Australian Government
Department of Climate Change, Energy, the Environment and Water

The Commonwealth's Approach to Reducing Light Pollution

Valuing Darkness Symposium
Cesar San Miguel
20 March 2025

Photo: West Coast of Kangaroo Island, South Australia, Omar Al-Samarrai

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My light pollution remit

~~Human Health~~

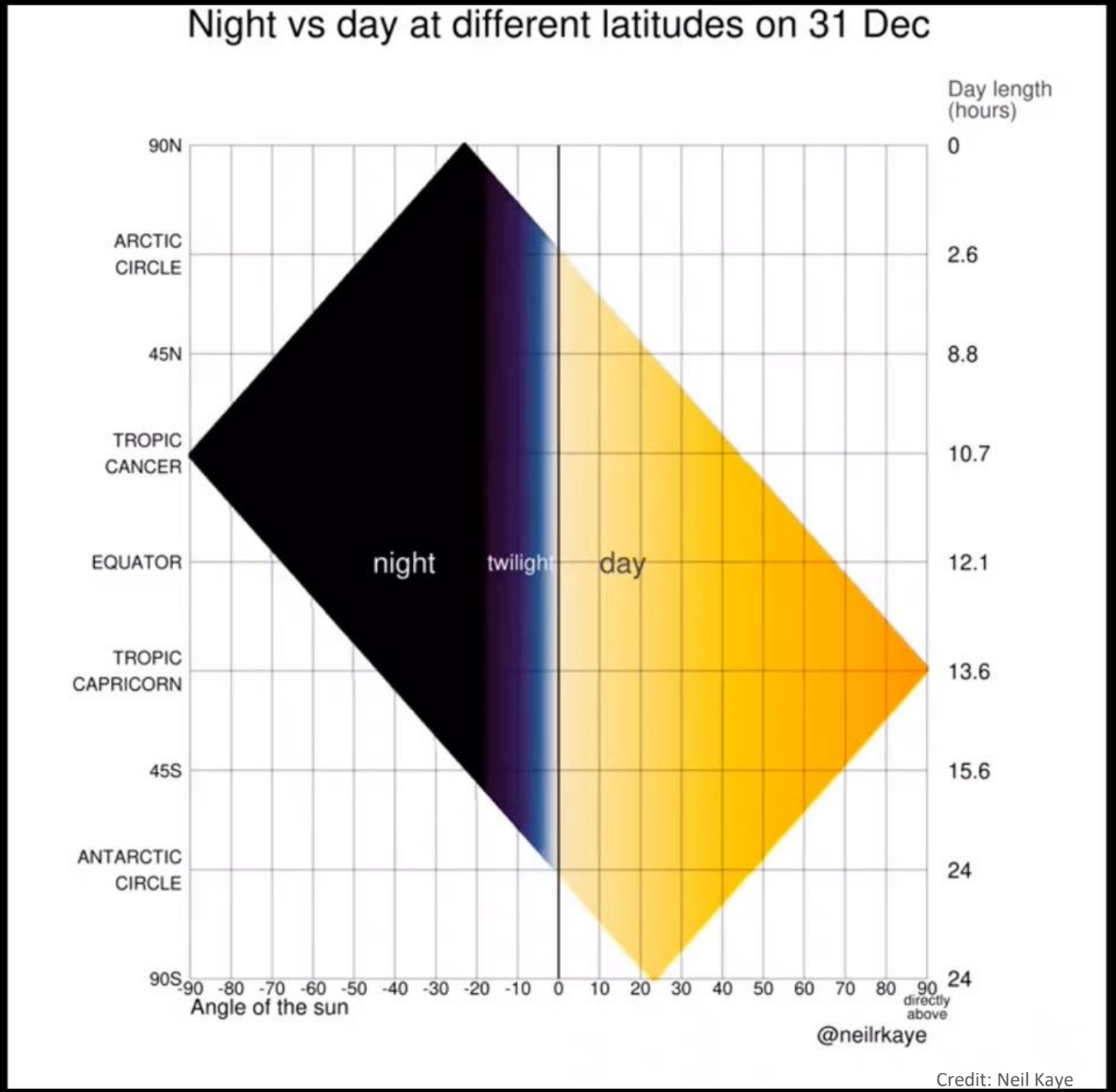
~~Infrastructure /Construction~~

~~Space/ Astronomy~~

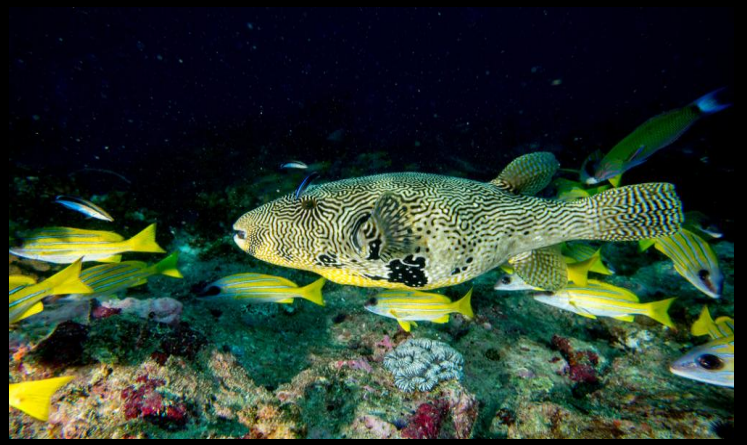
~~Commerce~~

Environment

(Particularly **Protected Species** under the *Environment Protection and Biodiversity Conservation Act 1999*)



Credit: Neil Kaye



James Blaney, Bruce Thomson, GBRMPA, Scott Whiting, Shutterstock

Photo credit: Shutterstock

Artificial light at night

Light pollution is artificial light that alters the natural patterns of light and dark in ecosystems.

*It is the presence of **unwanted**, **inappropriate**, or **excessive** artificial lighting*

Globally, artificial light at night is increasing by **10% per year** (Kyba et al., 2023)

The Ecological Economics of Light Pollution: Impacts on Ecosystem Service Value

by **Sharolyn J. Anderson** [1,2,*], **Ida Kubiszewski** [1,3] and **Paul C. Sutton** [2,4]

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2 Business School, University of South Australia, Adelaide, SA 5001, Australia
3 Institute for Global Prosperity, University College London, London WC1E 6BT, UK
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* Author to whom correspondence should be addressed.

Remote Sens. **2024**, *16*(14), 2591; **https://doi.org/10.3390/rs16142591**

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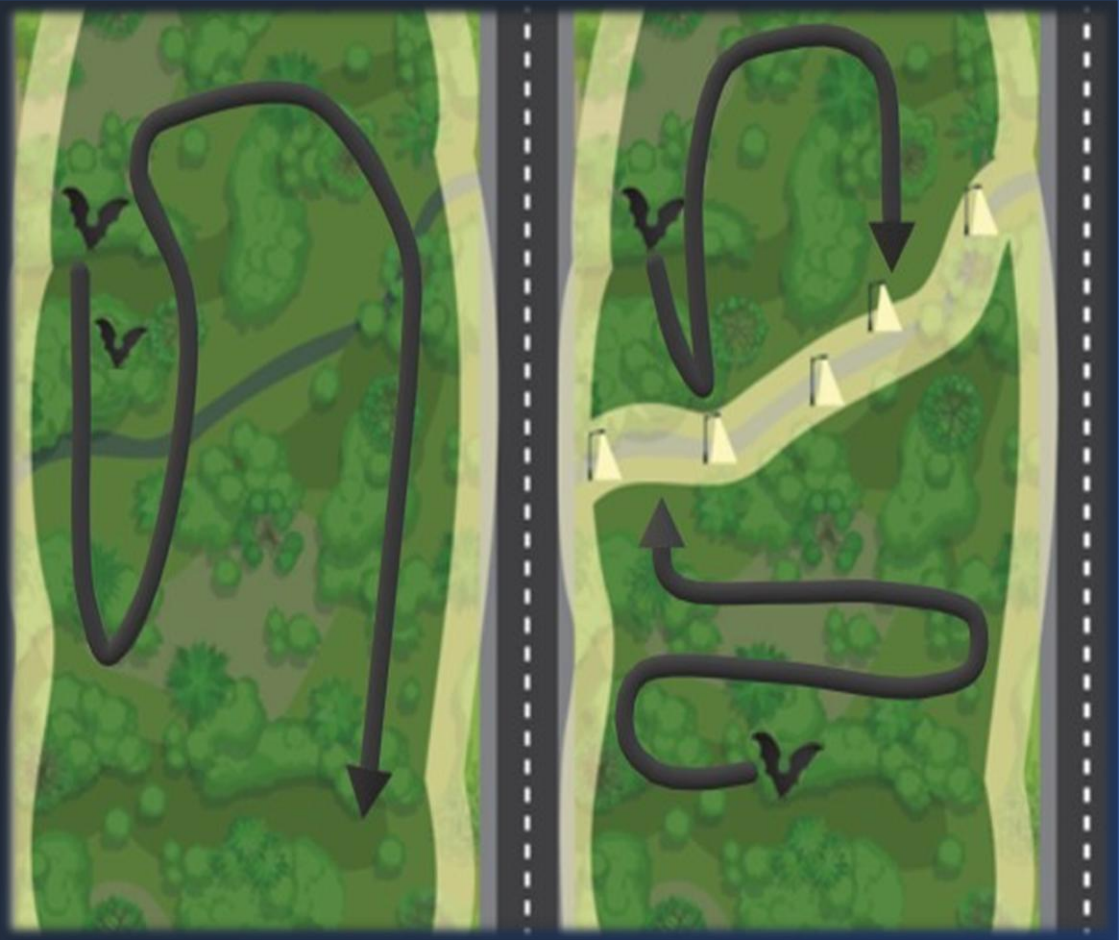
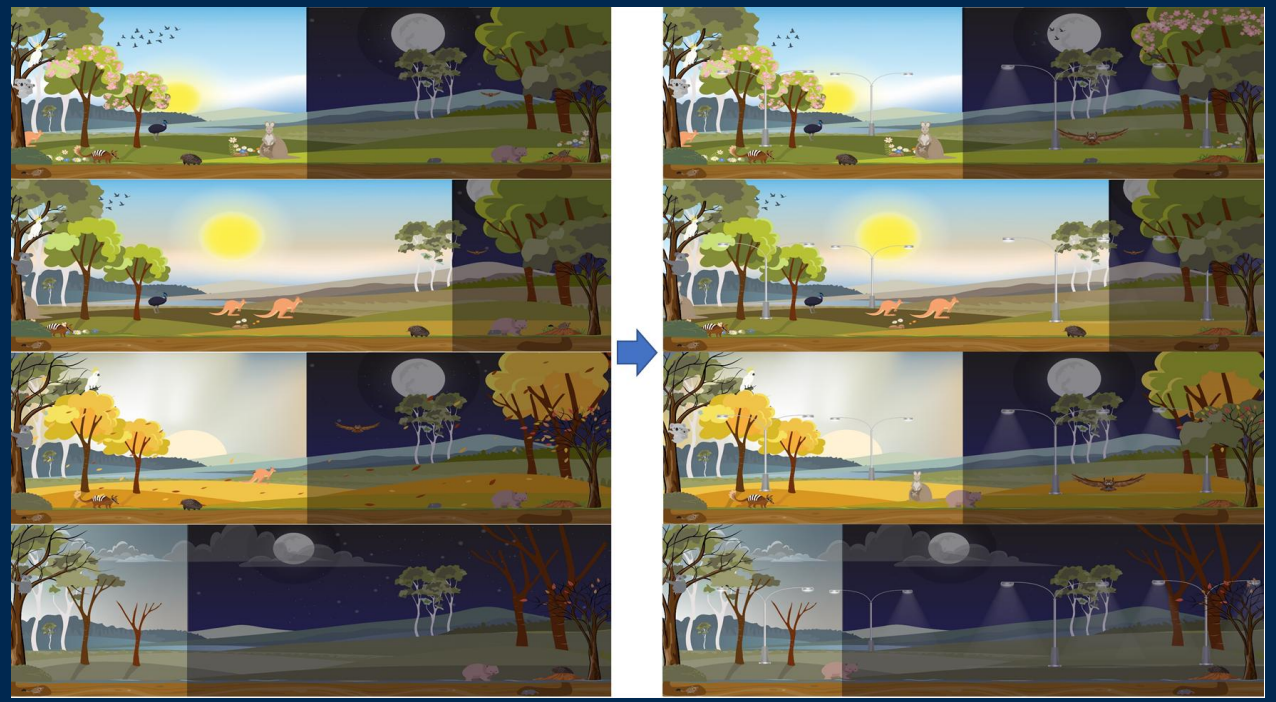
Behavioural impacts:

- Attracting (misorienting)
- Confusing (disorienting)
- Repelling



Artificial light can **mask** day/night, lunar phase and seasonal changes

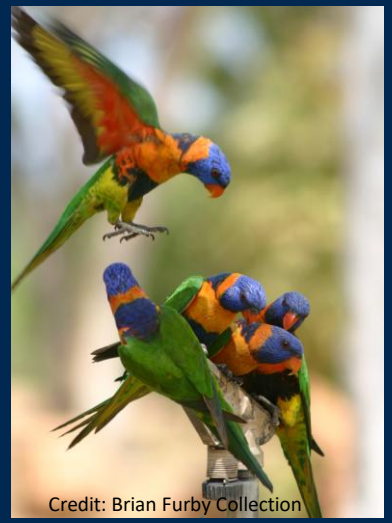
24-hour day/night disruption



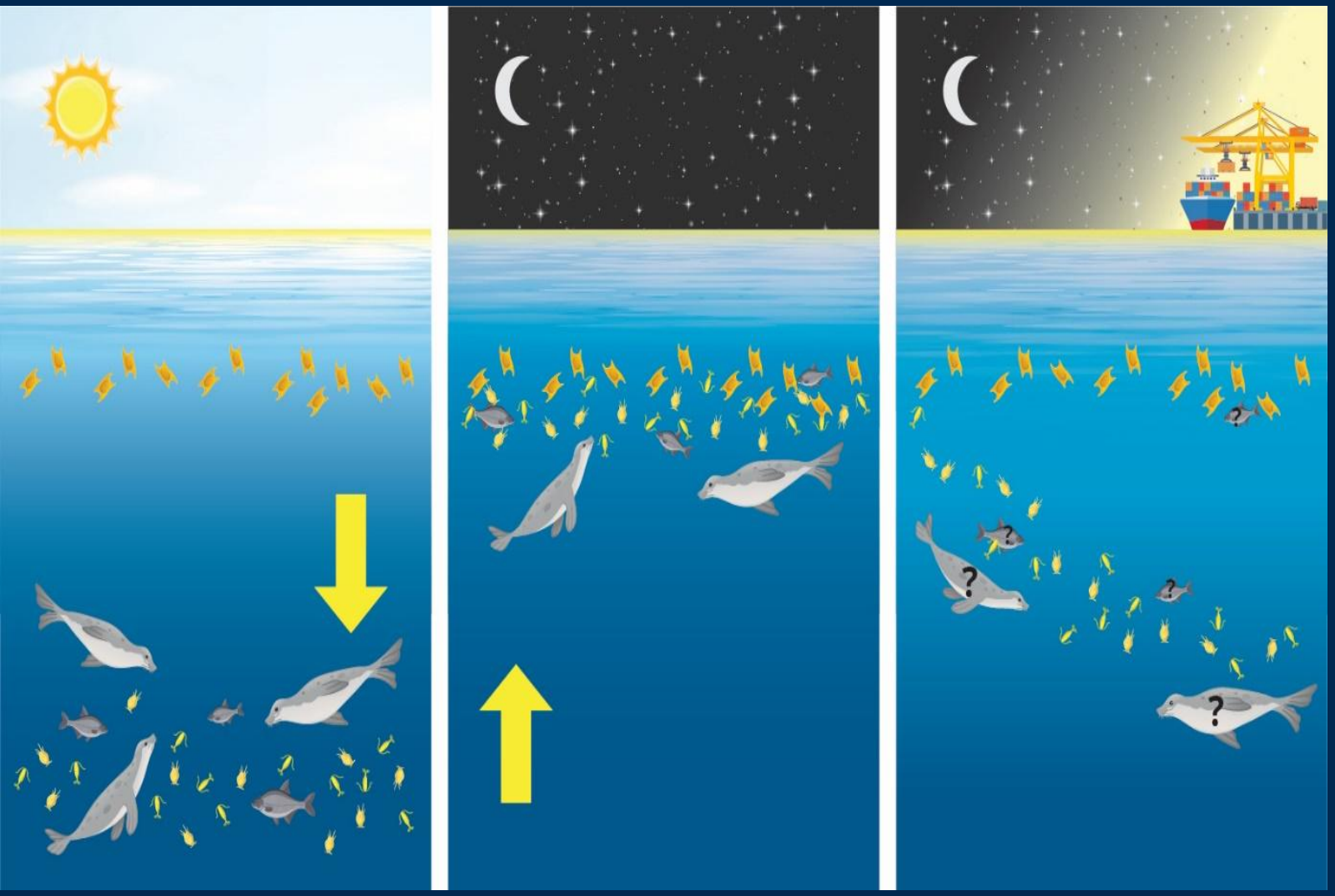
Seasonal day length disruption

Lunar Cycle disruption

Artificial light benefits **invasive species**



Credit: Brian Furby Collection



Marine Impacts

- Light on land can reach coral reefs >30m deep
- Light from ships can affect fish behaviour at depths >200m
- Light pollution now affects around 2 million km^2 of the world's oceans

Changes in the light environment affect wildlife in many ways

Behavioural changes

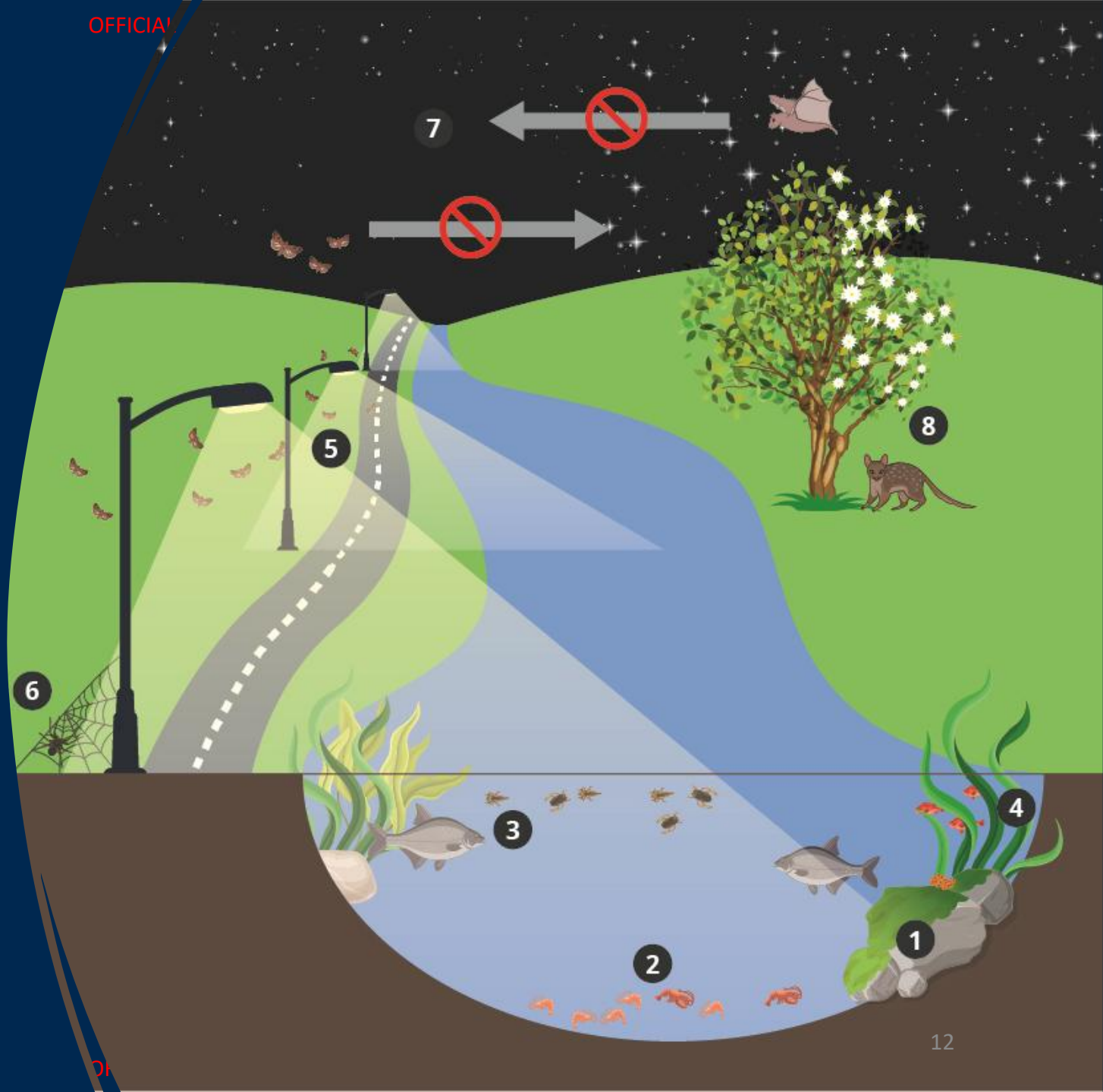
predator avoidance, migration

Physiological changes

reproduction, sleep, immune function

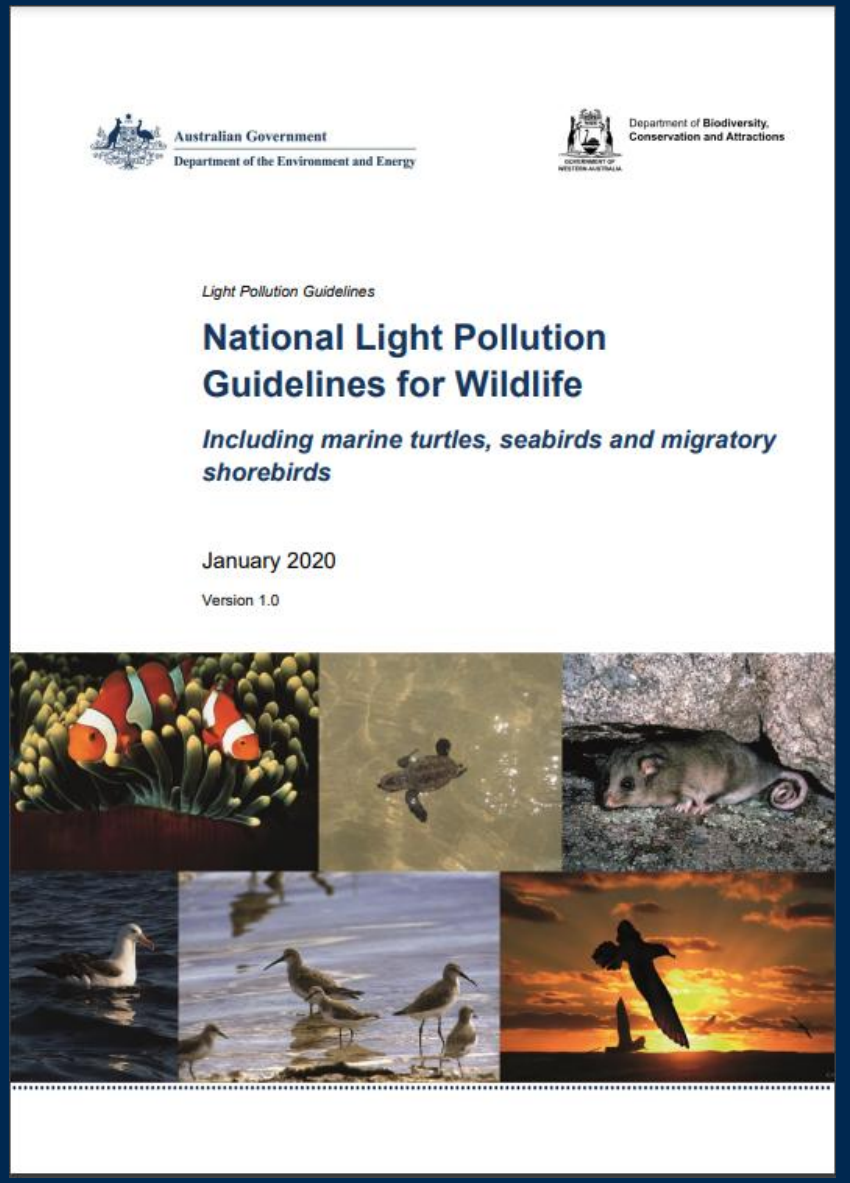
Ecosystem processes

who eats who, pollination, resource availability



National Light Pollution Guidelines for Wildlife

- **Raise awareness of impacts**



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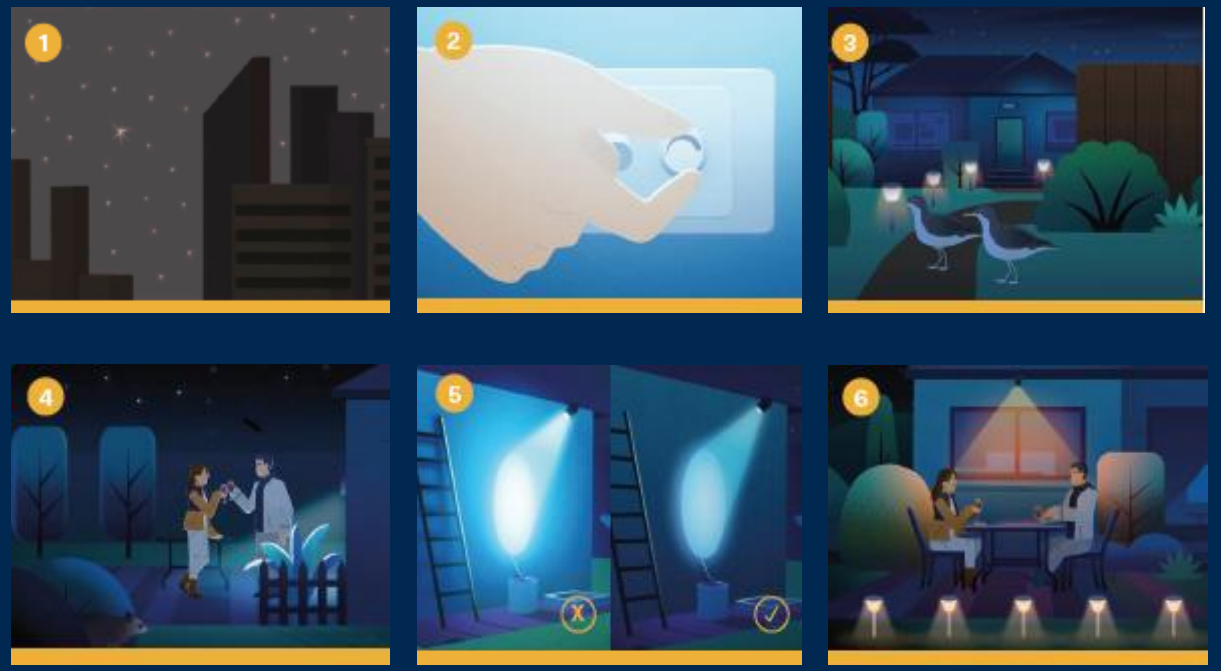
Department of **Biodiversity, Conservation and Attractions**

PENDOLEY ENVIRONMENTAL
MARINE CONSERVATION ENVIRONMENTAL SERVICES

National Light Pollution Guidelines for Wildlife

- Raise awareness of impacts
- **Provide Best Practice Lighting Design Principles**



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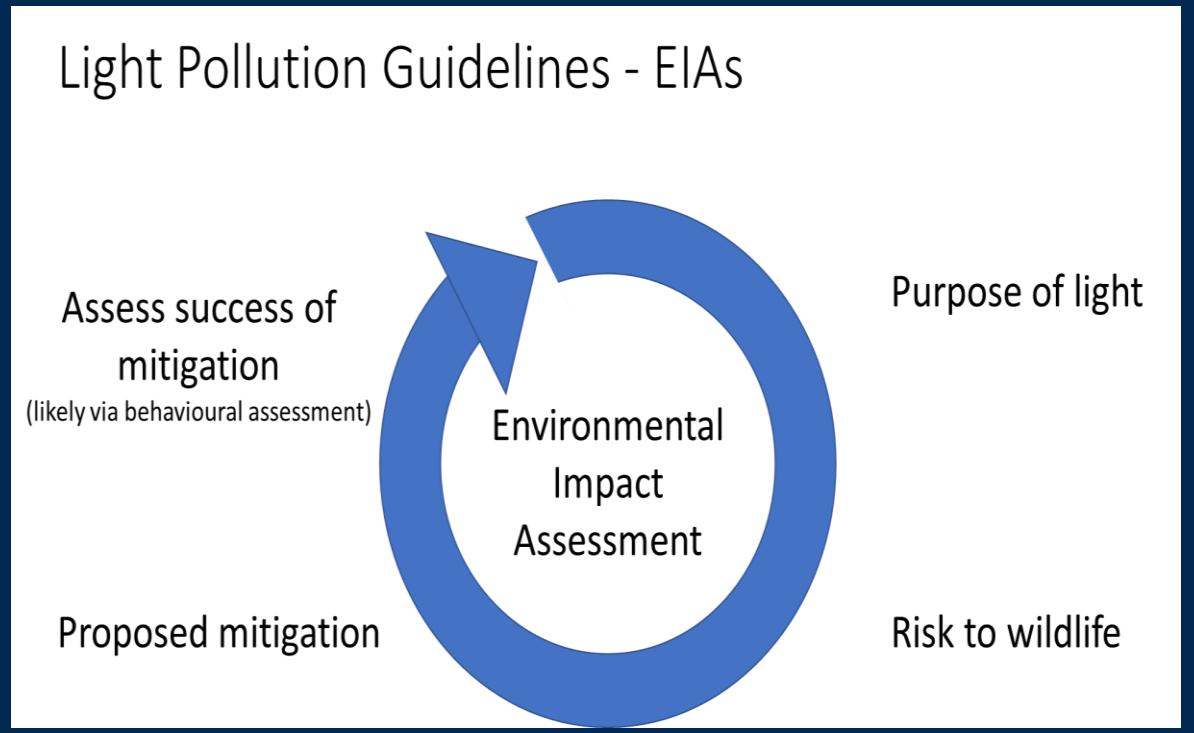
- Raise awareness of impacts
- Provide Best Practice Lighting Design Principles
- **Provide a framework for assessing and managing the impacts of artificial light**



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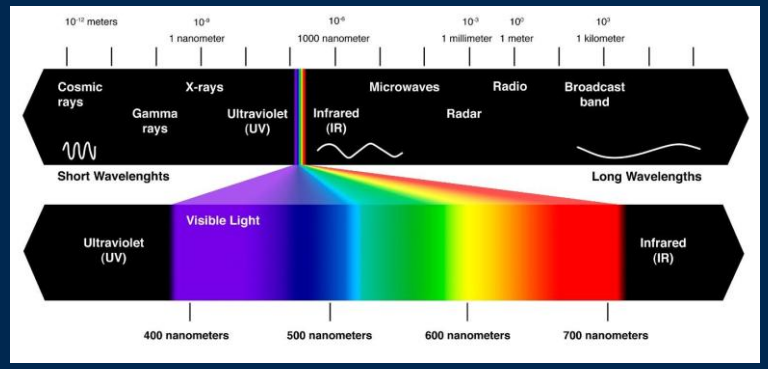
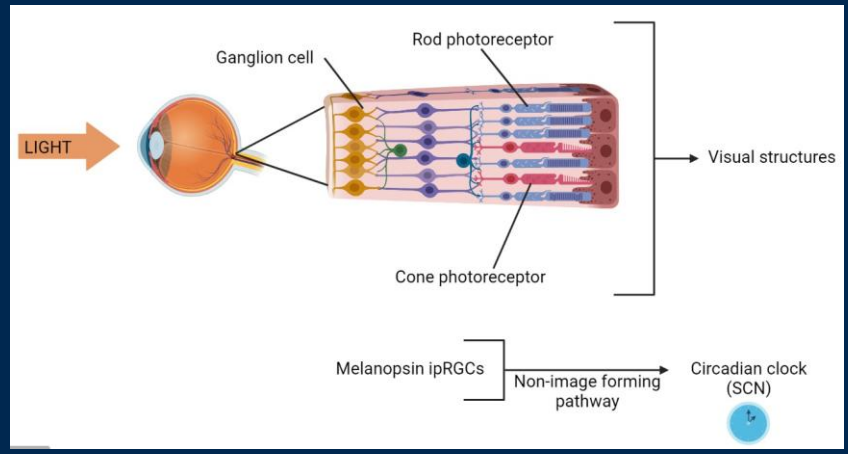
- Provide a framework for assessing and managing the impacts of artificial light
- **Bring together biologists/ecologists and lighting experts**





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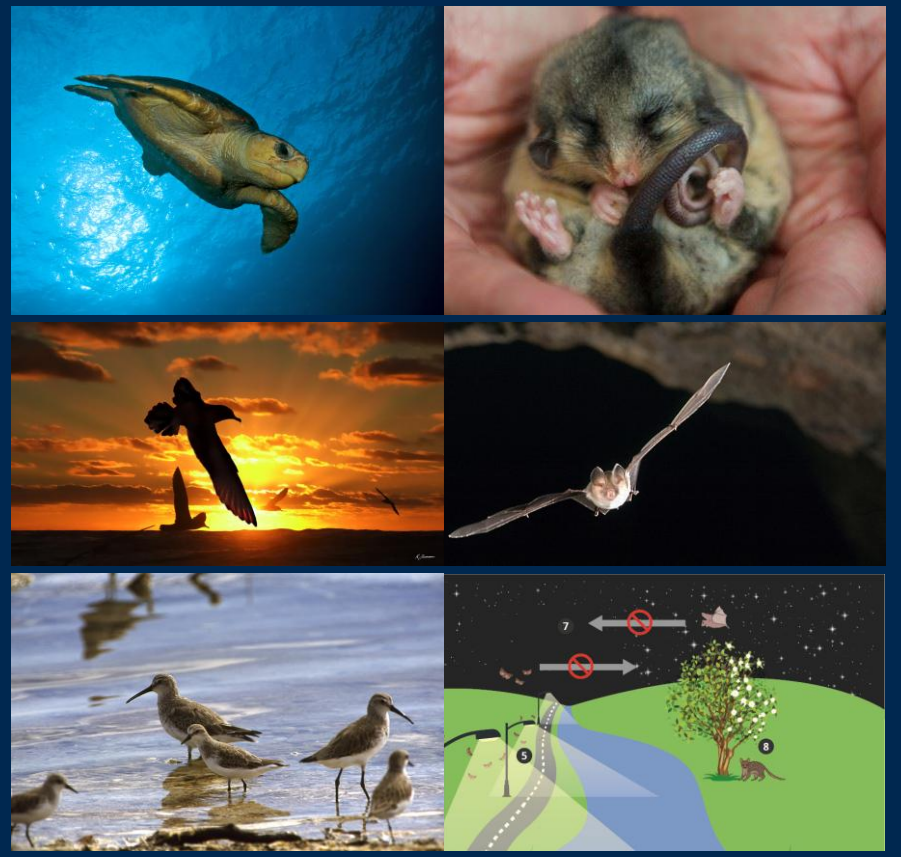
National Light Pollution Guidelines for Wildlife

- Raise awareness of impacts
- Provide Best Practice Lighting Design Principles
- Provide a framework for assessing and managing the impacts of artificial light
- Bring together biologists/ecologists and lighting experts
- **Provide a toolbox to mitigate light impacts**



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Commonwealth Actions

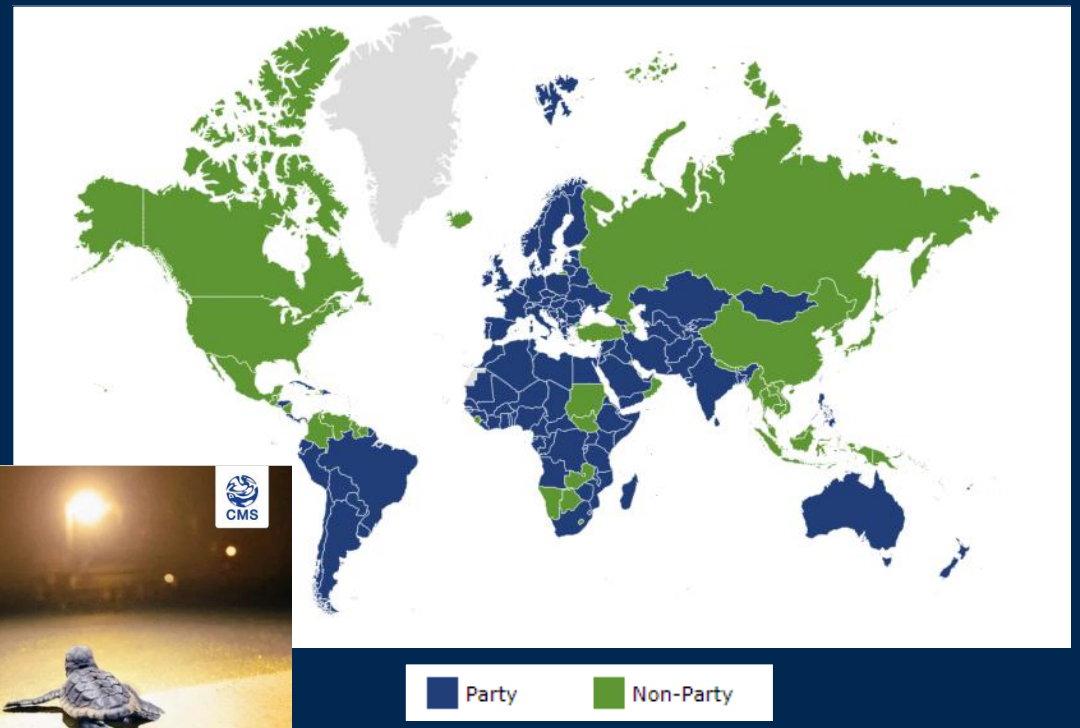
Australian Government

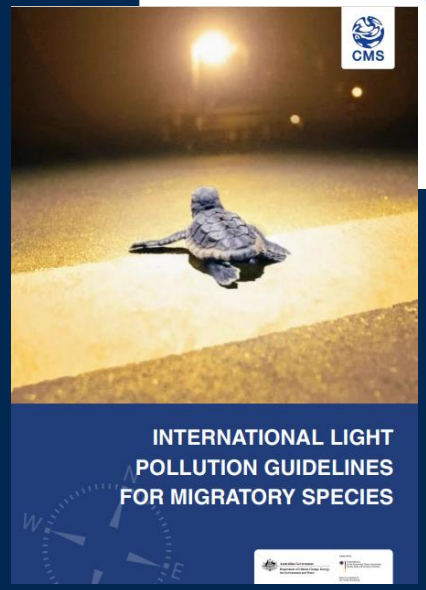
Department of Climate Change, Energy, the Environment and Water

1. Awareness raising
2. Enhance Implementation

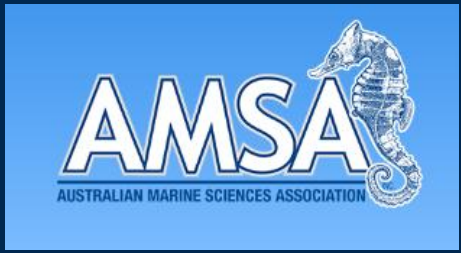
Convention on the Conservation of Migratory Species of Wild Animals

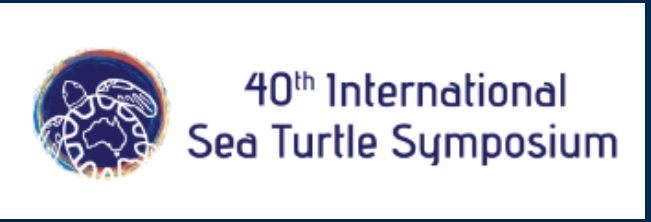
- 133 member countries endorsed Australia's Light Pollution Guidelines at the 13th Conference of Parties (COP), in India in 2020.
- At the 14th Conference of Parties in Uzbekistan in February 2024, CMS adopted their own **International Guidelines for Migratory Species**.
- They are available online for all countries to use:

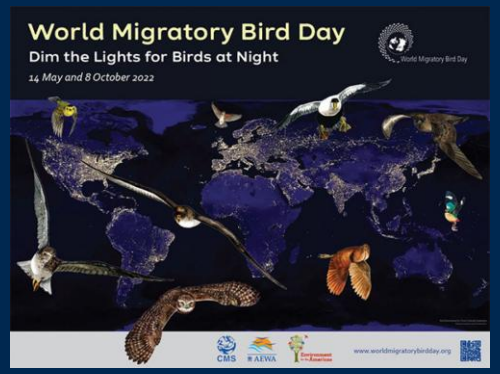


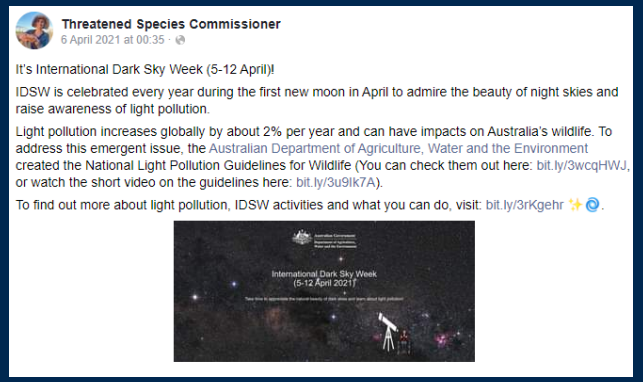


Awareness Raising









Comms Materials

National Light Pollution Guidelines for Wildlife

What is light pollution?

Artificial light helps humans work, play and travel safely at night. However, artificial lighting that is inappropriate, excessive or poorly designed spreads into unwanted places. This is known as light pollution, and it disrupts the health and wellbeing of humans and wildlife alike.

How does wildlife use natural light?

Animals and plants use natural light signals from the sun, moon and stars to time their behaviour and life processes such as:

- patterns of rest and activity
- growth, reproduction and migration
- navigation over short and long distances.

Light pollution harms wildlife and ecosystems

Light pollution can mimic, mask or confuse natural light signals, causing:

- mistimed activity, growth or breeding
- disturbed sleep and circadian rhythms
- disorientation and poor navigation
- attraction to artificial lights
- encounters with new predators
- reduced survival and reproduction.

Artificial lighting affects whole ecosystems by:

- dividing and disconnecting suitable habitat
- reducing pollination by nocturnal animals
- disrupting food webs and nutrient webs
- benefiting invasive species (cats, foxes and cane toads take advantage of artificial lights to feed).

Light Pollution Hurts Marine Turtles

Artificial light is a high-risk threat to Australia's marine turtles

- Female turtles prefer to nest on naturally dark beaches
- After hatching, baby turtles (hatchlings) immediately crawl towards light low on the horizon, which in natural landscapes is the ocean
- Artificial light confuses hatchlings, causing them to crawl in circles, travel away from the ocean, or to swim away from deep water
- Confused hatchlings are more likely to die due to predation, exhaustion or vehicle strike.

Which lights are most harmful?

- Hatchlings orient towards the brightest light
- In dark regional areas, even distant lights (up to 18km) can disorient hatchlings
- Blue, green, UV and white lights have the most harmful effect on turtles
- Amber, red and blinking lights have a weaker effect
- Elevated lighting can be seen by turtles at greater distances.

Six species of marine turtles breed in tropical and subtropical regions from northern NSW to WA. All six are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Adult females dig nests on sandy beaches to lay their eggs. Hatchlings immediately travel towards the ocean and swim out to sea. Turtles generally nest in summer, but season can differ by location and species. Nesting and hatching occur at night.

The management of light pollution near turtle habitat is a conservation priority.

How you can help

- Don't illuminate beaches.
- If lights are needed, choose low-intensity amber or red lighting.
- During nesting and hatching seasons, turn off lights that spill onto beaches between 7 pm and midnight.
- Avoid gas flares and industrial lighting where visible from beaches or inshore waters.
- In regional areas, avoid distant lights visible from beaches.
- Reduce skyglow by pointing all outdoor lighting downwards and using shielding to reduce light spill.

For further information please scan the QR code or refer to the National Light Pollution Guidelines for Wildlife which can be downloaded at: dcceew.gov.au/environment/biodiversity/publications/national-light-pollution-guidelines-wildlife

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Light Pollution Confuses Migratory Shorebirds

Artificial light disrupts navigation, roosting and feeding

- Shorebirds prefer nocturnal rest sites (roosts) that are free from artificial light
- Artificial light makes migrating birds lose their way and choose low-quality rest and feeding sites
- A lack of unlit roosts nearby prevents shorebirds from using otherwise suitable feeding grounds
- Many shorebirds avoid feeding at sites with artificial light.

Which lights are most harmful?

- Lighting near feeding grounds or nocturnal roosts excludes shorebirds from the area
- Artificial lights along migratory paths (including at sea) cause migrating birds to lose their way
- Mobile light sources (vehicles, vessels, torches) cause birds to fly away from feeding or resting sites
- Lots of collisions occur at offshore oil and gas platforms.

57 species of migratory shorebirds (waders) spend part of the year around Australia's coastline and at inland lakes and wetlands. 37 of these species are listed under the *Environment Protection and Biodiversity Conservation Act 1999*, and 10 are threatened. Abundance peaks between August and April, however some juvenile birds are present year-round. Many species feed day and night, as foraging opportunities depend on tides.

Large proportions of the entire global population of shorebirds often gather at a handful of sites. Protecting shorebird sites from light pollution is a high conservation priority.

How you can help

- Avoid lighting in and around shorebird habitat, including feeding sites and nocturnal roosts.
- Stop mobile lights (headlights, vessel floodlights, torches) from shining into shorebird habitat.
- Maintain natural barriers (dunes, vegetation) between sources of artificial light (roads, buildings) and feeding and roost areas.
- Use timers, sensors and dimmers to keep light use to a minimum in nearby areas.
- Avoid high-intensity lighting of any colour.
- Keep night-time gas flares and structure lighting to a minimum on oil and gas platforms.

For further information please scan the QR code or refer to the National Light Pollution Guidelines for Wildlife which can be downloaded at: dcceew.gov.au/environment/biodiversity/publications/national-light-pollution-guidelines-wildlife

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Light Pollution Undermines Ecological Communities

Artificial light harms ecological communities by directly affecting key species

- Many plants, animals and other organisms are harmed by light pollution. Harms include death, injury, reduced nutrition, changes in behaviour and mistimed growth and reproduction.

All species in an ecological community rely on each other

- Effects of lighting on one species have consequences for other species as they depend on each other for food, shelter or reproduction.

Artificial light reduces pollination, seed dispersal and nutrient cycling

Reproduction in many native plants relies on nocturnal pollinators and seed transporters, including bats, moths, possums, ants and native rats. Plants also depend on a network of animals, fungi and bacteria to process soil nutrients and maintain soil structure. Artificial light can reduce native plant growth, reproduction and fruit production by:

- distracting, repelling or killing pollinators, reducing flower visits and the amount of pollen transported
- restricting the movement of seed-dispersing animals across the landscape
- reducing nutrient cycling by soil-digging nocturnal mammals (such as bandicoots, bettongs and bilbies)
- reducing the activity of invertebrates that break down dead organic material (such as beetles, marine amphipods and saltmarsh crabs).

Light pollution changes food webs

Artificial light changes the way predators and their prey interact, including by:

- causing prey to gather around light sources
- reducing dark refuges for prey
- helping visual predators to detect prey (or vice versa)
- making prey less active in illuminated areas
- enabling daytime predators to hunt at night.

For plant-eaters, light pollution can reduce food availability by changing the timing of plant reproduction, growth, flowering and fruiting.

An 'ecological community' is any group of plants, animals and other organisms that occur together and depend on each other. Around 100 unique ecological communities are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Ecological communities support clean air and water, keep soils healthy, control erosion and salinity, store carbon and underpin Australia's native biodiversity.

Ecological communities are already under pressure from climate change, land clearing, invasive species, pollution and changes to fire behaviour and water availability. Light pollution imposes additional stress on already threatened communities.

Implementation - Prevent worst practice AS 4282

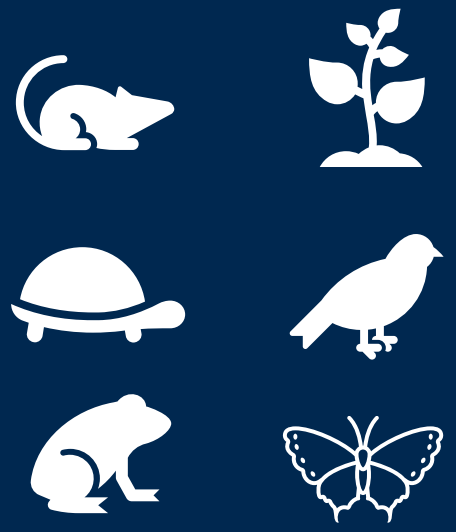
AS/NZS 4282: 2023

Control of the obtrusive effects of outdoor lighting

STANDARDS Australia

Considerations Prior to 2023

Considerations as of October 2023



Implementation - Support better practice

>$200k to reduce light pollution in coastal communities

Upgrades and Retrofits

Info sessions and information stalls

Light Audits 💡🔍

Identifying effective mitigation approaches

Light Management Plans 💡📜

FRIENDS OF GRIFFITHS ISLAND

watergum community for environment

GRIFFITH UNIVERSITY

Mackay REGIONAL COUNCIL

BYRON SHIRE COUNCIL

Implementation - Demonstrate and share better practice

Sunshine Coast COUNCIL

Case Study – Shelly Beach

COMING SOON

Monitoring turtles/measure light before light upgrade → Use National Light Pollution Guidelines to guide lighting design → Install Lighting → Monitor turtles /measure light → Adapt lighting as needed

Traditional Owners

Industry

Researchers

State/Territory Government

eNGOs

Local Government

Valuing Darkness

SYMPOSIUM & ROUNDTABLE

19 - 21 March 2025

Melbourne City Conference Centre

For more information

https://www.dcceew.gov.au/campaign/light-pollution

Email:
cesar.sanmiguel@dcceew.gov.au

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Let's switch off light pollution together

dcceew.gov.au/environment/biodiversity/conservation/light-pollution