ZOOPLANKTON ECOLOGIST

DR SVENJA HALFTER

Dr Svenja Halfter is a pākeha zooplankton ecologist with the National Institute of Water and Atmospheric Research (NIWA) who focusses on how Antarctic zooplankton communities impact the drawdown of carbon in the ocean. In this article, she shares her journey and passion for zooplankton with NZASE science communicator, Heather Goodey.

BACKGROUND

Svenja was born in Germany in 1993, where she attended high school. “School in Germany is a similar system to New Zealand. In middle school everybody took all the sciences, there wasn’t a choice. In the last three years, I chose biology and history as my focus subjects.”

INTRODUCTION TO SCIENCE

“When I finished school, I had a choice between the sciences. I chose biology because I could do a diverse range of things. As well as studying biology, you’re also studying physics and math and chemistry and a bit of geology. You need all this background knowledge to understand why species are somewhere. There’s a lot of stuff you need to know to understand ecology. I really like that connection.”

TOP PHOTO: Credit Laura Bassi.

TRAINING AND ROLES

After completing her biological sciences undergraduate degree at the University of Rostock in Germany, Svenja spent an exchange semester in Norway and took a course in Greenland studying the Arctic for her M.Sc. in Marine Biology. She then completed a Ph.D. in Marine Sciences in Tasmania, Australia, focusing on Subantarctic zooplankton. “It is a very understudied area because no one really wants to spend all their time bouncing around on a ship in the Southern Ocean,” she says.

SCIENCE FIELDS

Svenja studies zooplankton ecology. Ecologists study how animals, plants, and their environment interact. Zooplankton, tiny water drifting animals (2 µm–20 mm), include small crustaceans like krill, copepods, crab and lobster larvae, swimming snails, jellyfish, and juvenile fish. Zooplankton ecologists explore their diverse interactions and how environmental changes impact them.

Svenja with pyrosomes (Subantarctic Southern Ocean).

RESEARCH EXAMPLES

Svenja's research focuses on how climate change alters zooplankton communities and its impact on the drawdown of carbon in the ocean (carbon cycle). All living things contain carbon—algae, zooplankton, penguins, whales and humans. When algae and zooplankton sink or migrate deeper, they transport carbon deeper into the ocean. Understanding zooplankton communities is key to assessing climate change's impact on the ocean's carbon sink. In the Subantarctic Ocean, there is generally a downwelling of water masses that stores carbon longer than in other oceans.

EXPLORATION METHODS

Svenja is lucky to do fieldwork, recently returning from camping on Antarctic ice. To track zooplankton changes over time, she conducts long-term monitoring. "We collect samples from sites like the Ross Ice Shelf or from a boat in the Southern Ocean. We collect samples many times over a long period (years) to understand what is there and how it changes over time and how this relates to the environmental changes.

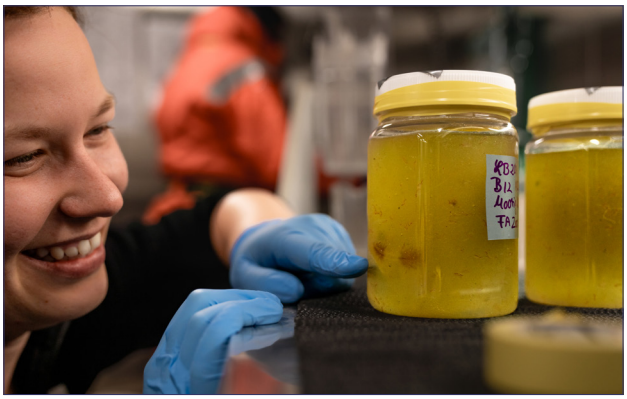
"We use special nets for the zooplankton. They are like fishing nets, but just smaller mesh size because the animals are much smaller and deploy them in the water just like fishing. The nets are typically deployed to 200m and then we pull them back up very slowly, otherwise the zooplankton will just look like 'moosh'. We also have nets that we can use to collect samples at different depths." Much of Svenja's sample collecting is done at night when the zooplankton are near the surface.

"We then collect the zooplankton samples and preserve them to be identified and counted once ashore. Some zooplankton are difficult to collect, like jellyfish as they are mostly water and don't make it up in the net in one piece or don't preserve easily; others are able to avoid the nets."

The Bongo net. Credit: Laura Bassi

Svenja and Georgia washing the net and collecting the plankton sample. Credit: Laura Bassi

Svenja is splitting the plankton sample to be used for different purposes. Credit: Laura Bassi



Svenja with a fresh plankton sample from the Ross Sea. Credit: Laura Bassi

The zooplankton samples collected in the net are preserved in one of two solutions depending on how they will be analysed ashore. It's difficult to make observations at sea because they are very small and need to be identified under a microscope to observe very small differences between different species. Some are preserved so they remain intact for visual identification, while others are preserved so the DNA remains intact and can be sampled. The data from these different methods is compared to ensure the data is reliable: that the visual observations of species and counts align with the DNA samples. This data is then recorded against other observations about the ocean, temperature, current and weather.

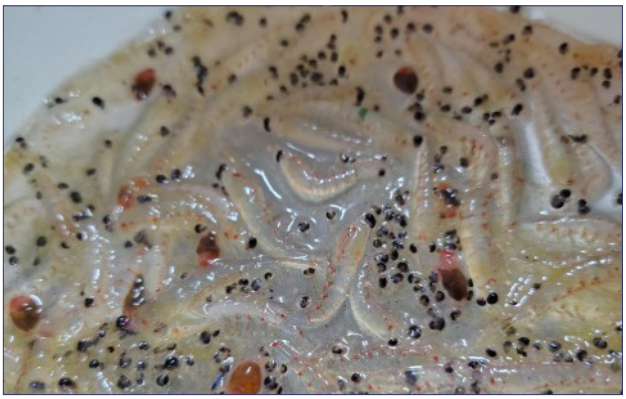
"I am looking at new methods of monitoring zooplankton including using cameras and observing them in their environment, which is very exciting," Svenja says.

The 'Zooscan' is a scanner in the lab that takes pictures of what is in a zooplankton sample. "It looks a lot like a document scanner only it is a bit deeper so we can pour the samples in. We are using machine learning to train the algorithm to identify different species from the scan it creates.

"[Antarctic zooplankton] is a very understudied area because no one really wants to spend all their time bouncing around on a ship in the Southern Ocean."
Svenja Halfter

"We already have robotic floats that collect environmental measurements (temperature, salinity). Now we are adding cameras. We can use these to provide year-round data of zooplankton in the ocean. The floats often spend years in the water so this can provide long term information. Currently we can only sample in the Southern Ocean in summer, so we don't really know what changes occur year-round. Again, this will create lots of data, so we are looking at how best to manage this."

New amphipod species discovered by Svenja in 2019.



Colourful mix of Antarctic zooplankton.

Copepod from the Southern Ocean.

Jellyfish from the subantarctic Southern Ocean.

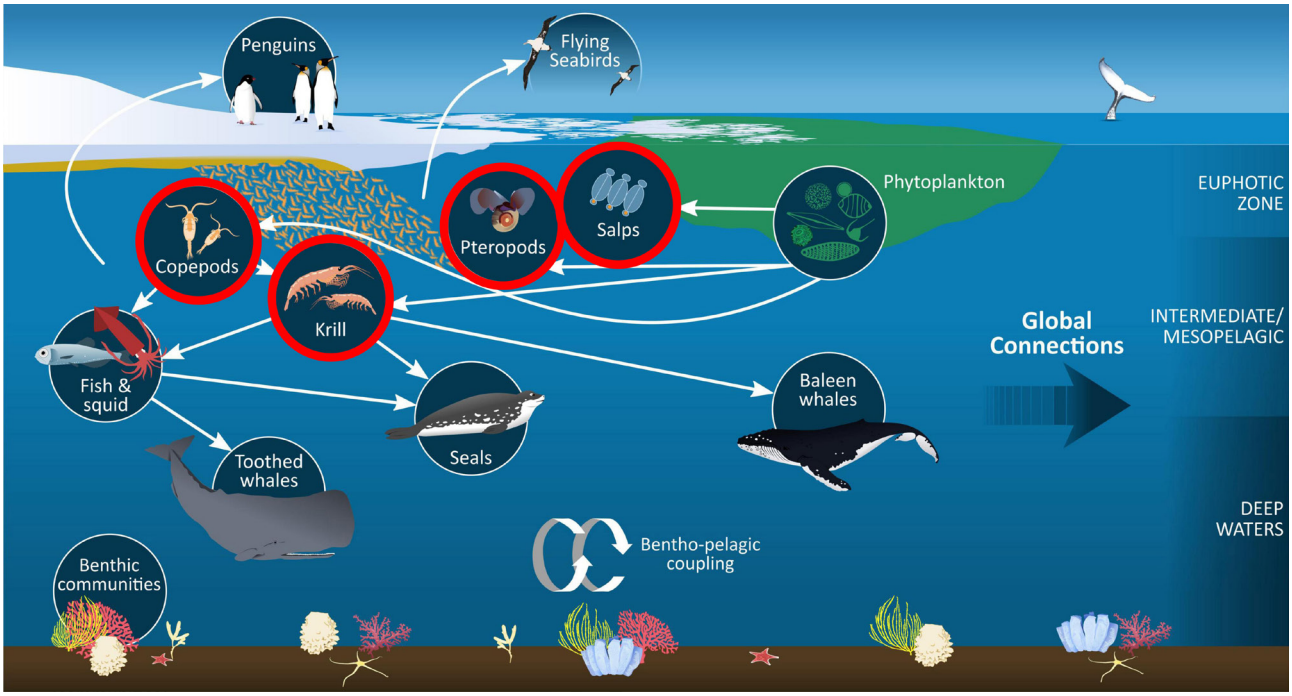
ABOVE: Svenja and colleagues ready to fly to the Italian base Mario Zucchelli in Terra Nova Bay.

VALUABLE RESULTS

"We have calculated the amount of carbon that is drawn down by a whole zooplankton community in the Sub Antarctic. We looked at all the different components in the community from krill, copepods, and jellyfish to even small fish and calculated how much carbon they can draw down in the ocean just by migrating deeper during the day and returning to the surface at night to feed. The question we are trying to answer is how climate change will impact the oceans. How will the size and make up of the community change and how will that affect all the other species in the ecosystem like fish that are supported by all these zooplankton. Zooplankton are important to transport the energy that is produced by algae up to the rest of the food web, like fish, seals and whales. Everybody relies on zooplankton.

Will there be less zooplankton, less fish, less carbon drawdown? It is all interconnected."

BELOW: Johnston, H et al. (2022). Status, Change, and Futures of Zooplankton in the Southern Ocean. Frontiers in Ecology and Evolution.



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NEX NETWORKS OF EXPERTISE

CARBON CYCLE

Zooplankton contribute to the carbon cycle through faecal pellets (poo), carcasses, respiration, being consumed (passing carbon up the food chain), and vertical migrations that transport carbon into the deep sea. Some store more carbon in their bodies, while others migrate deeper.

Though each zooplankton's impact is small, the vast biomass of all zooplankton makes them crucial to the ocean's carbon cycle. Svenja studies how different species contribute, including quantifying zooplankton poo. "Some just poo more than others. Figuring out who poos the most is very important for the carbon cycle," she says.

She also examines how far faecal pellets and carcasses sink and what gets recycled by other species. "If I know the size of the population and how a species of zooplankton contribute to the carbon cycle, we can look at the effect of changes to that population on the ocean's ability to retain carbon."

Using sediment traps, she collects faecal pellets and carcasses to measure sinking rates to determine which zooplankton species uptake the most carbon and how population shifts might impact the carbon cycle in the ocean.

WHAT SHE LIKES ABOUT SCIENCE

Svenja has always been fascinated by science, driven by curiosity about connections in nature and a desire to understand the world. She enjoys collaborating across disciplines, learning from others' projects, methods and expertise.

Although her job sounds like a dream, it's not always super enjoyable as there's a lot of work involved, she says. "But once I get there, it's just a different story. You feel like this is easy. It's just my life now and I have to pinch myself.

Svenja deployed one of the world's first floating cameras on a voyage. "There are so many new things now being developed and so many people working in different fields. There is so much future potential for new ways to do science; it is very exciting.

"Finding the right tool to answer them and trying different methods that get the same answer. I'll answer some questions and just came back with a whole pile more."

MĀTAURANGA MĀORI

"Mātauranga is important for me, that's understanding and there's a different way of knowing and different knowledge systems. Growing up in Germany, there's the certain way of doing science, but then you move to different countries and see there's so many ways of approaching the same problem. I think it's a good space for science."

NGĀ KUPU

Meroiti ika – zooplankton

RELEVANT LINKS

Exploring Marine Protected areas- the Ross Sea, presentation for sea week 2024. Interview (timestamp 5 - 25 min).

Status, Change, and Futures of Zooplankton in the Southern Ocean.

The Role of Zooplankton in Establishing Carbon Export Regimes in the Southern Ocean – A Comparison of Two Representative Case Studies in the Subantarctic Region.

Scientists hopeful tiny ocean zooplankton will help tell if climate change targets are met.

Carbon cycle

NZASE article Ocean upwelling.

CLASSROOM ACTIVITIES

How to make a zooplankton net.

More class room activities and information