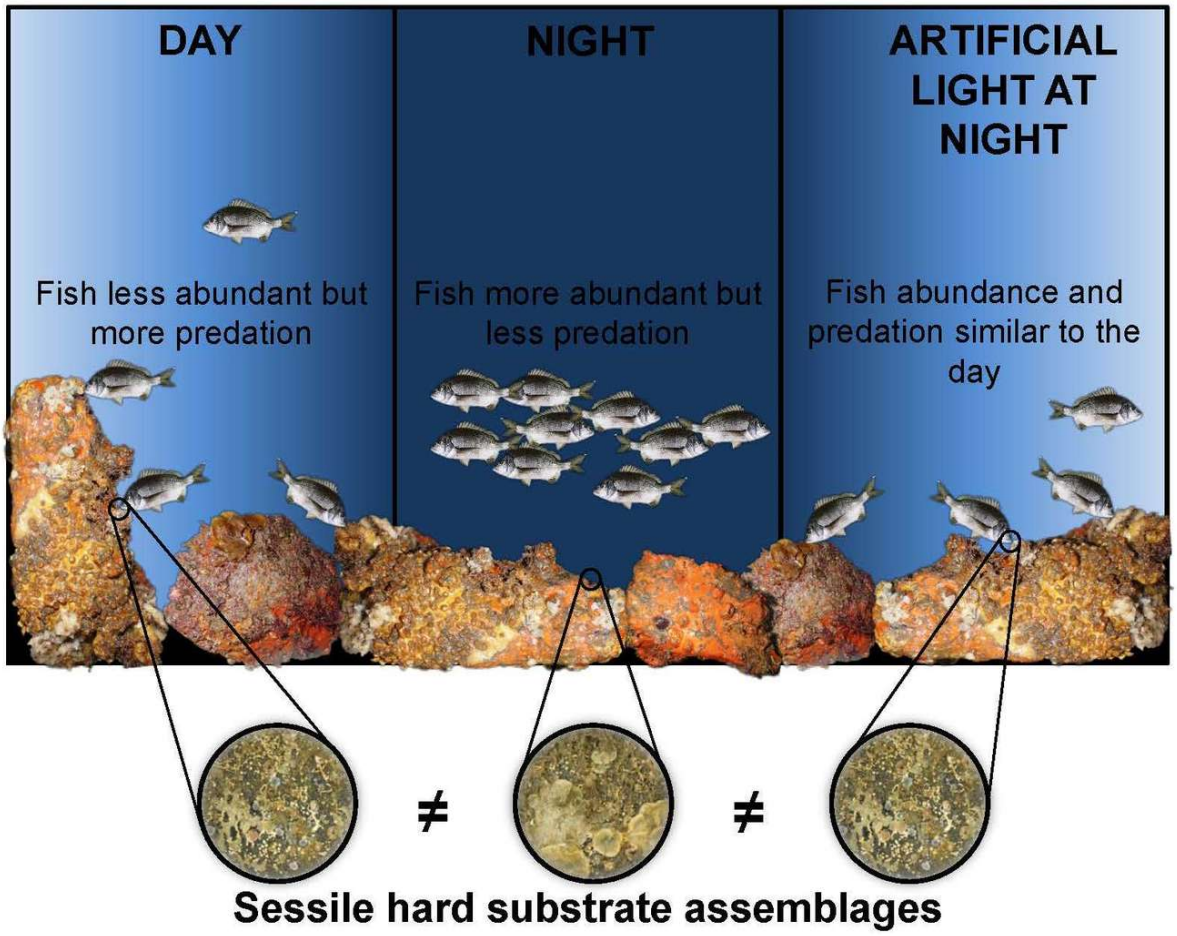
Bright city lights are keeping ocean predators awake and hungry

November 25 2016, by Damon Bolton



Light pollution is changing the day-night cycle of some fish, dramatically affecting their feeding behaviour, according to our recently published study.

In one of the first studies of its kind, we found that increased light levels in marine habitats, associated with large coastal cities, can significantly change predator-prey dynamics.

We used a combination of underwater video and sonar to spy on these communities and record how their behaviour changed. Like us, the animals in our study slowed down at night. Predatory fish became sluggish and had little appetite.

But when the lights went on some of these same predators disappeared, while others feasted on the well-lit underwater buffet. Overall, there was much greater predation on seafloor-dwelling communities when the night waters were lit.

The dark side of light

The dark blanket of night might once have heralded time to rest, but the great pace of human activity has required that nights get shorter and days become artificially longer.

As the sun sets, streetlights flicker to life, generators go into overdrive and the landscape becomes dotted with artificial light, producing some of the most spectacular images from space. The sky glow from major urban centres can be seen more than 300km away.

While this may have enhanced productivity, we are starting to realise that the ecological effects on animals that have evolved under natural day–night cycles are significant.

Artificial lighting of outdoor areas began in earnest in the late 1700s. We have been manipulating lighting regimes for centuries for purposes that include increased egg production in hens and to encourage birds to sing during winter.

However, we have only recently begun to investigate the damaging ecological consequences. We now know that lighting used on offshore energy installations causes increased deaths of migratory birds and beach lighting can cause turtle hatchlings to become disoriented and reduce the chances of a safe journey from nest to sea.

But these are the more obvious impacts of a disrupted day length. More subtle changes in animal behaviours caused by artificial lighting have yet to be illuminated (pun intended!).

Lights, camera, predation

Using LED spotlights, we manipulated the light patterns underneath a wharf in Sydney Harbour, illuminating sessile (attached to the seafloor and wharf) invertebrate prey communities to fish predators. We recorded fish numbers and behaviour under different lighting scenarios (day, night and artificially lit night), and the prey communities were either protected or exposed to predators.

Despite different changes in different species, overall we found that more animals were getting eaten. The main predators were yellowfin bream (*Acanthopagrus australis*) and leatherjackets (Monocanthidae). The prey being consumed included barnacles, bryozoans (encrusting and arborescent), ascidians (solitary and colonial), sponges and bivalves.

Large predators are very important in ecosystems and play a major role in the structure of the whole food chain. If these predators are removed from the system, there are cascading effects and sometimes entire

ecosystems collapse.

So we should expect that changes to the behaviour of predators will have major consequences for prey communities. When we turned on the lights, we found prey communities changed to more closely resemble communities exposed to predation during the day. This increase in predation pressure highlights the effect prey communities face under a brightening future, possibly leading to shifts in prey structure with flow-on effects to ecosystem functioning.

A bright future

About 70% of the world's largest cities are situated on the coast, and there has been a corresponding increase in urban lighting that also illuminates the underwater world.

When coupled with the chemical pollution and increasing noise that our urban activities are introducing into waterways, the outlook is harsh for our marine life.

We are beginning to understand the effects of artificial light on the natural world around us, but there is still a long way to go – especially in the underwater realm. World populations continue to grow and increasing pressure is placed on our coastal fringes to support this growth, so we need to find solutions to reduce our impact wherever we can.

One solution for light pollution is to control the wavelength of light used depending on the location of the lights. LEDs are increasingly being used because they are effective and cheap to run, but they emit a broad spectrum with peaks in blue and green wavelengths, which penetrate to great depths underwater. Moving towards other spectra, such as red which doesn't penetrate as far, could reduce the problem.

Ultimately, while our requirement for artificial light at night is unlikely to diminish, darkness remains a necessary component of many animal's lives. We must do our best to bring back their night.

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Provided by University of New South Wales