

COVER STORY

### Into the blue

Understanding marine light pollution

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We restore the nighttime environment and protect communities from the harmful effects of light pollution through outreach, advocacy, and conservation.

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#### On the cover

"Graceful jellyfish" Singapore by Karan Karnik on Unsplash

This image was taken in a public aquarium under controlled lighting that is low-intensity, filtered, and tailored to each species. For jellyfish displays, light is carefully managed to avoid harm while enhancing their natural translucence and color. In contrast, artificial light at night in the ocean is often unregulated, high-intensity, and widespread, altering natural rhythms and disturbing ecological balance. This issue of *Nightscape* further addresses how excessive lighting in the ocean is a real threat to marine life.

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### Nightscape

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## From the **Executive Director**



As a supporter of DarkSky, you know that the night sky is alive with light — from the glow of the Milky Way, to dancing auroras and the faint zodiacal light. But did you know the dark ocean can similarly be alive with light?

I discovered this in **Oman** one winter, swimming off beaches with bioluminescent phytoplankton. Gliding through the luminous water was magical. Each stroke sent blue eddies swirling, and waves sparkled as they met the shore.

As you will read in this issue, light pollution extends far beyond our land. Our cities' glow is dramatically altering coastal ecosystems worldwide. Shipping lanes and fishing fleets brighten oceans far beyond the shore. A 2012 study found that 35% of marine protected areas worldwide experience light pollution – undoubtedly more today. Ocean conservation has emerged over the past decades as a critical environmental concern. These challenges require our urgent attention and action.

I witnessed this firsthand on **Matsu** Island off **China**'s coast. This beautiful archipelago, working towards **Dark Sky Park** designation, faces a challenge from seasonal fishing fleets whose powerful lights impact marine life and the island's night skies.

As we protect dark skies, let's remember that our mission includes the waters covering 71% of our planet. By addressing both terrestrial and marine light pollution, we ensure future generations can experience the wonder of our luminous night skies and the natural bioluminescence of our oceans.

Thank you for your continued support.



For the night, **Ruskin Hartley** ruskin@darksky.org Tucson, Arizona, U.S.

### From the Editor





Last year, while researching my upcoming book on darkness, I spent some time at the Iriomote-Ishigaki Dark Sky Park, an archipelago in southern **Japan**. During an evening mindfulness session at the beach, I noticed some fishermen on a small boat near the shore using flashlights to attract fish. I was shocked to see the fish leap out of the water when the light was shone near them.

It's easy to think of light pollution as only affecting our skies. But a staggering 94% of all life on Earth is aquatic, and as you'll read in this issue, the reach of artificial light extends well beyond the atmosphere into the depths of our oceans. Marine light pollution is perhaps less visible to us land-dwellers, but no less urgent. From coral that waits for darkness to spawn, to zooplankton that rise and fall with the night, to baby turtles that need moonlight to make it safely to the sea, so much aquatic life depends on darkness to survive.

We know that life is a web - what affects one species affects us all.

As we mark World Ocean Day (June 8) and World Sea Turtle Day (June 16), we celebrate the growing movement to protect marine ecosystems from artificial light. In this issue, we highlight the latest research on marine light pollution and the harm it causes below the surface - and we're proud to spotlight our DarkSky quality lighting programs, particularly the newly updated DarkSky Approved Luminaires, which include those certified as "Sea Turtle Sensitive" and designed specifically to safeguard coastal habitats.

Whether you live near the seaside or far inland, I hope this issue invites you to consider what darkness means below the tide line and how we can all help protect it.



Megan Eaves nightscape@darksky.org London, U.K.

### Advocate highlights

News snippets from our network of DarkSky Advocates around the world





### 🌐 Global

#### International Dark Sky Week 2025

was a big success with thousands of participants and numerous events on six continents. There were 114 proclamations issued across 17 countries, and the event reached an audience of nearly 1.5 million people on social media with thousands of new followers, plus global press coverage and support from organizations like the **U.S. Fish and Wildlife Service**, the **Bureau of Land Management, Space. com**, and many more!

### 🖗 U.S.

Advocates from the northeast U.S., including **Delegates Stephen Mariconda** and **Ruoyu Li**, represented DarkSky at the **Northeast Astronomy Forum** from April 5–6 in New York, one of the largest astronomy forums globally.



### ₿ U.K.

DarkSky Advocate Nick Dunn released a new book, Dark Futures: When the Lights Go Down, exploring the pervasive



presence of artificial light in contemporary life and advocating for darkness as a vital aspect of wellbeing, ecological balance, and creative expression.

### **Q** U.S.

Oregon chapter leader and longtime DarkSky supporter, **Bill Kowalik**, was



featured as an "Earth Hero" by the local Bend, Oregon newspaper, Source Weekly, for his work on dark sky issues. Bill was noted as "a strong champion of

the air" and celebrated for his dark sky advocacy.

# Lighting by example

The **DarkSky Approved** programs offer practical tools for reducing light pollution and supporting responsible lighting design across industries. From luminaires and lodging to sports fields and oil sites, these initiatives help people and organizations worldwide make a difference.



### DarkSky Approved Luminaires

Updated in 2025, the Luminaires program helps individuals, businesses, and governments choose lighting that protects the night, including Sea Turtle Sensitive lighting. Approved products meet strict criteria for shielding, colour temperature, brightness, and zero uplight. With more than 1,400 approved models and 180 manufacturers, this is Dark-Sky's largest and longest-running program. Explore the full list using the new product search tool at: darksky.org/darksky-approvedluminaires-program



### DarkSky Approved Outdoor Sports Lighting

Lighting sports fields can pose a challenge for protecting night skies. This program recognizes lighting designs that are safe, effective, and night-friendly. Approved installations must include shielding, light control, and adaptive features like dimming and timers, as well as employing curfews.

#### CASE STUDY

### Université Sainte-Anne, Nova Scotia, Canada

Université Sainte-Anne worked with Musco Lighting to install a custom system that meets strict criteria for shielding, light control, and energy efficiency. The result is a shared-use track and football field that supports student and community athletics without disrupting nearby nature trails or a local observatory.



### DarkSky Approved Lodging

This program certifies accommodation providers that demonstrate a commitment to dark sky protection. To qualify, properties must install compliant outdoor lighting, educate guests, and host night-friendly experiences.

#### CASE STUDY

### Pousada Verbicaro, Santa Maria Madalena, Rio de Janeiro State, Brazil

Pousada Verbicaro is a rural lodge adjacent to Desengano Dark Sky Park.This rural inn uses timers and motion sensors to limit lighting, turning off most lights by 10 pm. Guests learn about the value of darkness and enjoy stargazing in a peaceful, star-filled valley in the richly biodiverse Atlantic Forest.





### **Meet James Brigagliano**

Lighting Program Manager, DarkSky

James leads DarkSky's Approved programs from his home in the Hudson Valley, New York. With a background in lighting design and a love for outdoor recreation, he joined DarkSky in 2023.

#### What brought you to DarkSky?

My background is in outdoor lighting design and product development. I've always dreamed of serving as a steward to protect the environment. Fortunately, my passions led me to this position with DarkSky. I truly love what I do.

### What motivates you to work on dark skies?

Experiencing a natural night sky helps connect us to the Earth and our place in this world. I want to ensure that this experience is accessible to as many

### DarkSky Approved Oil and Gas Industry Lighting

One of DarkSky's newest programs focuses on reducing high-impact lighting at industrial sites. Facilities must submit lighting plans, luminaire specifications that include no uplighting, elimination of off-site light trespass, and are 3000 K or lower color temperature.

#### CASE STUDY

### Franklin Mountain Energy, New Mexico, U.S.

At three pilot sites in New Mexico, Franklin Mountain Energy installed new lighting that reduced glare and skyglow while preserving worker safety. Monitoring has confirmed a measurable improvement in sky quality, showing how heavy industry can adopt lighting solutions that protect the night.



people as possible and for generations to come.

### How do the quality lighting programs benefit members and supporters?

These programs help educate professionals and advocates, promote community-friendly design, and challenge the industry to produce the best products possible.

### **Get involved**

Anyone can use the DarkSky Approved programs to inspire and implement change.

- Encourage local lighting ordinances to refer to the luminaires list.
- Share the Lodging program with ecotourism partners.
- Talk to schools or sports leagues about sports lighting certification.
- Highlight the oil and gas program to policymakers as an example of industry innovation.

Learn more, apply for certification, and search for DarkSky Approved products: darksky.org/approved



 Even if you never have the chance to see or touch the ocean, the ocean touches you with every breath you take, every drop of water you drink, every bite you consume. Everyone, everywhere, is inextricably connected to and utterly dependent upon the existence of the sea."

**Sylvia Earle**, marine biologist and oceanographer Excerpt from *The World Is Blue: How Our Fate and the Ocean's Are One* 

# Protecting sea life with smarter lighting

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In celebration of World Oceans Day and World Sea Turtle Day

Every year in June, two international observances call attention to the health of our seas: World Oceans Day (8 June) and World Sea Turtle Day (16 June). As DarkSky supporters, these days are an opportunity to reflect on how artificial light at night affects ocean life and to spotlight solutions already making a difference.

Many sea turtle species are especially vulnerable to light pollution. Hatchlings rely on natural light cues from the moon and stars to find their way to the ocean after emerging from their nests. Artificial lighting near nesting beaches can disorient them, leading them away from the water and toward danger.

In response to this critical issue, DarkSky has partnered with manufacturers to create the DarkSky Approved Sea Turtle Sensitive Luminaires program. These specially designed luminaires meet the strictest criteria for both protecting the night sky and safeguarding coastal ecosystems. They emit long-wavelength light (typically amber or red), avoid the blue spectrum that disrupts turtle behavior, and are fully shielded to prevent glare and uplight.

DarkSky's new policy templates, which help policymakers write municipal ordinances, include an optional Coastal Marine Turtle Supplement to regulate lighting in areas with sea turtles. Access the templates: <u>darksky.org/what-we-do/darksky-recognized-codes-and-statutes</u>

Whether you're working in coastal planning, managing beachfront properties, or advocating for marine protection in your community, the Sea Turtle Sensitive designation provides a practical tool for choosing lighting that meets conservation goals.

This June, help spread the word about marine light pollution and the simple ways we can protect sea turtles and other ocean life through responsible lighting.

Explore the full list of DarkSky Approved products, including sea turtle luminaires, at <u>darksky.org/approved</u>.

"This program supports communities and developers who want to do the right thing near sensitive coastal areas. It's one of the most targeted applications of DarkSky principles, with clear benefits for wildlife."

- James Brigagliano, Lighting Program Manager



Image credit: First Light Technologies (FLT)



COVER STORY

### Into the blue Understanding marine light pollution

by Megan Eaves, London, U.K.

Most of us think of light pollution as a problem affecting the skies above our cities. But what about the light that spills into our oceans?

Artificial light at night (ALAN) has long been studied for its impacts on humans and wildlife on land. Increasingly, scientists are also turning their attention to how it affects marine ecosystems, from coral reefs and seabirds to fish and zooplankton. It turns out that our oceans are far from dark.

"Marine artificial light pollution is a growing problem that many people don't even know exists," says Professor Tim Smyth, head of science for marine biogeochemistry and observations at Plymouth Marine Laboratory (PML) in the U.K. "We're now seeing clear evidence of widespread ecological impacts."

### New frontier for dark sky advocacy

For nearly a decade, researchers at PML and the University of Plymouth have been exploring the extent of ALAN in the ocean. Their studies show that some 22% of the world's coastal waters are exposed to measurable levels of artificial light at night. That's 2 million sq km (772,000 sq mi) in total — an area roughly the size of Western Europe or about half the size of China.

Marine light pollution can come from streetlights, ports, coastal developments, fishing boats, oil platforms, and other shoreline infrastructure. While the brightest impact zones are often limited to around 100 meters offshore, light can scatter far beyond this. Skyglow from urban centers can reach many miles out to sea, particularly under cloudy skies or where waters are very clear.

"One of our main concerns is how light disrupts the natural rhythms that marine organisms depend on," Smyth explains. "From daily migrations of zooplankton to coral spawning cycles and turtle hatchlings, many marine species rely on darkness as an environmental cue."

### Biological clocks and blue light

Under natural conditions, light in the ocean fades rapidly the deeper you go. But ALAN, especially from white or blue-rich LEDs, penetrates much deeper into the water column, up to 40 meters below the surface in clear water. This can disturb behaviors and biological processes in organisms adapted to the dark.

Smyth and his PML colleagues have focused much of their current research on zooplankton, tiny sea organisms that usually migrate toward the surface at night. These have been observed staying deeper in artificially lit waters, and the team believes this is likely to have knock-on effects across the marine food web.





Sea turtles rely on natural darkness for critical behaviors like nesting and hatchling navigation.

Unlike marine ALAN, aquarium light is carefully managed for jellyfish health.

Many marine species are known to be vulnerable to ALAN. Research by Tim Smyth's colleague, Thomas Davies, published in *Nature Communications*, showed that coral reefs rely on the cycles of the Moon to synchronize mass spawning events. Artificial light at night, particularly in the blue spectrum, "fills in" the natural dark periods that corals rely on to initiate spawning, such as the dark window between sunset and moonrise.

Sea turtle hatchlings become disoriented by shoreline lighting and travel inland instead of toward the sea. Seabirds such as shearwaters and petrels are drawn off-course by artificial light at night, often colliding with vessels or buildings. Even shore crabs and intertidal snails show altered foraging and camouflage behaviors under artificial light, changing predator-prey dynamics.

Coastal lighting near penguin colonies can delay or prevent adults from coming ashore, interfering with nightly feeding and chick survival. Squid are drawn to bright fishing lights — a behavior exploited by fisheries but with broader ecological consequences for marine food chains. Even jellyfish appear to respond to subtle changes in underwater light, and increased ALAN may affect their vertical movement and predator interactions.

"Blue light, in particular, penetrates deeply into seawater," says Smyth. "And unfortunately, many newer LED fixtures are heavy on the blue spectrum, especially in urban and industrial settings."

### Mapping the light below

To support research and awareness, PML has created the first-ever Global Atlas of Artificial Light at Night Under the Sea. This online tool is similar to other light pollution maps and is based on their work, allowing anyone to explore the extent of marine light pollution by region or coastline. It builds on satellite data, in-water optical modeling, and ecological thresholds to show where artificial light may be disrupting marine life.

"We wanted to make the data accessible to scientists, policymakers, and the public," he says. "The atlas helps identify areas of concern and guide better lighting practices."

The atlas is part of a growing global effort to highlight marine ALAN as a serious environmental issue. In 2024, the Global Ocean Artificial Light at Night Network (GOALANN) was launched, endorsed by the United Nations Ocean Decade. GOALANN brings together researchers, conservationists, and regulators to better understand marine light pollution and inform international action.

PML's work is also part of Aqua-PLAN, a four-year research project funded by Horizon Europe, the EU's flagship science program, which studies the combined impacts of ALAN and human-made noise on aquatic ecosystems. The project brings together scientists, conservationists, and policymakers to develop strategies for monitoring and mitigating these stressors, with a focus on protecting biodiversity in European waters.

### Solutions from shore to sea

Like terrestrial light pollution, marine ALAN is a tractable problem that can often be reduced quickly and affordably. For instance, coastal The river Thames at North Greenwich just prior to dawn, London, U.K.



"We're not saying to turn off all lights," Smyth says. "Safety is important. But we can light smarter — reduce skyglow, use appropriate colors, and turn off lights when they aren't needed." To this end, Plymouth City Council has worked with Smyth's lab to begin trialing dynamic street lighting near the coast to reduce light pollution while maintaining public safety — a model that could inform coastal planning elsewhere.

DarkSky is currently developing a new Approved Ports program to be launched later this year, which follows the Five Principles for Responsible Outdoor Lighting. The program will address light trespass into the water as well as the sky.

DarkSky also recently launched templates for ordinances to promote higher quality lighting with reduced light pollution in communities. The templates are modular and can be amended to fit local conditions. One such optional addition is language for sea-turtle sensitive areas, which is based on the U.S. state of Florida's "Model Lighting Ordinance for Sea Turtle Protection."

Another emerging concept is the creation of certified dark sky marine places, which could be



protected ocean or coastal zones where artificial light at night is limited to conserve sensitive habitats. Tim Smyth thinks dark sky marine reserves would be "a way of extending the success of terrestrial dark sky places into the ocean." He says such reserves could play a vital role in conservation planning, particularly in places like the U.K.'s Marine Protected Areas, where vulnerable species rely on natural light cues to survive and thrive.

The impacts of ALAN on marine biodiversity are still being uncovered, but it is clear that darkness matters, even in the sea. As we work to protect the night sky above, we must also consider the waters below. DarkSky Advocates can play a role by raising awareness of marine light pollution and encouraging policymakers and local governments to include oceans in lighting regulations. So far, most lighting laws focus only on land-based impacts.

As Tim Smyth put it: "Light pollution is not just a sky issue; it's a planetary issue. It affects the atmosphere, the land, and the ocean. Recognizing that is the first step toward protecting the full natural night." **+** 

#### Learn more

To explore the Global Atlas of Artificial Light at Night Under the Sea and learn more about GOALANN, visit goalann.org. More info on AquaPLAN at aquaplan-project.eu



### Newly certified International Dark Sky Places & Lodgings

Announced since March 1, 2025



#### ABOUT THE PROGRAM



The International Dark Sky Places program certifies communities, parks, and protected areas around the world that preserve and protect dark sites through responsible lighting policies and public education.

#### **BY THE NUMBERS**



International Dark Sky Places around the world



Countries and territories represented



Continents represented

### 194,100+

Square kilometers of protected land and night sky

Find a Place near you: **DarkSky.org/places** 





















### Tāhuna Glenorchy

#### New Zealand

Remote sanctuary in the Southern Alps near Queenstown, where Māori star knowledge and wilderness protection converge.

Dark Sky Sanctuary

2,150 km²

### Landes de Gascogne Regional Natural Park

#### France

Reserve in southwest France encompassing dozens of municipalities preserving forests and wetlands with community action and dark wildlife corridors. Dark Sky Reserve 4,763 km<sup>2</sup>

### Teton County Wyoming, U.S.

World's first DarkSky-certified county, encompassing the rich ecosystems of Yellowstone and Grand Teton National Parks and the town of Jackson.

Dark Sky Community

10,920 km²

### ULUM Moab

### Utah, U.S.

Luxury tented resort near Arches and Canyonlands Dark Sky Parks with night-friendly design and openair stargazing.

DarkSky Approved Lodging

### Diamond Mountain Retreat Center Arizona, U.S.

Desert meditation center near the Chiricahua Mountains focused on serenity, sustainability, and spiritual practice in a remote setting.

DarkSky Approved Lodging

### Pousada Verbicaro

#### Rio de Janeiro State, Brazil

Family-run eco-lodge near Desengano Dark Sky Park committed to dark sky education and lowimpact lighting in the heart of the Atlantic Forest. DarkSky Approved Lodging

Darksky Approved Lodging

### Kestrel Nest EcoHut

### New South Wales, Australia

An off-grid retreat on a regenerative farm near Woomargama National Park, offering dark skies, native wildlife, and stargazing from a restored 1890s shepherd's hut.

DarkSky Approved Lodging

### News & notables

News from the global movement promoting responsible outdoor light at night

### European manifesto calls for action on light pollution



ASA

Adopted during Spain's 2023 EU Council Presidency, the **European Light Pollution Manifesto** urges policy recognition of artificial light as a pollutant, coordinated monitoring, and stronger regulation. It's a major step for conservation across Europe. Sign and share the manifesto:

#### darksky.org/european-manifesto



### DarkSky's photo contest back on for 2025

DarkSky proudly announces the return of **Capture the Dark**, the premier nightscape and astrophotography contest, after a hiatus in 2024. Submissions are open from May1 – June 30, and winners will be announced in August. Visit Dark-Sky's website for details and to submit your photos.

#### capturethedark.darksky.org



### Bird Collision Prevention Alliance launched

The U.S. Fish and Wildlife Service hosted a summit in 2024 with experts from conservation, architecture, science, and government. Out of that, the Bird Collision Prevention Alliance has been formed, incorporating DarkSky's principles as core components — a significant advancement in cross-sector cooperation to address light pollution and bird collisions.

#### stopbirdcollisions.org



### Show your support for the night

Give yourself or a loved one the gift of the night by purchasing our selection of customized mugs, apparel, and totes.

bonfire.com/store/darksky

### 2025 ALAN Conference to be held in Ireland

The 9th annual **Artificial Light at Night** (ALAN) Conference will be held from October 28–31 in Westport, Ireland.



Held every two years, it is the largest scientific

conference on light pollution and in 2025 is hosted by **DarkSky Ireland**. Invited speakers include light pollution researchers, lighting designers, tourism and policy experts, and ecologists. More info and registration:

artificiallightatnight.org

#### IN CASE YOU MISSED IT

### Nalayini Brito-Davies named Board President

DarkSky International has appointed **Nalayini Brito-Davies** as President of its



Board of Directors. She is a long-time advocate and technical expert with decades of experience in astronomy, physics, and lighting standards. Based in

New Zealand, Brito-Davies has served on DarkSky's Board since 2019 and is a co-founder of the Aotearoa Astrotourism Academy.

darksky.org/who-we-are/board/

### 2025 State of the Science report released

DarkSky International has published its **2025 report on artificial light at night**, reviewing the latest global research on ALAN's ecological, health, cultural, and technical impacts. This annual roundup is a vital tool for advocates, offering easy-to-understand summaries of peer-reviewed studies and highlighting emerging themes.

### DarkSky's updated home lighting pledge

No matter where you live, protecting the night starts at your front door. DarkSky's recently updated **Home** 

Lighting Assess-

ment is a simple activity to help you reduce light pollution at home. Following four simple steps,

DARK SKY FRIENDLY This home proudly protects the night.

DarkSky

you can check and

adjust the lights around your home and sign the pledge for a healthier nighttime environment.

darksky.org/home-lighting-assessment

### Light pollution is solvable

With your help, we can make a difference. Your gift to DarkSky International empowers and equips communities to reduce light pollution, protect wildlife, and restore our starry skies. Together, we're creating lasting change for future generations. Join others in supporting the movement to address



light pollution today. donate.darksky.org

### "Saving the Night" event held at the Grand Canyon

Lowell Observatory and the Grand Canyon Conservancy hosted a virtual panel on April 22 to mark National Park Week. Former Grand Canyon Astronomers in Residence Dean Regas, Lauren Camp, Kevin Schindler, and Dark Sky Ranger Rader Lane highlighted the importance of preserving natural night for wildlife, ecosystems, and future generations. Watch the recording:

bit.ly/42LzZLB

darksky.org/news/

Capture the Dark 2025 The global stage for photography at night

DarkSky International proudly presents Capture the Dark – the premier global photography contest celebrating the wonders of the night and what's at risk of being lost to light pollution.

We invite photographers of all skill levels to participate and share their unique perspectives.



Learn more! Capturethedark.darksky.org

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Photo credit: Royce Bair