Space

Ocean worlds may teem with life

Planets only slightly different to ours could host more marine organisms than Earth

Leah Crane

EARTH is well-stocked with life, but it might not be the best possible cradle for it. Ocean dynamics are crucial to living things here, and it seems that slightly different conditions would allow aquatic life to be even more widespread and healthy. This insight might help us find such worlds and search for life there.

On Earth, life in the ocean faces a tension between the availability of sunlight and of nutrients. Most organisms are concentrated fairly near the surface, where they can photosynthesise. But living things also need minerals such as phosphorus, and these tend to sink to the sea floor. Life depends on these chemicals being buoyed to the surface by a process called upwelling.

"Photosynthetic life must live at the surface where there is light, but gravity is always going to act to accumulate nutrients at the bottom of the ocean," says Stephanie Olson at the University of Chicago. "If you look at life in Earth's oceans today, it is overwhelmingly concentrated in areas of upwelling for that reason."

Upwelling occurs primarily because the wind pushes around the surface water. Deeper water then flows upwards to fill the gaps. Olson and her colleagues have simulated a series of worlds that are slightly different to Earth to figure out how various planetary characteristics could affect upwelling and other facets of ocean circulation (arxiv.org/abs/1909.02928).

The team found that upwelling raised the most nutrients on a planet not quite like our own. "Earth is not the sweet spot – life on other planets could be even more productive than it is here," says Jennifer Macalady at Pennsylvania State University. "It would look greener and slimier and more seaweedy."

The most sea-life-friendly planet would be slightly larger than Earth, with continents and a salty ocean like ours. It should also be rotating slower than Earth and have a spin that doesn't quite align with its orbit so it has strong seasons, changing the way the seas circulate throughout the year.

Because the wind is so important to upwelling, the atmosphere is also critical. An ideal planet for ocean life would have a thick atmosphere and high surface pressure, which would allow a strong wind that would prompt more upwelling.

The more photosynthetic marine organisms there are on a planet, the easier that life will be to detect, says Olson. That is because this sort of life pumps oxygen into the atmosphere. An oxygen-rich atmosphere is a strong hint of life. This doesn't account for anything living at the bottom of a sea or on land, but those have signatures that are harder to detect from afar.

Most of the properties of planets that Olson's team simulated would be detectable with planned telescopes, says Macalady. So we could look specifically for planets with thick atmospheres and slow spins.

This kind of thinking might help us distinguish between planets that are merely habitable, and those that have detectable life, says Macalady. ▮

Astronauts in the film *Interstellar* find themselves on an ocean world

PARAMOUNT PICTURES

Nutrition

Avoiding red meat doesn't seem to give any health benefits

THERE are no health reasons to cut down on eating red or processed meat, according to a new review of the evidence.

Numerous health bodies have said for decades that we should limit our intake of red meat because it is high in saturated fat, thought to raise cholesterol levels and cause heart attacks. More recently, both red and processed meat have been linked with cancer.

However, most research in this area is of a type that is thought to be unreliable, as it simply observes what people choose to eat.

The best research involves randomised trials in which some people are helped to change their diet in a certain way, such as eating less meat, and the rest aren't, with their health compared at the end. Such trials are rarer because they are costly and hard to run.

Bradley Johnston of Dalhousie University in Canada and his colleagues reviewed the 12 randomised trials that have been done in this area, and found little or no health benefit for people who cut down on eating these meats.

The authors conclude that people should "continue to eat their current levels of red and processed meat unless they felt inclined to change them themselves".

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However, they add that some might want to change their diet for animal welfare or environmental reasons (*Annals of Internal Medicine*, doi.org/db52).

Duane Mellor at the British Dietetic Association says people shouldn't take the advice as a green light to eat more red meat. "What it doesn't say is that we can tear up the guidelines and start eating twice as much meat. But red meat three times a week is not a problem." ▮

Clare Wilson