from the offshore direction, and to inspect the barriers and distance between the Port site and the Gahirmatha nesting beach. The trip revealed that the at-sea straight line distance was still great, and that direct lighting was unlikely to have any impact on turtles. However, the glare could pose a significant problem if not addressed, and thus the recommendations on lighting from IUCN would have to be strictly adhered to, so that upwards glare would be minimised.

Evening visit to the Dhamra port site to inspect construction lighting

A second visit was made to the Port site to document the potential impacts of improper lighting, and to demonstrate the effects of these on atmospheric glare.

25 March 2008

Visit onboard dredger Antigoon to inspect modifications to draghead deflector

Following a second trip to Dhamra by Dena Dickerson earlier in the month to assess the performance of the draghead deflector, it was found that some additional horizontal depth was needed to ensure constant seabed contact with the deflector. N. Pilcher, B. Bhuta and A. Dutta travelled onboard the dredger Antigoon to evaluate the performance of the enhanced deflector, and determined that the deflector was in constant touch with the seabed, through evidence of abrasion on the deflector's leading edges.

Meeting with Fishing Cooperative of Dhamra

In an effort to start to address the fishery mortality issues, N Pilcher and B Bhuta conducted a dialogue session with the fishermen to get a feel of their concerns and interests in participating in trial efforts to mitigate fishery bycatch. Concerns were raised by the Orissa State Fishery Cooperative of the lack of dialogue in setting up the marine reserve, but acknowledged that something needed doing about the turtle mortality. They indicated they were, in principle, agreeable to being part of observer and TED trial programmes,

and to work out a mutually agreeable solution. This workshop was a testing ground for acceptance of DPCL involvement in general, non-port related conservation issues, and we believe it was a resounding success. The fishermen all agreed we should meet again, and welcomed the idea of learning more about turtles, their biology, and what can be done to mitigate fishery impacts.

Blair Witherington and Erik Martin depart BBI for Mumbai and onwards.

26 March 2008

Travel from Dhamra to BB.

Following an early morning briefing with the observers, BB, AD and NP travelled by road from Dhamra to BBI.

Dinner Meeting with Senior Research Officer, Orissa Forestry Department (1930)

Present:

C.S. Kar (Senior Research Officer, Department of Forestry)
Biren Bhuta (Dhamra Project Manager, IUCN)
Nicolas Pilcher (IUCN)

Meeting notes:

- The dinner setting was used to follow up on discussions on potential areas of cooperation and joint research between the IUCN/DPCL team and the CWW's office.
- CS Kar reiterated a strong willingness to collaborate and to support research and mitigation efforts proposed by the IUCN/DPCL team, and noted the complexities of the project from the outset.

27 March 2008

Nicolas Pilcher departs from BBI to Mumbai and onwards.

Annex I: Background on Lighting Impacts to Marine Turtles

Construction and development activities have the potential to emit a large amount of light. These sources include direct light, reflected light and sky glow, and all have the potential to impact on the reproductive success of sea turtles. For example, females may be deterred from nesting on their preferred beach or hatchlings are disoriented or misoriented after emerging from the nest, and fail to make it to the water (Witherington and Martin 1996).

Hatchlings emerging from the nest immediately crawl towards the sea. While the bulk of the nests emerge at night when the sand temperature drops below daytime highs, it is not uncommon for nests to emerge during the day time following rain storms or in the cool of the morning or afternoon (Lohmann et al. 1996). The seafinding ability is predictable regardless of the time of day, the weather conditions, or the location of the nest relative to the ocean (Mrosovsky 1972).

The seafinding process is directed by several cues; light brightness, shape and form of the beach environment, and to a lesser extent, beach slope (Lohmann et al. 1996; Tuxbury and Salmon 2005). Hatchlings crawl away from the dimmer landward horizon, toward the brighter seaward horizon (Mrosovsky & Carr 1967; Tuxbury & Salmon 2005). They also crawl away from the higher dune towards the lower seaward horizon, but beach slope is considered a secondary cue relative to vision and is not addressed any further here (Salmon et al. 1992; Lohmann et al. 1996).

Since the ability to see is a function of light availability and type, hatchling studies have focussed primarily on the following properties of light; intensity, wavelength and directivity. Brightness is recognised as an import cue for hatchlings as they attempt to orient toward the ocean (Witherington & Martin 1996). Brightness refers to the intensity and wavelength of light relative to the spectral sensitivity of the beholder (Ehrenfeld & Carr 1967; Witherington & Martin 1996). Both field and laboratory based studies suggest hatchlings have a strong tendency to orient towards the brightest direction, with brightness being a function of light intensity, wavelength and hatchling spectral sensitivity (Witherington 1992; Witherington 1992a). The brightest direction on natural beaches is typically towards the ocean where the horizon is open and unhindered by dune or vegetation shadows.

The orientation or seafinding ability of hatchlings can be affected by the presence of artificial lighting on beaches (Verheijn 1985; Witherington and Martin 1996; Salmon 2003; Tuxbury and Salmon 2005) and flares (Pendoley 2000). Artificial lighting may adversely affect hatchling seafinding behaviour in two ways; disorientation, where hatchlings crawl on circuitous paths; or misorientation, where they move landward, possibly attracted to artificial lights (Witherington and Martin 1996; Salmon 2001).

A range of commercial light types have been tested with sea turtle hatchlings to determine which lights are least disruptive to hatchling seafinding (Witherington 1991; Witherington & Martin 1996; Tuxbury 2001). Lights emitting large proportions of short wavelength light (e.g. metal halide, halogen, fluorescent, mercury vapour) are not recommended while low pressure sodium vapour is the most highly recommended. High pressure sodium (HPS) vapour is an acceptable alternative after low pressure sodium (LPS) light. This recommendation is based on studies that show green turtles are only weakly attracted to yellow LPS and has therefore been suggested as a good lighting alternative for green turtle nesting beaches (Witherington & Bjorndal 1991; Witherington & Martin 1996).

Annex II: IUCN Recommended Guiding Principles for Managing Artificial Lighting at the Dhamra Port, Orissa

The general principles below are meant to guide specific choices of luminaries within and surrounding the Dhamra port facility. These lighting choices would minimize sky glow over the port area and minimize effects from lighting on sea turtles using regional nesting beaches.

1. All area lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures shall include no other luminaries except full cutoff luminaries. Full cutoff luminaries shall meet the IESNA classification for "full cutoff," which describes a luminary having a light distribution with zero candela intensity at or above an angle of 90° above nadir and with no more than 10% of candela intensity at or above a vertical angle of 80° above nadir. All full cutoff luminaries shall be mounted horizontally so that the angle of 90° above nadir equals the Earth's horizon.
2. All area lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures shall be of the minimum lamp wattage to achieve required safety within the lighted area.
3. No area lighting or any lighting mounted on masts or other elevated structures shall include fluorescent lamps, mercury vapour (MV) lamps, metal halide (MH) lamps, or other broad-spectrum high-intensity discharge lamp types.
4. No lighting of grounds, building walls, signs, cranes, or other elevated structures shall employ flood lighting, up-lighting, or other forms of directional lighting aimed above the horizon.
5. Lighting of elevated walkways or conveyors shall use luminaries that are <70 W HPS and shielded, so that candela intensity above an angle of 90° above nadir is 10% or less.
6. Where possible, use full cutoff fixtures that specify shielding that keeps light at least 15 degrees below the horizontal plane of the fixture.
7. Where possible, use low-pressure sodium vapour lamps or other light sources that exclude wavelengths less than 520 nm.

Annex III: Options for Alternate Lighting Installations at the Dhamra Port, Orissa

Sl.No	Area	Lux-level requirement	Planned	Proposed
1	Jetty Conveyor Walkway Area	20	70 W HPSV lamp	Option 1: 70 W, HPSV lamp with a shield (like a baffle) with a cut off angle of 70 Deg. (Cannister down light). Option 2: LPSV lamp with 90 Deg Cut off.
2	Ship Loader / Unloader Area			Option 1: 70 W, HPSV lamp with a shield (like a baffle) with a cut off angle of 70 Deg. (Cannister down light). Option 2: LPSV lamp with 90 Deg Cut off.
3	Street Lighting from Jetty Area to Plant Area	20	1 X 150 W HPSV lamp with 9 M post	Less than 90 Deg cutoff - Horizontal mounting.
4	Conveyor - Walkways	100	1X 70 W HPSV lamp	Indoor
5	Transfer Point - Outside Area Lighting		1X 70 W HPSV lamp	Horizontal Mounting, with 90 Deg Cut off
6	Stockyard Area Lighting	20	Lighting mast of 20 M/30 M with 10 to 20 light fittings of 400 W	30 M is acceptable.The light fitting is to be installed horizontallywith 90 Deg cut off. Since the yard conveyor also has lighting, the high bay fitting has to be installed horizontally. The high bay fitting should have shield and restrict the lighting only in the stockyard area.
7	Switchyard / Electrical Room / Transformer Yard Lighting		70 W HPSV lamp	90 Deg cutoff - Horizontal mounting
8	Administration OuttcL high intc	20		