Sea noise adventures

November 29 2010

Dr. Steve Simpson taking a recording of a reef in Southern Oman. Image by Jen McIlwain

In 1953, Captain Jacques-Yves Cousteau published his groundbreaking book *The Silent World*, which has since sold five million copies and captured the imagination of generations of armchair adventurers. While breathtaking in its pioneering approach and imagery, it fell short on one minor detail: the underwater world is anything but silent.

Dr. Steve Simpson in the School of Biological Sciences, currently working on the effects of climate change on fish and fisheries, has spent much of the past decade studying the natural sounds produced by fish, shrimps and urchins on coral reefs.

"Coral reefs produce truly amazing soundscapes," he says. "Snapping shrimps generate a constant crackling sound – which mariners often liken to that of frying bacon – that vibrates through the hull of a boat when anchored near to reefs. On top of this, fish talk to each other with a whole array of pops, grunts and chirps, and urchins scrape away at the reef to feed. Taken together, this sound is immense, and can be detected using a hydrophone (underwater microphone) from kilometres away."

During his PhD, Simpson realised that the models of dispersal of coral reef fish used to test fisheries management strategies lacked some basic biology. Coral reef fish undergo an early phase of their life in the open ocean, away from the predators on the reef, where they develop from eggs to fully functioning larvae. During this period, which can last from weeks to months, fish may be dispersed up to thousands of kilometres, although amazingly, many return to the reef on which they were originally spawned. The models of the time failed to capture any of this.

Through a series of experiments, Simpson has found that reef fish larvae are highly attracted to the reef noises at the time they are ready to seek adult habitat. "We started by making recordings of reefs and playing them back around traps,' he explains. We caught more than twice as many larvae in the noisy traps as we did in traps where we played no recordings. Then we built artificial reefs and used recordings to attract larvae to recruit to these new sites."

This work was published in *Science* in 2005, and is now being used in the Philippines and French Polynesia as part of trials for managing fish populations.

Noisy damselfish on a reef in Hoga, Sulawesi. Image by Steve Simpson

More recently, Simpson and his students have turned their focus to variations in reef noise in different locations. He explains: "Since reef noise is produced by the animals that reside there, it offers fish, and marine biologists, an opportunity to eavesdrop on the community. The fish can use it to select the best habitat to live in; for biologists and fisheries managers it provides a totally new tool for monitoring the health of the community."

In a study published this year in the *Journal of Experimental Marine Biology* and *Ecology*, Simpson and his team found that 'noisier' reefs in Panama had more fish and greater proportions of live coral than 'quieter' ones in the same region. This autumn, a recent Bristol Masters graduate, Sophie Holles, is building on this research by cruising around French Polynesia recording reefs and surveying fish communities and habitat.

Fish have a highly specialised auditory system, so perhaps it's not so surprising that larval coral reef fish use these sensitive hearing capabilities to exploit a reef's rich acoustic cues and steer towards habitat from the open ocean. In contrast, the larvae of corals appear to be little more than a bag of cells, developing for a few days in open water before hoping to land on a hard spot to start building their skeleton and, ultimately, a colony. But recent work by Simpson and his collaborators in Curaçao (published in the interactive open-access journal PLoS ONE) shows that coral larvae are also attracted by reef noise.

"At first I thought that playing sounds to coral larvae was crazy," says Simpson, "but it soon became clear that these simple animals were moving towards the noise." Simpson is now developing methods with a bioacoustician (Dr. Marc Holderied), an animal behaviorist (Dr. Andy Radford) and a nanoscientist (Professor Daniel Robert), all in the School of Biological Sciences, to use lasers to measure the vibrations of tiny hair cells on the surface of the coral larva in response to sound. As Simpson explains: "We have hair cells inside our ears; coral larvae have them on their outer surface. It is possible that coral larvae are actually inside-out ears, swimming around looking for a good spot to land."

Omani clownfish. Image by Steve Simpson

Unfortunately the underwater acoustic world is now a very different place to that of a century ago. Man-made (or anthropogenic) noise pollution is currently doubling every decade, and a low-frequency hum from shipping can be detected in every ocean. Additionally, the noise of pile-driving and operational turbines from offshore windfarms has caught the attention of policy-makers and conservationists, and the pulses from seismic airguns – used in the search for oil – and naval sonar activities have been implicated in mass strandings of whales and dolphins. In a further study published this year in *Behavioral Ecology*, Simpson showed that the larvae of coral reef fish, when exposed to man-made noise for a few hours, can later become attracted to it. 'This would be bad news for fish,' he points out, 'if they follow ships out of harbours or try to set up home in industrial areas rich in noise but poor in natural resources.'

In collaboration with Drs Radford and Holderied in the School of Biological Sciences, and with funding from Defra, Simpson is now investigating the chronic effects of anthropogenic noise on UK marine animals. He explains: 'By combining hearing studies and behavioural experiments with measurements and models of soundscapes, we hope to estimate the distances over which animals are affected. This will help policy-makers determine how best to mitigate the effects of noisy activities in UK waters, and hopefully ensure a productive, healthy, and very naturally noisy future for the marine environment.'

Provided by University of Bristol

Citation: Sea noise adventures (2010, November 29) retrieved 11 September 2024 from https://phys.org/news/2010-11-sea-noise-adventures.html