Can't Fight the Moonlight

WHO?

A team of researchers led by Te Herenga Waka—Victoria University of Wellington's Professor Jeff Shima.

WHAT ARE THEY INVESTIGATING?

Whether the growth rate of fish larvae is affected by the changes in moonlight during a lunar cycle.

WHY?

Ecology research is faced with what some people call 'The Nocturnal Problem'. The vast majority of ecological research looks at how natural systems behave in daylight hours. This has created a large gap in our understanding of global ecosystems, particularly when it comes to the ocean.

- *Why do you think this is?*
- *What are some major environmental factors that change between day and night?*

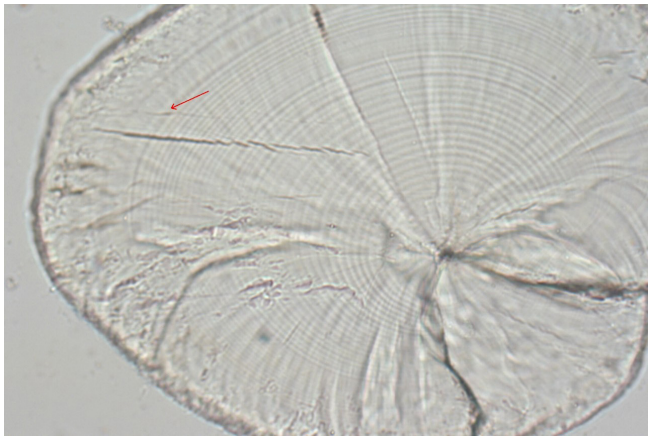
WHY LOOK AT MOONLIGHT?

Many people don't realise that night is when there is the greatest variation in brightness. It can go from pitch black at a new moon, to total illumination during a full moon. As the moon goes through its different phases, the time that it rises and sets also changes. In its first quarter, the moon is already in the sky at sunset and sets at around midnight, leaving the second half of the night in darkness. In its last quarter, the opposite happens: the first half of the night is in darkness while the second half is illuminated.

- *How could this influence ocean ecosystems?*

HOW WAS THE STUDY DESIGNED?

Professor Shima and his team looked at the larvae of sixbar wrasse, a species of reef fish native to Tahiti. After spawning, the fish larvae will spend up to two months in the pelagic zone of the ocean before returning to settle in the reef as adults.



A sixbar wrasse larvae otolith with growth rings indicated.

Over the course of four months, the researchers collected young sixbars that had recently returned to the reef and extracted their otoliths (ear bones). After sawing the tiny bones in half, they were able to observe the growth rings, which allowed them to estimate the date of birth as well as how their daily rate of growth had varied. They then compared the variation in growth to the lunar cycle, as well as nocturnal weather records.

- *Do you think there was a relationship between the phases of the moon and the growth rate of the fish larvae?*
- *If so, what do you think could have caused it?*
- *Why do you think they looked at weather records as well as the lunar cycle?*

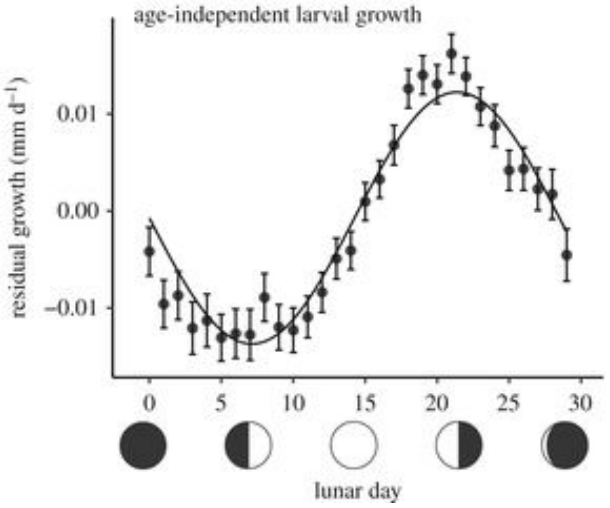
CAPITAL THINKING. GLOBALLY MINDED.
MAI I TE IHO KI TE PAE

Examining the Results

Professor Shima and his team discovered a very clear lunar periodicity in the fish larvae growth.

1. Growth rates peaked during the last quarter moon.
2. Growth rates troughed during the first quarter moon.
3. This relationship was a result of changes in moonlight and not other aspects of the lunar cycle, such as tides.

- *What are some possible explanations for these findings?*



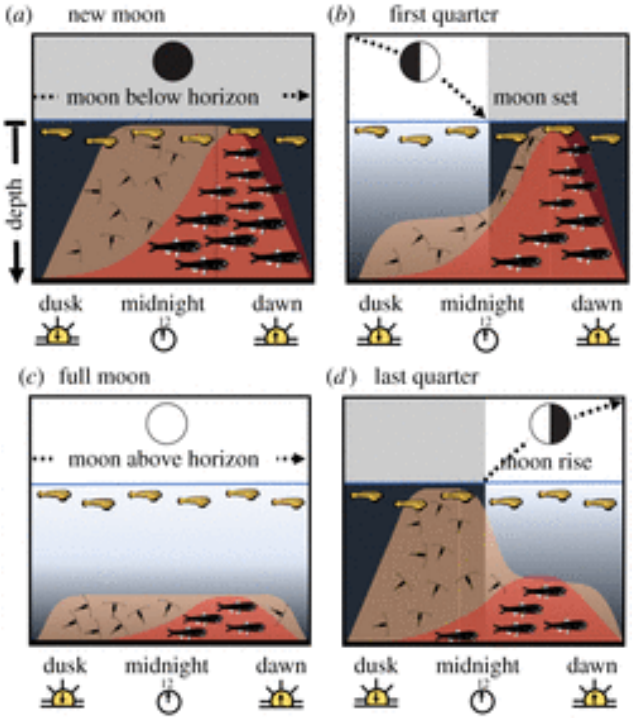
The growth rates of fish larvae mapped to a lunar period of 29.5 days where 0 is the new moon at the start of the lunar month, 15 is the full moon, and 29.5 represents the beginning of the next cycle.

DANGER IN THE DEPTHS

Professor Shima hypothesises that the lunar periodicity in growth rates of larval fish is linked to the effect of moonlight on organisms that have a daily vertical migration from deep waters in the day to surface waters at night — diel vertical migrants. Many of these organisms are zooplankton, a food source for fish larvae. However, as the zooplankton rise to the surface, so too do predators that will happily expand their diet to include fish larvae.

One such group of predators are bristlemouths, small bioluminescent fish that exist in the trillions throughout the world's oceans. These creatures are the world's most common vertebrates, and have been known to form such dense clusters that ship depth sounders have been fooled into thinking they were the sea floor. Bristlemouths have their own predators, so prefer to stay within the cover of darkness. Even a full moon can be bright enough to suppress their movement, as well as the movement of the zooplankton.

Professor Shima thinks that during the last quarter moon, when the night begins in darkness, the zooplankton quickly move to the surface where they can be hunted by larval fish. By the time the bristlemouths and other predators can follow them up, the moon is beginning to rise, bringing its suppressing light. This is the optimal time of the lunar cycle for fish larvae to feed and grow.



- *Design an experiment to test Professor Shima's hypothesis*
- *What impact do you think this discovery could have on fish conservation or fisheries management?*