



OFF TO THE ANTARCTIC SEA ICE ON THE ICEBREAKER POLARSTERN

A freezer full of life

Four researchers from IMARES sailed on the icebreaker Polarstern to the sea ice of Antarctica. They fished under the ice and counted wildlife from the air. Jan Andries van Franeker talks about the cold, the krill and the charm of working in a magical environment.

TEXT ARNO VAN 'T HOOG PHOTOGRAPHY IMARES AND CORBIS ILLUSTRATION JENNY VAN DRIEL

Jan Andries van Franeker, project leader of the Antarctic research at IMARES Wageningen UR, just got back to Texel at the end of October after a ten-week absence. His main concern is to deal with his overflowing inbox and catch up on all the other work that has lain still during the WISKY expedition (Winter study on sea ice and key species), a field trip to study the ecology under the sea ice around Antarctica. The 120 metre-long German icebreaker Polarstern is equipped with all the latest conveniences and technology, but the possibilities for email and internet use on board are extremely limited.

On Friday 9 August Van Franeker left Schiphol airport with three of his colleagues for Punta Arenas on the southernmost tip of Chile. The name of the hotel where they

stayed for a few nights before sailing says enough about their location: Finis Terrae, the end of the world. The winter made its presence felt, with icy winds, rain and snow drifts that hampered the work of loading the containers full of research equipment onto the ship. About 15,000 kilos of apparatus had travelled on ahead of the expedition. But a day or two later the sun suddenly came out and the containers could be unpacked after all.

HEAVY STORMS

The researchers wanted to spend their few days onshore setting up the research station and bird observations posts and getting various pieces of apparatus ready. They were aware that the ship's course to the pack ice of the Weddell Sea, 3000 kilometers to the

south-east, would pass straight through the notorious Drake Passage, a sea plagued by heavy storms and high waves. Conditions which usually make it impossible to carry out the work on board.

On the day of sailing, Wednesday 14 August, the plans were changed. So much pack ice had been reported on the route to the south that even a powerful icebreaker like the Polarstern, which is capable of ploughing through 1.5 metres of ice, would have trouble reaching the research area. So the course was changed from southward bound to due east, in the direction of the waters of the island of South Georgia 2000 kilometres away. A sediment trap put out last year would be collected here. The trap measures how much organic waste from sea life sinks to the bottom. The stop here was origi- ➤

nally planned for the return journey. ‘The route is always changed on an expedition,’ says Franeker. ‘In fact the only things that were fixed from the start were the departure from Chile and the arrival in Cape Town on 16 October. Everything in between can change.’

The new route in the somewhat calmer seas gave the voyagers more time to get used to the ship’s roll. For the first few days they had the wind diagonally behind them, which reduces the chances of seasickness. Van Franeker: ‘Seasickness is just part of the deal for the first few days. On other expeditions in heavy weather I was totally out of it for the first two days. That’s not nice but you know it will pass by itself. It wasn’t too bad on this exhibition. At most I just felt a bit out of sorts for a while, and once I went to bed for an hour.’

ABOUT TURN

But even this ice-free route turned out not to be entirely hitch-free. En route to South Georgia the Polarstern suddenly had to do an about-turn in the direction of the Falkland islands, 1000 kilometres away. Although there was a ship’s doctor for the 50 researchers and 50 crew, one of the crew caught an infection so serious that the captain did not want to go any further away from specialist medical help. As the islands came in sight the Polarstern’s helicopter took the man to hospital and the ship continued on its way to South Georgia. From there it turned due south towards the research area: the sea ice of the Weddell Sea. The voyage through the Drake Passage brought winds of force 9 to 10 accompanied by a swell of six metres. Van Franeker: ‘That wasn’t too bad. I’ve known much worse in the past, so bad that equipment broke and one of our team fell and broke his ankle.’

The various research teams used the two weeks on the open sea to test their equipment, as well as to take measurements of the composition of the water and the sea life. IMARES’s biggest contribution on this expedition was a special fishing net (SUIT) which was to be dragged under the ice. Practising on the open sea gave Michiel van Dorssen and the other team members, Fokje Schaafsma and Carmen David, the chance to go through the procedures once more. The ship’s crew needed to get to know the SUIT too. The first test on 22 August went to plan. SUIT stands for Surface and Under Ice Trawl. It is a fishing net which scrapes a reinforced steel opening along the hard, raw underside of the sea ice. The floating frame of the SUIT measures four by two metres, with a fishing net behind it. The ship’s towing cable is attached to the front left of the hulking construction, so it tends automatically to move to the right, away from the ship’s wake. Under the ice, the frame scrapes a layer of ice off so the marine creatures that live there end up in the net. Most of the catch would consist of young krill (*Euphausia superba*), an Antarctic species of shrimp with an adult length of five to six centimetres. This shrimp is the hub of the food web and the food supply of birds, fish and marine mammals is largely dependent on it. ‘In recent years it has become clear that sea ice in the winter is tremendously important for the survival of young krill. Algae and all sorts of microscopic organisms grow on the underside of the sea ice, and krill feeds on them.’

OBSERVATIONS UNDER THE ICE

The catch in the special trawl net gave the researchers an impression of the number of krill living under the ice. Divers from other teams observed under the ice to see exactly

where the young krill lived. ‘They mostly saw the shrimps in rough corrugations and holes. Divers can survey them on a scale of a few square metres to see what sort of ice the krill prefer.’

The SUIT, on the other hand, takes samples from a much bigger surface area, says Franeker. ‘Eventually we will have to translate the information from all these observations into an overall picture: what sort of ice do krill use, and what is the relation between the quality of the ice and the number of krill living there.’

This relation between sea ice and organisms is reflected in the expedition’s acronym, WISKY: Winter study on sea ice and key species. Climate change and krill fisheries call for a better understanding of the ecology under the sea ice, says Van Franeker. Global warming could lead to fewer large masses of sea ice in the winter, or to ice with different characteristics and a smaller habitat for young krill. Meanwhile, krill fisheries are expanding fast: the shrimps are fished for food, omega 3 oil and fish feed. The Antarctic fisheries treaty requires, however, that commercial fisheries avoid disturbing the food supply of other species such as penguins and whales. Van Franeker: ‘So knowledge of this ecosystem is very important, for deciding on quotas for example, or for adapting the quotas if the amount of sea ice is changed by climate change. We do have a broad understanding of the relation between krill and various predators. But the ecological calculation model for the sea around Antarctica is not quite right yet. If you count the number of predators in the area and the number of krill, you actually have to conclude that there is not enough food available. But that is not the case; we just don’t yet know quite how the system works.’

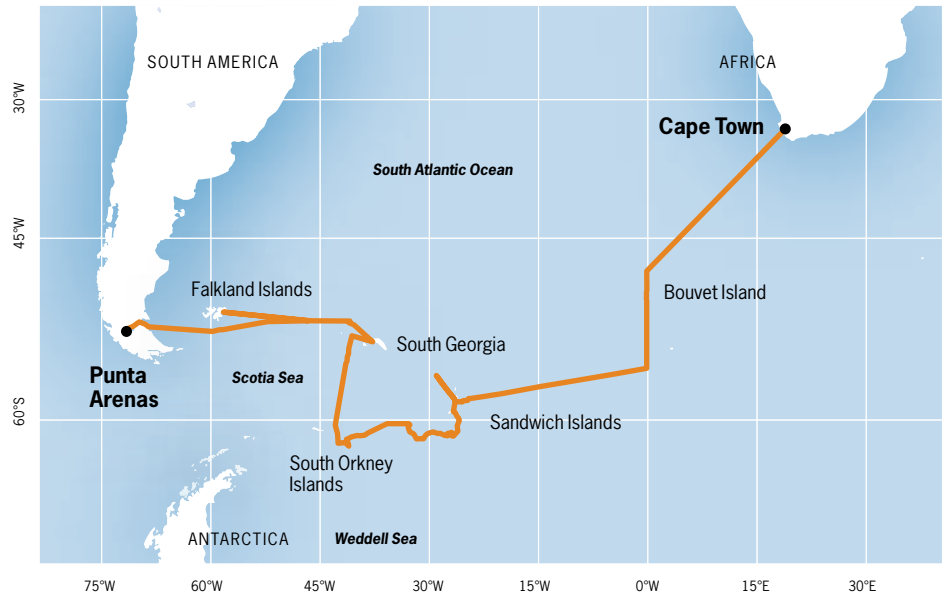
PERFORMING PENGUINS

A new kind of underwater camera was attached to the SUIT during this expedition. It produced beautiful footage of performing penguins under the ice. Many people imagine the South Pole resembles the lifelessness of their own freezers, says Van Franeker. ‘But it is not a sterile freezer; it is a highly productive environment, even in the >

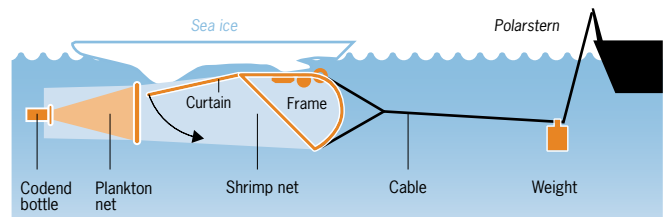
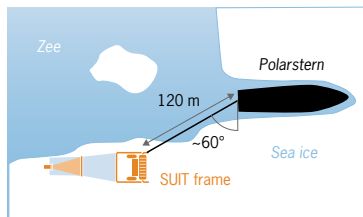
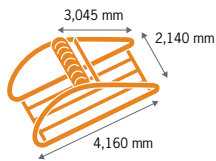
‘The ecological calculation model for the sea around Antarctica is not quite right yet’

TO THE SEA ICE OF ANTARCTICA

The voyage of the Polarstern to the Antarctic began in Chile and ended two months later in South Africa. En route to South Georgia, the ship had to change course to the Falkland Islands to bring a sick crewman ashore.



SUIT frame



24 AUGUST 2013

‘Everything went swimmingly’

‘In the course of yesterday morning, our SUIT net went over-board for the first time so we could systematically check the work procedures and material in detail. In spite of our complicated methods of keeping the towing cable under the (here imaginary) ice, everything went just swimmingly.’



1 SEPTEMBER 2013

‘You want to share such beauty’

‘The first time I looked out of my cabin porthole I saw a beautiful sunrise in a small clear strip of sky between the horizon on the sea ice and a band of clouds. It took a while before I realized that I was looking at three rising suns. So I ran outside to take a photo, shivering from the cold. Because such beauty makes you want to share it.’





Antarctic krill (*Euphasia superba*), seen here under algae-covered ice, are the main zooplankton in the Antarctic food chain.

8 SEPTEMBER 2013

‘Didn’t see many penguins’

‘Under a clear blue sky we could fly about 90 kilometres south over the sea ice in the helicopter. There are not as many top predators in our research area as I had expected but we did count three common minke whales and 17 seals. Didn’t see many penguins.’



26 SEPTEMBER 2013

‘A terrifying under-ice world’

‘The SUIT frame is lowered into the water along the slipway at the stern of the Polarstern. Once it shoots beyond the choppy wake we can see what’s in front of us. A beautiful but at the same time terrifying under-ice world in which the SUIT must find its way by fits and starts!’



‘The South Pole is not a sterile freezer; it is a highly productive environment’

winter. There are so many large animals to be seen, such as emperor penguins, albatrosses, seals and whales.’ The researchers spent about 22 hours in the helicopter in order to count the animals present from the air. The count gave an impression of the diversity and numbers of predators that depend on the ice and the food supply produced underneath it. Van Franeker had intended to spend 40 hours in the air but the changeable polar weather did not allow that.

But in general the weather conditions on this expedition were not extreme, says Van Franeker. ‘The temperature ranged from -5 to -20. With a hard wind that feels like -40. It makes a difference than we didn’t go very far into the ice on this expedition, only about 400 metres. When there was a wind on the open sea it even felt quite spring-like at times.’

Surrounded by Antarctic sea ice you are in a magical setting, says Franeker. ‘It is such a beautiful, mysterious world. So work

and pleasure go hand in hand there. On an expedition I work seven days a week, 14 to 16 hours a day. It varies from practical work to meetings and organizing all sorts of things. Because a lot of the work depends on the weather you constantly have to adjust your plans or change them completely. That takes up a lot of time too.’

After years of preparation the researchers wanted to get everything they could out of the expedition. ‘Of course on board you have a lot of contact with fellow researchers from other countries. But apart from that I was mainly busy with research work. There is a video system on board but I didn’t see a single film. A couple of times a week after a long day I would go and have a beer in the bar after 10 o’clock. And I also had time to finish a whole book, which is quite exceptional for me on an expedition.’ Now they are home there is plenty to sort out in the months to come, what with analyzing the samples and describing the catches from the SUIT. And plans are

already being made for further expeditions in the direction of the South Pole in the Arctic summer of 2014-2015. The ICEFLUX research programme on which the four researchers work is part of a five-year collaboration between researchers from the Alfred Wegener Institute (AWI) in Bremerhaven and those at IMARES. The programme is led by former IMARES researcher Hauke Flores, who now works for the AWI.

The research in ICEFLUX revolves around the relation between ice and ecology: the ice surface is the basis of marine life around the South Pole. PhD researcher Fokje Schaafsma studied to what extent the Antarctic food web is influenced by the decrease in sea ice and the change in its structure. Her colleague Carmen David focusses largely on the biodiversity of algae, bacteria and molluscs under the ice: exactly which species live there and in what numbers. Van Franeker will return to the ice next year. He is an old hand now, having already made nine voyages in the region and countless other field trips. This experience puts the long absence this time in perspective. ‘In the past I regularly did field research for which I was away for four to six months. An expedition of 10 weeks is seen as a relatively short absence at home.’ ■

Info: www.wageningenur.nl/antarctica

NORTH POLE RESEARCH

The North Pole region is another important research area for IMARES Wageningen UR. There are regular expeditions from the Dutch Arctic Station on Spitsbergen. ‘The Arctic research programme is all about sustainable development,’ says Arctic programme manager Bas Bolman. ‘The North Pole is changing, the ice is receding. That makes new forms of exploitation possible, such as new shipping routes and oil and gas drilling. The debate on these developments between governments, NGOs and companies must be fed with knowledge. All those parties are involved in the research too.’

Monitoring is a major component of the research, explains researcher Martine van den Heuvel-Greve. She is doing research on bio-indicators: the responses of a whole range of organisms to oil drilling and shipping. ‘Physiological responses and levels of pollutants in seabed organisms such as worms and shellfish can tell you whether they are sensitive to disturbance by these activities.’

Bolman and Van den Heuvel-Greve were on Spitsbergen this summer and were joined by a camera crew from Dutch television programme Labyrinth. The programme was broadcast in September.

More on the research on Spitsbergen in the next edition of *Wageningen World*.

Info: www.wageningenur.nl/arctic



Spitsbergen