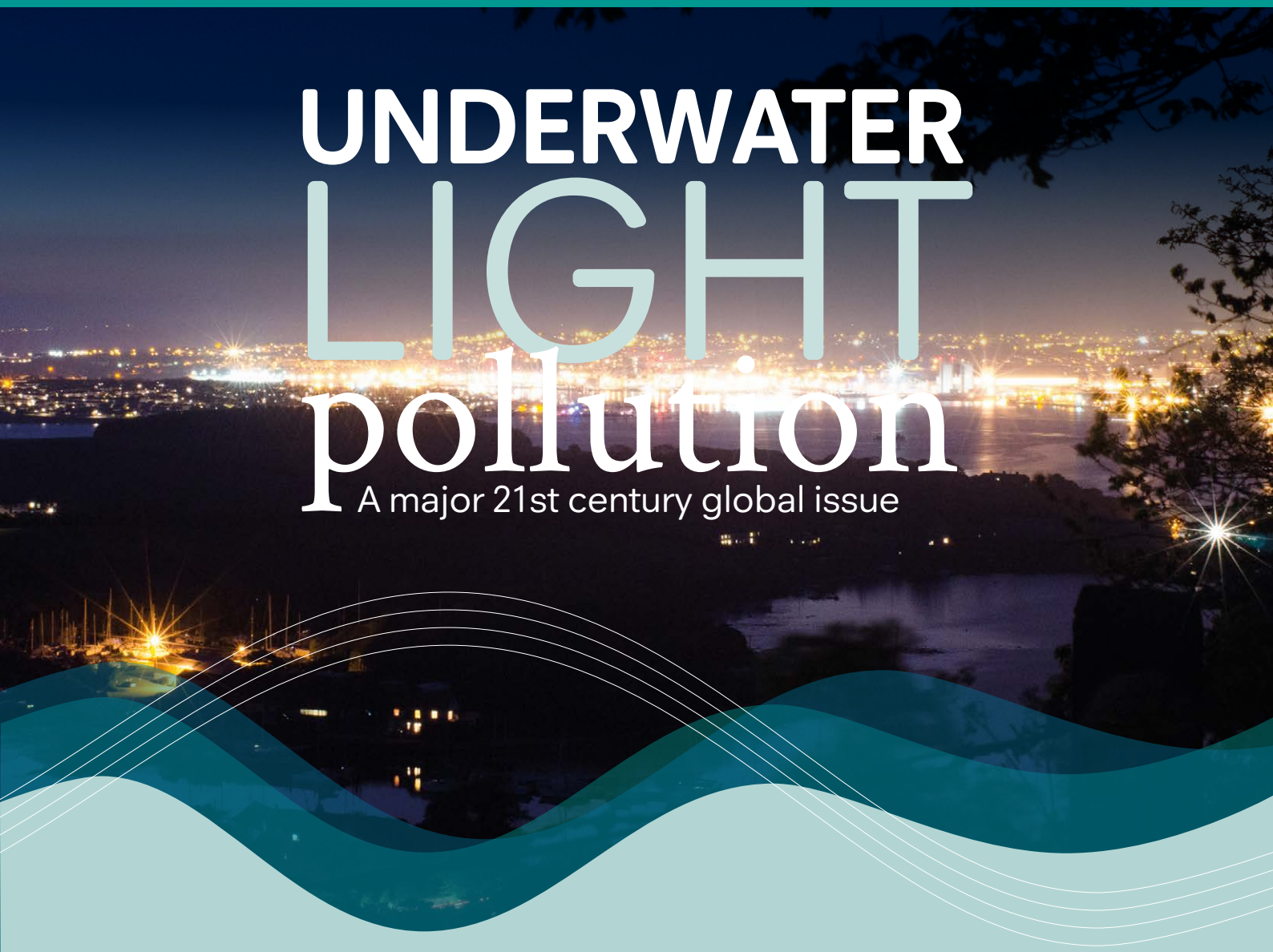
UNIVERSITY OF PLYMOUTH
Marine Institute

POLICY BRIEFING FOR PARLIAMENTARY EVIDENCE WEEK 2024/25



UNDERWATER LIGHT pollution

A major 21st century global issue

EXECUTIVE SUMMARY

Dr Thomas Davies and Professor Tim Smyth

2 million km² of the world's oceans and 22% of coastlines are exposed to light pollution from coastal cities and offshore infrastructure. The growing popularity of Light Emitting Diodes (LEDs) – now more than 80% of the global lighting market – has resulted in more blue light entering the oceans that penetrates furthest in seawater, and to which marine animals are highlysensitive. The predominant lighting technologies of the 20th century impacted only the first 10m of the ocean, while in the 21st century, impacts can occur below 100m depth. LED lighting has been rolled out across UK coastal cities and offshore infrastructure without consideration of its impacts on the marine environment. There are now more than 200 published impacts of light pollution on marine ecosystems, including those on species that support critical ecosystem services. Yet, marine light pollution remains completely unregulated. **We want to recommend that light pollution is considered under descriptor 11 of the UK marine strategy**, and a legal requirement to consider and mitigate for the ecological impacts of light pollution on the marine environment in offshore and onshore planning processes.

POLICY CONTEXT

Light emissions into the sea are unregulated by national policy. In fact, the widespread adoption of LED's by UK local authorities has likely exacerbated the impact of city lighting on marine ecosystems over the last ten years. LED's save energy, money, and carbon emissions making them a very attractive option for lighting our streets, but emit more blue light than previous lighting technologies.

There is currently no UK legislation that aims to set the criteria for Good Environmental Status of light pollution at sea.

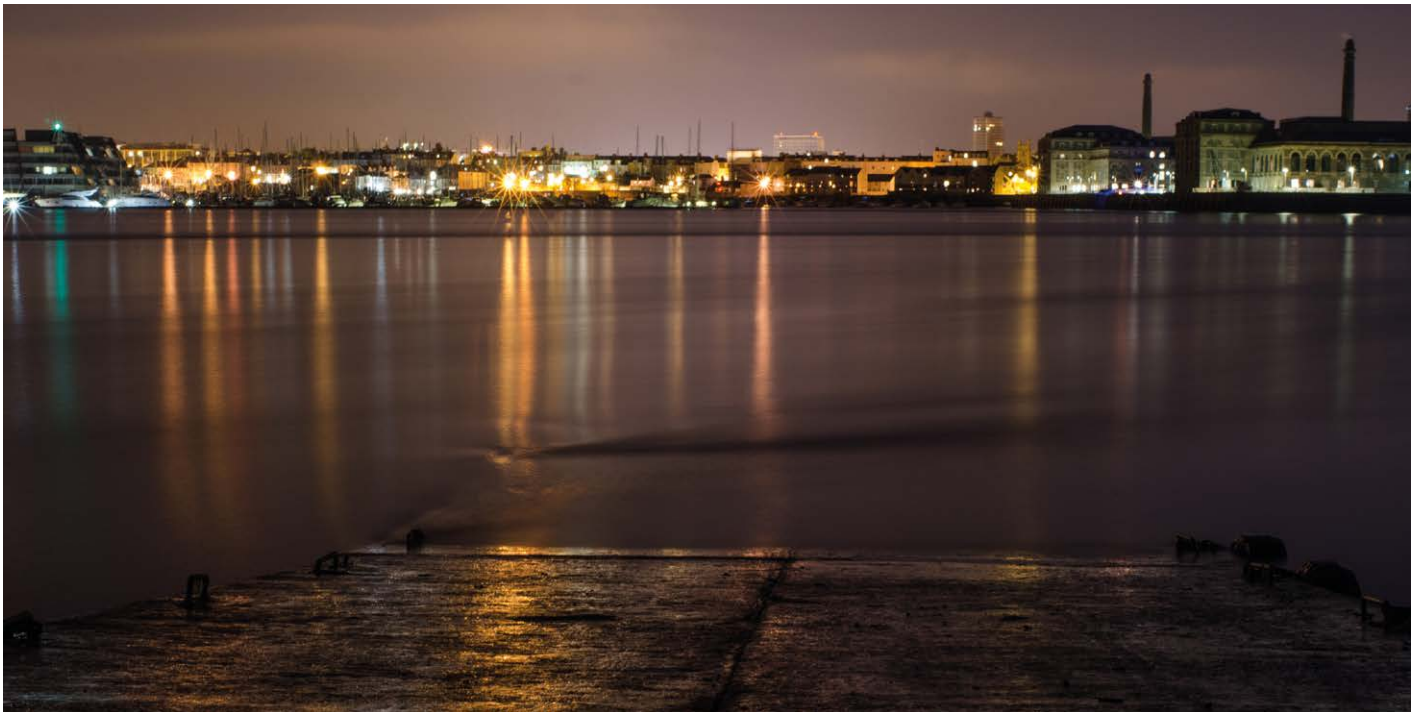
Descriptor 11 of the Marine Strategy Framework Directive (MSFD) (2008/56/EC) is defined as **'the introduction of energy'** which includes noise, light and electromagnetic radiation. When translated into The UK Marine Strategy however, D11 was interpreted to refer exclusively to underwater noise. Reference to light was omitted. There is currently no UK legislation that aims to set the criteria for Good Environmental Status of light pollution at sea. There are currently no legal provisions that include light pollution impacts on the sea during the offshore planning process. There is currently no guidance for considering impacts on coastal species in the UK planning mechanism

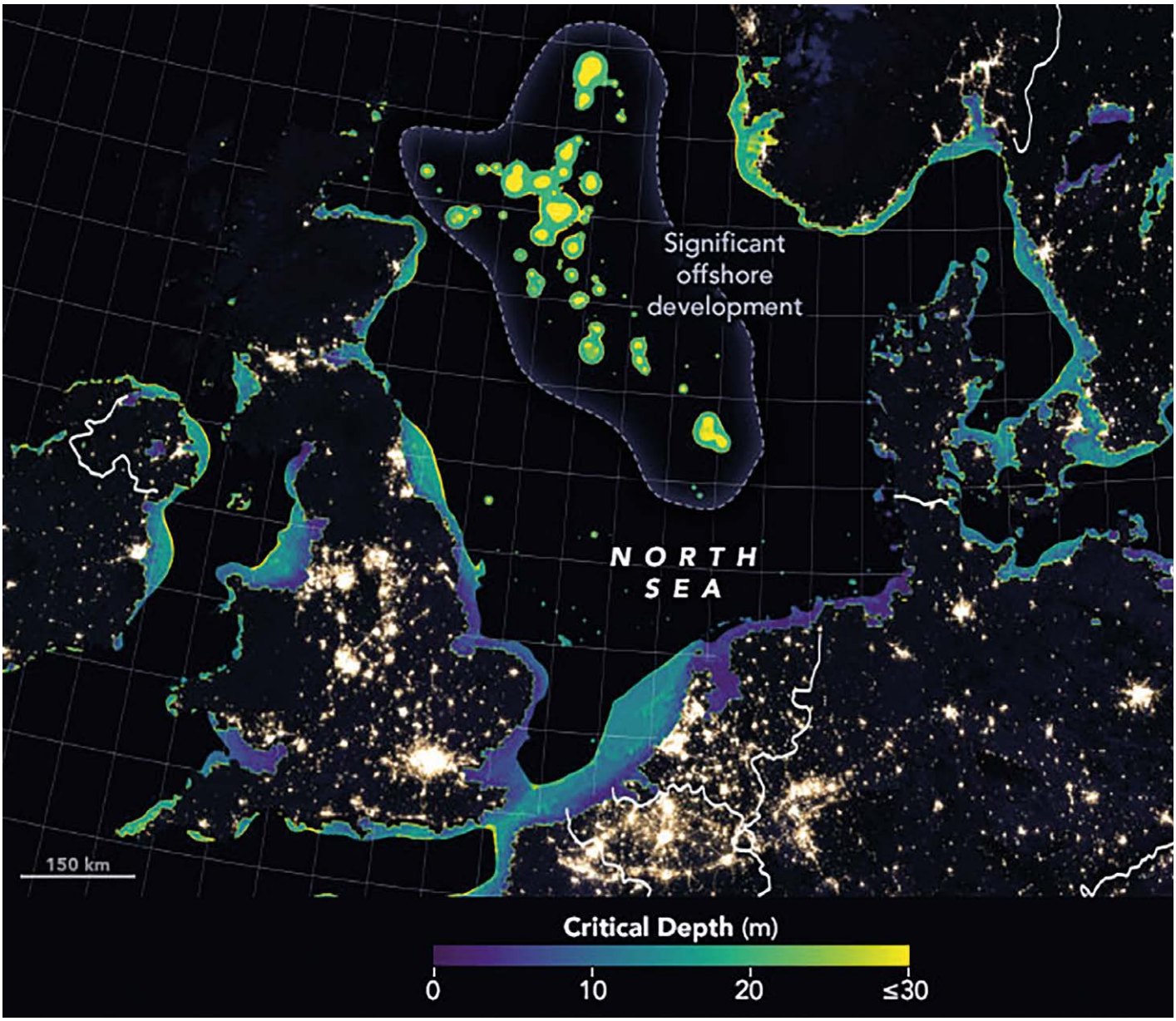
RESEARCH AIMS

- Quantifying the global extent of light pollution in the sea for the first time.
- Investigating the impact of light pollution on key biological processes in UK marine ecosystems.
- Quantifying the criteria of Good Environmental Status for light pollution under the Marine Strategy Framework Directive.
- Working with stakeholders to understand the social, political and economic barriers to mitigation.
- Reaching out to environmental managers and policy makers around the world with the Global Ocean Artificial Light at Night Network (GOALANN) - www.goalann.org.

KEY RESEARCH FINDINGS

- 22% of the world's coastlines and 2 million km^2 of Exclusive Economic Zones are exposed to light pollution.
- Light pollution from coastal cities enters the marine environment where it can reach 100's of metres down in biologically important quantities.
- These impacts are not confined to coastal cities but can be seen many kilometres offshore.
- Any biological adaptation that utilises light can be impacted by light pollution. This includes the ability of animals to 'see' their environment, to hunt, to hide, communicate, navigate, grow, time important events and reproduce.

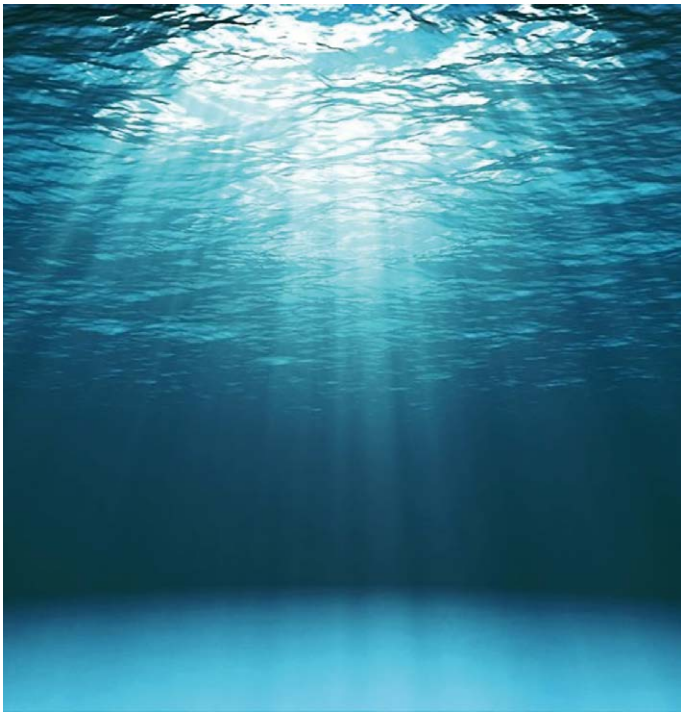




KEY MESSAGES

- Light pollution is emerging as a major global change issue in the 21st century.
- Artificial light emissions into the sea have widespread detrimental impacts on marine ecosystems, yet are completely unregulated by UK policy.
- The implementation of effective policy can reduce the ecological impacts of light pollution and improve the ecosystem service potential of our seas

Light pollution is emerging as a major global change issue in the 21st century.



POLICY IMPLICATIONS

1. During the next UK marine strategy review, make Descriptor 11 inclusive of light pollution by adopting its broader definition under the MSFD 'Introduction of Energy'.
2. Commit to adopting the criteria of Good Environmental Status for light pollution during the next UK Marine Strategy review. We are already developing the methodology for defining these criteria for the EU.
3. Make consideration of light pollution impacts mandatory for offshore planning applications managed by the Marine Management Organisation.
4. Introduce specific reference to 'impacts on coastal marine species' into the guidance for land-based planning applications. They are often overlooked due to the perception that light pollution affects only bats, songbirds and insects.

Our research suggests that long-wavelength (red) light is generally less harmful to marine ecosystems than short-wavelength (blue) light. This is because blue light penetrates seawater to a greater extent and triggers more biological responses in marine species. To minimize ecological impacts, measures such as shielding, dimming, turning off lights, and avoiding harmful wavelengths should be implemented.

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Professor Tim Smyth
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The Research Team: Plymouth is leading the world in marine light pollution research. **Dr Thomas Davies** is a lecturer in marine conservation at the University of Plymouth. He has researched the ecological impacts of artificial light at night for more than a decade, specialising in how marine ecosystems are responding to the changing lightscapes of our oceans. Thomas has worked on several major research projects investigating the impacts of light pollution on the sea and recently co-founded The Global Ocean Artificial Light at Night Network (GOALANN) with **Professor Tim Smyth** at Plymouth Marine Laboratory

Find out more about our researchers and their work: **plymouth.ac.uk/research/parliamentary-evidence-week**