Ecology of ALAN

What's ALAN and How Does it Impact Wildlife?

In recent years the impact of artificial light at night (ALAN) has come under increasing scrutiny.

The Sea Turtle Sensitive Area Code (A Model Code for Local Government) released in May 2019 and the National Light Pollution Guidelines released in January 2020 reflect (*pun absolutely intended*) a growing awareness of how anthropogenic light can influence the behaviour of wildlife, often in detrimental ways.

Obviously light can affect animal behaviour. Some are prompted to roost as darkness falls, others are startled by flash-photography, yet others are attracted by light (moths to a flame, baitfish to an illuminated jetty). These responses are perhaps obvious, but some of the most ecologically significant responses to light are far more subtle. Importantly, humans and animals perceive light differently, with some animals having lesser or greater sensitivity to light at either end of the spectrum (red to ultra-violet). For example, both turtles and migratory waders have a greater sensitivity than humans to blue and ultra-violet light.

An example relevant to our burgeoning coastal communities is the potential effect of light on nesting turtles and emergent hatchlings. Studies from around the world have shown that light can deter females from coming ashore to nest and can disorient hatchlings' affecting their sea-finding and dispersal. Hatchlings emerging from the nest use a variety of cues to find the ocean: the relative darkness of dunes to landward, the slope of the beach, and light reflected off the water. Unsurprisingly, ALAN has a greater influence on hatchling behaviour on moon-less nights.

Whilst the effects of ALAN are understood in *principle*, they're not always understood in *practice*. Or to put it another way, it's now widely accepted that too much light can have deleterious effects on turtle nesting and hatchling behaviour, but determining how much light is too much, is often a challenge for ecologists, resource managers and planners.

Industrial lighting from Gladstone's aluminium refinery has been shown to impact hatchling sea-finding behaviour 18 km away, and lighting at a well-known dive resort on the Great Barrier Reef has been shown to disorient emerging hatchlings; whilst

Green turtle, Lady Elliot Island

Dr Thorogood's opinions on this issue were supported by his analysis, which was unchallenged. I accept his opinions.

Extract from Her Honour, Judge Kefford's judgement in the matter of Development Watch Inc. & Anor v Sunshine Coast Regional Council & Anor [2020] QPEC 25.

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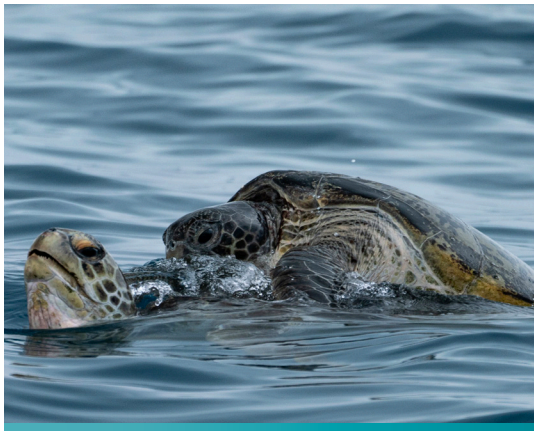
studies of the impact of urban lighting on nest-site selection on the Sunshine Coast have been inconclusive. In fact, the 'most popular' nesting beaches on the Sunshine Coast are also some of the most illuminated. An appropriate understanding of the ecology of a species is critical to determining the likelihood and likely severity of impact.

Nesting red-tailed tropic bird, Lady Elliot Island

The Ecology of ALAN and Urban Planning.

By way of example, at Yaroomba on the Sunshine Coast, developer Sekisui House recently gained planning approval for a development that will incorporate a beach-front 5-star hotel and conference centre. Concerned that the development would impact on the nesting of critically-endangered loggerhead turtles, and despite the suite of focused conditions of approval imposed by Council, the Sunshine Coast Environment Council Inc. together with Development Watch Inc. appealed the approval in the Queensland Planning and Environment Court. In response, Sekisui House developed a comprehensive Sea Turtle Management Plan and Sea Turtle Lighting Management Plan, ultimately convincing the Court that the proposed development would not pose a significant threat to turtle nesting and hatchling behaviour. Factors the developer relied on included the set-back of development from the dunes together with the height of the dunes, a raft of controls relating to the type, location and use of lighting, and data collected over a decade showing that Yaroomba Beach was used on average by only a very small number of nesting turtles each year.



Mating, critically endangered loggerhead turtles, Hervey Bay

Other south-east Queensland local governments are also picking-up on the need to better manage lighting on the coast, both in respect of their own infrastructure and development approvals. On the Gold Coast, lighting specification for the expanding network of 'Oceanways' (shared coastal paths to landward of the dunes) is consciously taking into account the need to avoid ecological impacts by using luminaires of the lowest wattage meeting Australian Standards, that minimise light-spill and that can be programmed to dim outside periods of peak usage.

The 'ecological' management of artificial light at night is based on 6 principles:

- start with natural darkness, adding light only for specific purposes
- use adaptive light controls to manage timing, intensity and colour
- light only the areas intended – keep lights close to the ground, directed and shielded to avoid light spill
- use the lowest intensity lighting appropriate to the task
- use non-reflective, dark coloured surfaces, and
- use lights with reduced blue, violet and UV wavelengths.

Lady Elliot Island at the southern end of the Great Barrier Reef, a significant turtle and seabird rookery, provides an excellent example of 'ecological' management of lighting, with most lights of low intensity, using 'warm white' light sources (less blue output), mounted low to the ground and shielded to avoid light-spill.

frc environmental's Dr John Thorogood is an acknowledged expert on the ecology of ALAN.

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