— followed by the United Kingdom and Germany in second and third place. Less than 2% of reviewers were in developing nations.

Of the full submissions, the study found that 1,549 (22%) had a female last author — a position that indicates seniority — and 5,127 had a male last author. About 53% of manuscripts with male last authors were accepted, compared with around 50% of those with female last authors.

Fifty-seven per cent of fully submitted papers with a male last author were accepted when the review panel was all male (see 'Peer-review patterns'), whereas mixed-gender teams accepted 51% of male-last-author papers. And submissions that had been edited or reviewed by someone in the same country as the corresponding author were more likely to be accepted than those with a country mismatch.

The trends are likely to be a result of implicit biases, says study co-author Cassidy Sugimoto, an information scientist at Indiana University Bloomington. The study did not seek to reveal how the disparities arose, say the authors. But because the gender make-up of senior authors and gatekeepers closely matches disparities found broadly in science, there is no evidence that *eLife* is making such disparities worse.

The research was prompted by *eLife*, which approached Sugimoto and her colleagues with the data; two study authors are *eLife* employees. The journal's reviewing process is unorthodox in that referees know each other's identities, which allows them to discuss any differences of opinion on manuscripts.

BODY OF EVIDENCE

The study is robust, says Jevin West, an information scientist at the University of Washington in Seattle. And it is concerning that women and authors in developing countries seem to be marginalized in peer review, he says. "It's very important that we have diverse voices represented and that those voices are treated equitably."

"It's important that we have diverse voices represented and that those voices are treated equitably."

The results echo previous findings about peer review. This month, a global survey by Publons — a site that allows academics to record their peer-review activity — found that researchers in developing countries are under-represented as reviewers, yet are more likely than scientists in richer countries to accept review requests, and complete reviews faster.

And last year, an analysis of American Geophysical Union (AGU) journals found that women are invited to review less often than expected, but that the editors' gender has no influence on acceptance rates (J. Lerback and B. Hanson *Nature* **541**, 455–457; 2017).

Sugimoto says that journal policies should aim to ensure diversity on review panels, for example, by inviting a greater proportion of women and researchers in developing nations to do reviews. "This is one of the simplest policy changes we can make," she says, "without high risks, and potentially high benefits."

Andrew Collings, *eLife*'s executive editor and a study co-author who is based in Cambridge, UK, says that the team is communicating its results to the editorial board, so that editors can consider the findings as they assess submissions and select reviewers. "We are particularly keen to see editors using diverse groups of reviewers whenever possible."

To weed out the effect of implicit biases on acceptance rates, it is tempting to see blinding as a solution, West says. But, he adds, double-blind peer review — in which neither authors nor reviewers know each others' identities — often works poorly, because some fields are so small that reviewers can guess who wrote a paper.

Sugimoto says that more data are needed to determine the effectiveness of techniques such as blinding or open peer review, in which reviews are published and authors and reviewers might know each other's identities.

She hopes that more journals and publishers will release data on peer review for analysis. "Then, we can inform it with evidence rather than with anecdote." ■

ECOLOGY

Hidden lives of deep-sea animals

Cameras record behaviours long cloaked in darkness.

BY AMY MAXMEN

Advances in video cameras and low-light sensors are revealing animal behaviours in the deep sea that researchers have never recorded before.

The behaviours include a worm-like predator shooting off rings of blue light, and an animal anchored to the sea floor sending flashes of light dancing along its body, creating the illusion of a tiny creature swimming upwards.

Steven Haddock, a marine biologist at the Monterey Bay Aquarium Research Institute (MBARI) in California, showcased videos of these phenomena and more for the first time on 13 September at the Deep Sea Biology Symposium in Monterey. He is one of a handful of researchers around the world who are using extremely high-resolution cameras and ultra-sensitive sensors to capture unprecedented footage of marine organisms in the wild.

"We can see natural behaviour in a way that we've never been able to before," says Haddock.

COMING INTO FOCUS

Until recently, researchers needed to use bright lights to capture footage of animals living in the deep dark ocean. The lights scared many creatures away, and when scientists tried filming under low-light conditions, poor camera resolution made it difficult to pick out fine details such as a small ring of light.

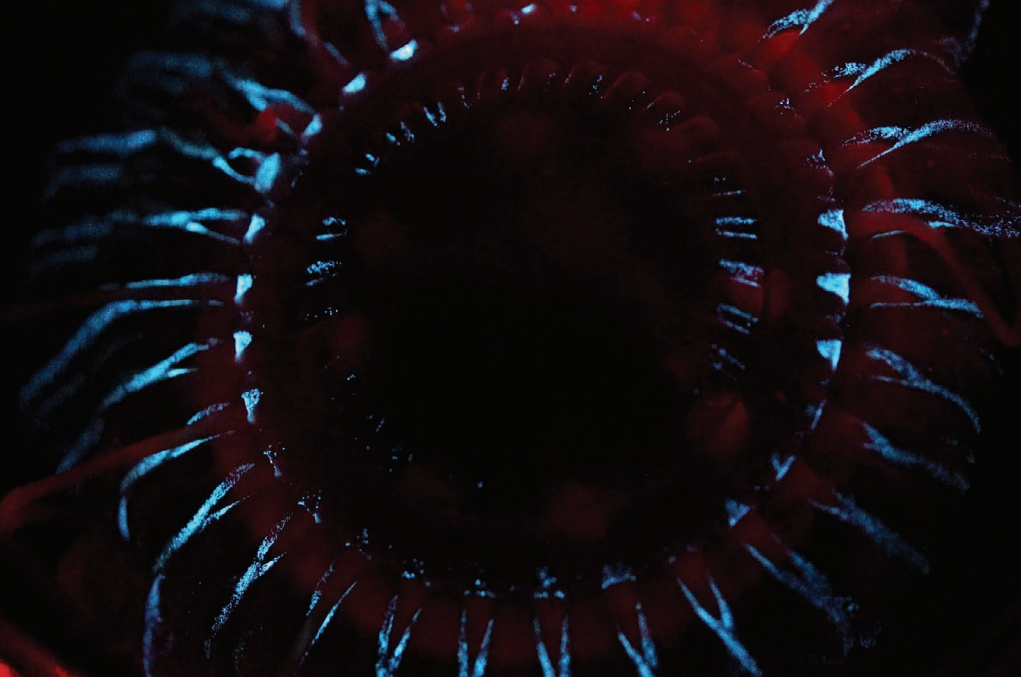
In 2016, Haddock's team attached a 4K camera, which has four times as many pixels per image as a high-definition (HD) camera, to one of MBARI's remotely operated vehicles (ROVs). On one of Haddock's first voyages with the camera, he recorded a 2.5-centimetre-long animal called an arrow worm emitting a trail of doughnut-shaped rings of blue light. Haddock speculates that the creature uses the display to distract predators as it escapes. "Our HD camera wouldn't have captured this at all," he says.

In mid-August, another research team deployed an 8K camera in the deep sea for the first time to explore hydrothermal vents in the Okinawa Trough near Japan. The 8K camera's resolution nearly matches that of the human eye, and it enabled Dhugal Lindsay, a marine biologist at the Japan Agency for Marine-Earth Science and Technology in Yokosuka, to film near-microscopic plankton in enough detail to identify their species.

SEEING IN THE DARK

Other marine biologists are fine-tuning the latest low-light camera sensors that also reduce noise from scattered, indirect light. This allows researchers to use a lot less illumination to record ocean life, decreasing the chances of their ROVs scaring off animals.

The sensors also allow scientists to pick up phenomena such as bioluminescence — the production of light by an organism — and to



Dim red light illuminates a bioluminescent display by an *Atolla* jellyfish.

HADDOCK/MBARI

identify the animals giving off the light show.

"I can't tell you how many times I've seen bioluminescence in the dark and said, 'hey, that was cool, but I have no idea what it is'," says Brennan Phillips, an oceanographer at the University of Rhode Island in Narragansett.

A few years ago, Phillips recorded an as-yet unidentified species of *Tomopteris*, a marine worm that looks like a centipede, using cameras fitted with advanced low-light sensors. He was able to capture footage of light glowing in the animal's central nervous system and then radiating into each of its legs.

And on a trip off the coast of Mexico in May, Phillips and other researchers used another new, specialized sensor to record an elusive 68-centimetre-long jellyfish called *Deepstaria enigmatica* (D. F. Gruber *et al. Am. Mus. Novit.* No. 3900; 2018). This jellyfish lacks tentacles, and researchers had long wondered how it captured its prey. The detailed footage showed how the invertebrate moved, which enabled scientists to deduce that the animal 'bags' its meal using the thin, membrane-like sac of its body.

Roughly three-quarters of marine organisms, excluding microscopic species and those that live on the sea floor, produce light. But researchers are only beginning to learn how the creatures use this ability to communicate, to attract mates or prey, or to defend themselves, says Haddock.

The footage that he and others are collecting shows animals acting in ways scientists have never before recorded, prompting more questions than answers. "We are going deeper than 'gee-whiz'," Haddock says. ■

TECHNOLOGY

Harpoon-throwing satellite takes aim at space junk

Tests of experimental craft include flinging a net and shooting a spear at targets in space.

BY ALEXANDRA WITZE

In a move Spiderman might envy, one satellite flung a net at another craft in low Earth orbit on 16 September. A few months from now, the satellite will ape the spear-wielding Aquaman and fire a harpoon into space.

The manoeuvres will test ideas meant to address the growing problem of space junk. If they work, future missions might use similar nets or harpoons to ensnare dangerous space debris and drag it to a fiery end in Earth's atmosphere.

"This is proof of concept of a new technology," says Guglielmo Aglietti, director of the Surrey Space Centre at the University of Surrey in Guildford, UK, and principal investigator for the project, known as RemoveDEBRIS. "The idea is to be really useful and clean up satellite space."

The US military tracks approximately 20,000 objects in orbit that measure at least 5–10 centimetres across. That's big enough to cause serious damage if two objects collide, and the threat is growing as more junk builds up in space. In 2009, a US communications satellite accidentally smashed into a Russian one — creating thousands of shards that now hurtle through low Earth orbit, raising the threat of future collisions.

Now researchers are dreaming up ways to clean up some of this orbital junk. Last year, the Japan Aerospace Exploration Agency tried to unfurl an electrodynamic tether and hook it on to a piece of space debris; the mission failed when the tether did not release as expected. A team spun off from the Swiss Federal Institute of Technology in Lausanne (EPFL) is raising money to build a satellite that would throw a conical net around a defunct craft and steer it to its doom. And the European Space Agency (ESA) is working on ideas for a more complex spacecraft that could dispose of space junk or perhaps even refuel a satellite in orbit, extending its life, says Luisa Innocenti, head of ESA's Clean Space initiative in Paris.

"There will always be a tension between letting debris stay as it is or going to clean up some of it."

TAKING OUT THE TRASH

The €15-million (US$17-million) RemoveDEBRIS mission is meant to test cheap ways to drag junk out of orbit. "There will always be a tension between letting debris stay as it is or going to clean up some of it," says Aglietti. But if a space agency could remove particularly big and dangerous pieces of debris — such as ESA's defunct, bus-sized Envisat Earth-observing satellite — it might be worth the effort.

RemoveDEBRIS will test four technologies over a carefully choreographed few months. The spacecraft launched to the International Space Station in April and deployed into space in June. The first test, the net experiment, took place on 16 September (see 'Ready, aim … fire').

The craft ejected a CubeSat, a satellite about the size of a loaf of bread, which inflated a balloon to a diameter of roughly 1 metre — big enough to be worth grappling with. RemoveDEBRIS then hurled its net around the ▶