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ECR SPOTLIGHT

ECR Spotlight – Carolin Nieder

ECR Spotlight is a series of interviews with early-career authors from a selection of papers published in Journal of Experimental Biology and aims to promote not only the diversity of early-career researchers (ECRs) working in experimental biology during our centenary year, but also the huge variety of animals and physiological systems that are essential for the 'comparative' approach. Carolin Nieder is an author on 'Comparison of auditory evoked potential thresholds in three shark species' and 'Comparison of acoustic particle acceleration detection capabilities in three shark species', published in JEB. Carolin conducted the research described in these articles while a PhD student in Craig Radford and Andrew Jeff's lab at Institute of Marine Science, University of Auckland. She investigates the sensory and behavioural ecology of marine animals, with a particular passion for the perception of underwater sound.

Describe your scientific journey and your current research focus

I graduated with my master's degree in biology from the University of Freiburg, Germany in 2013, with a major in neurobiology and biophysics, and minors in marine biology and genetics. After that I spent five years working as a research assistant at the Smithsonian Tropical Research Institute in Panama and at Taichung University in Taiwan, where I focused on coral reef macroalgae ecology and fish behaviour. I was fortunate to receive a doctoral scholarship in 2018 to do my PhD degree at the University of Auckland, where I discovered the fascinating topic of hearing in sharks.

How would you explain the main finding of your papers to a member of the public?

The papers show that sharks differ in their hearing capabilities, mainly with respect to bandwidth, where some species possess very narrow hearing ranges (restricted frequencies <300 Hz), while others can hear slightly higher frequencies of up to 800 Hz. The reason why some sharks have broader hearing ranges compared to others deserves further research.

What are the potential implications of this finding for your field of research, and is there anything that you learned during this study that you wish you had known sooner?

Audiometric baseline data, in this case for sharks, could be used to model potential impacts of anthropogenic noise on a species listening space. I hope that more species will be investigated to understand how different species of sharks have exploited the low frequency sound spectrum. One thing that I learned is to start experiments very simple first. Once that is working, you can then add to the complexity of the experimental design. What I thought of as simple was often already very complex.

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Carolin Nieder

Which part of this research project was the most rewarding/challenging?

The Covid-19 pandemic was the most challenging part of my PhD as big parts of my research experiments got cancelled after we had already put months of work and resources into it. But luckily, I got enough data in the end in order to graduate. The most rewarding part was right at the end while writing it all up and seeing it all come together.

Are there any important historical papers from your field that have been published in JEB?

There are many important historical papers from the field of fish hearing that have been published in JEB. One example is Chapman and Johnstone's seminal paper 'Some Auditory Discrimination Experiments on Marine Fish' from 1974 (doi:10.1242/jeb.61.2.521), which showed that fish can discriminate between sounds from different directions and that helped pave the way towards our understanding on how fish localize sound.

Are there any modern-day JEB papers that you think will be the classic papers of 2123?

My favourite modern-day JEB paper from the field of sound localization in fish is 'Local acoustic particle motion guides

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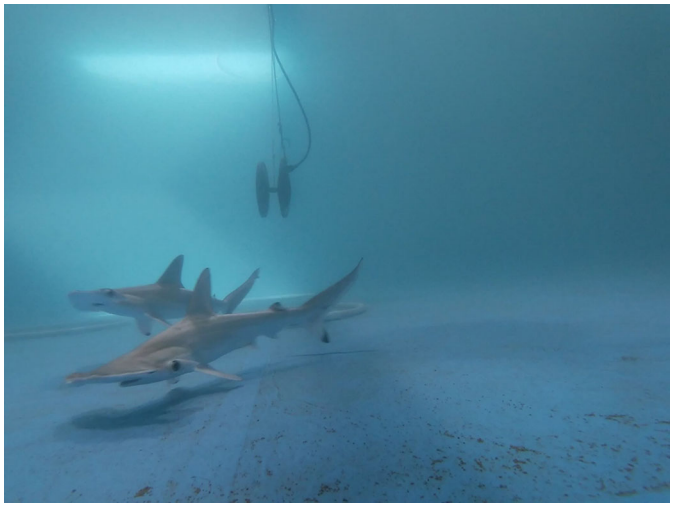

Two scalloped hammerhead pups (*Sphyrna lewini*) caught on camera just after fetching their squid rewards underneath the sounding underwater speaker during my behavioural conditioning experiment at the Hawaii Institute of Marine Biology (HIMB).

sound-source localization behavior in the plainfin midshipman fish' by Zeddies et al. (2012) (doi:10.1242/jeb.064998), where the authors take advantage of the phonotaxis behaviour of gravid midshipman fish females to test potential underlying sound localization mechanisms. One day, I would like to design a similar experiment with an elasmobranch species. Although this will likely involve operant conditioning.

If you had unlimited funding, what question in your research field would you most like to address?

I would like to run a series of behavioural experiments with free swimming sharks and rays in a semi-wild environment to test their sound localization capabilities as well as their far-field hearing abilities.

What changes do you think could improve the lives of early-career researchers, and what would make you want to continue in a research career?

I hope that in the future early career researchers can benefit from more financial security in their early career jobs. Often very short contracts, and the expectation to move frequently, while exciting at first, makes it harder for young researchers to find stability. I also would like to see more opportunities for women with children and families to reach higher academic positions that allow for a more balanced work–life–family routine.

What's next for you?

I recently defended my PhD at the University of Auckland and am now looking to find an exciting postdoc opportunity in animal sensory ecology and behaviour.

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