Feature

Fantastic species and where to find them

Fantastic beasts are not only found in the imaginary worlds of authors like J.K. Rowling. The oceans are full of them. Michael Gross rounds up some unusual suspects.

In the fictional textbook of ‘magizoology’, Fantastic Beasts and Where to Find Them, magizoologist Newt Scamander covers 85 magical species from Acromantula to Yeti, including various kinds of dragons, unicorns and werewolves. Originally mentioned as a school text in the Harry Potter series, the fictional book took on a real life of its own when J.K. Rowling published it as a charity stunt in 2001, which eventually led to the release of the eponymous feature film in 2016.

Many of these imaginary creatures are based on ancient myths and legends, often only one step removed from the actual zoology of the real world. Thus, the tusks that over centuries helped to feed the myths around unicorns came from narwhals, while fossilised remains of various extinct megafauna may have inspired legends of dragons and other magic beasts.

Large parts of the ancient myths can be interpreted as the consequence of incomplete zoological knowledge. When white spots on the map were inscribed “here be dragons”, the gaps in humanity’s knowledge were filled in using pure imagination, creating unicorns on the basis of tusks alone.

Back in the real world, as scientists progress to discover and describe more and more of the species that were once hidden in the depths of the oceans or in impenetrable jungles, the sense of awe and wonder inspired by the ancient myths and their modern CGI-enhanced reincarnations could equally well be fed by the exploration of real zoology. The oceans, for instance, are full of fantastic beasts — one only has to figure out where to find them.

The last unicorn

Legends were right in that the fantastically straight, spiralled tusks belonged to a single-horned mammalian species. They only got the shape slightly wrong, as the animal behind the impressive spear is not of the elegant equine sort but a rather plump-looking whale.

Living in the Arctic oceans, the narwhal (Monodon monoceros) can work its own kind of magic. It produces ultrasound clicking, which it uses for echolocation. As Jens Koblitz from the Bioacoustic Network in Neuss, Germany, and colleagues recently established with acoustic measurements in Baffin Bay, West Greenland, the narwhal’s sonar is the most strongly focused sound beam produced by any species investigated so far (PLoS ONE (2016) 11, e0162069).

Until now, narwhals have been able to live in the Arctic oceans relatively undisturbed, following their seasonal migration patterns, typically spending the summer in the high Arctic waters and congregating on winter feeding grounds in Baffin Bay, where deep waters allow them to feed at around 1,500 metres below the surface. The sea floor below the area acts as an acoustic bowl making it particularly suitable for ultrasound navigation and prey detection.

Considering the dramatic loss of sea ice in the Arctic due to climate change, which is already leading to increased commercial interest in the area for tourism, new shipping routes, and resource extraction (Curr. Biol. (2012) 22, R547–R550), there is the danger that cetaceans like the narwhal may suffer the impact of increased shipping traffic, as the noise pollution from ships may interfere with their acoustic navigation system.

This was part of the motivation of the detailed investigation by Koblitz and colleagues into the current, still undisturbed sonar use of narwhals. It is of crucial importance as a baseline for future studies aiming to detect how the anticipated increase in shipping in Arctic waters and through the Northwest Passage will affect the natural behaviour and hunting success of the narwhal. All too soon, such basic understanding could become essential in efforts to save the species — after all, we don’t want these very real animals to become the stuff of myth and legends like the unicorns.

Here be dragons

While the dragons in old tales tend to be large and terrifying, with their indomitable fighting spirit and the scientifically unexplained ability to spout fire, the real world seadragons are comparatively small and harmless. Two species of seadragon have long been known to scuba divers exploring coral reefs off the southern and western coasts of Australia, namely...
the common seadragon (*Phyllopteryx taeniolatus*) and the more elaborately camouflaged leafy seadragon (*Phycodurus eques*), which grow to adult lengths of up to 45 centimetres and 24 centimetres, respectively. With their eccentric shapes (for a fish) and plant-like appendages, they look like they might have sprung up from the imagination of some writer of fantastic fiction, but they are in fact very real and easy enough to find. Both are listed as ‘near threatened’ in the IUCN’s Red List.

Only recently did Greg Rouse and colleagues from the Scripps Institute of Oceanography at La Jolla, USA, identify a third related species, the ruby seadragon, *Phyllopteryx dewysea*. In 2015, the authors had described the species based on four museum specimens. Now they report the first video observation of the species at a depth of 54 metres (Marine Biodiversity Records (2017) 10, http://dx.doi.org/10.1186/s41200-016-0102-x). This is out of range for recreational scuba diving, explaining why the species hasn’t been reported before.

Reflecting the less leafy nature of its habitat, the ruby seadragon has no appendages for camouflage but appears to rely on its red hue making it less visible in the poor light of the ocean’s twilight zone. Another intriguing feature of the new dragon species is its prehensile tail, which the other two species lack. With it, the animals can anchor themselves against strong currents, which may explain why the ruby seadragon doesn’t wash up on beaches as frequently as its relatives. Whether the ruby seadragon kept or re-acquired this feature also seen in other species of the syngnathidae family (pipingfishe, seahorses and seadragons) remains to be established.

Incidentally, the prehensile tail is also found in the similarly eccentric-looking seahorses, which also feature a whole range of other morphological traits not usually found in fish, including an elongated snout made of fused jaws with a small terminal mouth, bony plates instead of scales, fins in unusual places, and the famous brood pouch in which the male incubates the spawn.

A recent genome study of the tiger tail seahorse (*Hippocampus comes*) showed that the magic of the seahorses can in part be explained by an unusually rapid rate of evolutionary change (Nature (2016) 540, 395–399).

**Colourful diversity**

One of the most intriguing aspects of biodiversity in the oceans is the dramatic display of colour, not only in tropical fish appreciated by aquarium lovers but also in invertebrates such as the jellyfish and nudibranchs (sea slugs). The vast diversity of species-specific colours and patterns among these species dramatically visualises the marine biodiversity of which we are only beginning to appreciate a small fraction.

For instance, in a recent survey of jellyfish found around the coasts of South America, Antonio Carlos Marques from the University of São Paulo, Brazil, compiled 958 morphological types, of which 800 were identified as species. The study included both the phylum of Ctenophora (comb jellies) and the sub-phylum Medusozoa from the Cnidaria phylum. Medusozoa have a life cycle that includes a jellyfish-like phase, while other members of the cnidaria, which were not included in the study, don’t (Zootaxa (2016), 4194, http://dx.doi.org/10.11646/zootaxa.4194.1.1).

Apart from their colourful and translucent beauty, the jellyfish impressed researchers with their wide range of sizes, from one millimetre to one metre. While most are harmless to humans, as long as they are not disturbed, some produce powerful toxins that can become fatal. Results of the census are now compiled in an interactive database to which researchers will continue to add new finds.

Similarly, the nudibranchs, named after their peculiar exposed gills, are expanding in colourful variety each time researchers dive in the oceans to look for more. They are found around the globe in a wide range of habitats, from the intertidal zones to depths beyond 2,000 metres. Many species have been described off the coasts of California, but in a recent excursion to the Philippines the group of Terry Gosliner from the California Academy of Sciences could identify over 40 new species adding further colour to the palette.

**Unusual but useful**

For many researchers, the very existence — and the current threats...
Colourful crustacean: The genome of the marine crustacean Parhyale hawaiensis has given insights into mechanisms of limb regeneration and of the degradation of lignocellulose, the indigestible fibre material of wood. (Image: Anastasios Pavlopoulos and Igor Siwanowicz from HHMI Janelia Research Campus, published under https://creativecommons.org/licenses/by/4.0.)

Patrick Keeling

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What drew you to your specific field of research? I think many of us do a random walk to the field where we work for the rest of our lives. In my case, in second year university I became excited by molecular biology — the idea that we could possibly know so much about how complex machines like the ribosome function at the molecular level. I wanted to learn more about this, so I signed up for courses in “microbiology”, thinking “these things are really small, that must be microbiology, right?” A month or so into this it finally dawned on me what I had done, but in the meantime I realized microbiology was also pretty interesting. My first job was in a structural microbiology lab (Susan Koval) and she indulged my interest in DNA, but there I also learned to appreciate the microscope and cells.

If you had to choose a different field of biology, what would it be? I have always thought that ‘developmental microbiology’ would be fascinating, but it hardly exists as a field. There have been some great experiments over the years, but it’s not really unified or at the point of working out general principles. There are some big questions about how to accurately develop complex, asymmetrical, sub-cellular structures