You can see the speed of the ship in this photograph – underway measurements. Image: UCT Oceanography

The moon pool through which the CTD is lowered.
Image: UCT Oceanography

The UCT Oceanography honours class with Isabelle Ansorg. Image: UCT Oceanography

Life at sea

Life at sea is very different from life on land... Or is it? It may be hard to imagine spending weeks even months at sea, but for many oceanography and marine biology researchers and students, living and working at sea is an important part of their careers. By **Christopher Jacobs**, **Jennifer Butler**, **Mokete Kaogo**, **Alistair Blair** and **Marcel du Plessis**.

Many students who start studying oceanography don't quite know what they are signing up for. Oceanography is a multi-disciplinary and exciting science and often an oceanographer can be a biologist, chemist, physicist, geologist, engineer, mathematician, computer scientist or a meteorologist. As a relatively new science, oceanography is a wonderfully challenging and exciting field of study providing many career opportunities.

As part of the 2012 Oceanography Honours class at the University of Cape Town we were extremely fortunate to participate on the SA *Agulhas* II's inaugural scientific voyage to the edge of the sea ice at 60°S. At this latitude the new ships capabilities and facilities would be put to the test for the first time. The SA *Agulhas* II is currently the most advanced Southern Ocean research vessel in the world and it was a privilege to be onboard her. The aim of our participation was to gain invaluable hands on experience in working with oceanographic instruments, understanding how data is analysed and interpreted, and most importantly getting a feel of what life as a sea going oceanographer would be like.

Why is ocean research important south of Africa?

The oceans are linked to our survival on Earth and oceanographers work side by side with policy makers, social scientists, educators, and businesses to develop effective ways of managing and maintaining our ocean resources. Our dependence on the global ocean will increase as we look to the ocean to sustain our expanding population's needs such as food and water. Through continued research and new technology, we are learning how the oceans affect life and the future of our planet. To do this successfully, repeat monitoring lines need to be undertaken across all ocean basins. The GoodHope transect between Cape Town and Antarctica is one such line.

Laboratory work can be repetitive, but is vital to certain types of research. Image: UCT Oceanography

The GoodHope programme was started in 2004 by the scientific community to answer the need for regular closely spaced oceanographic observations between Cape Town and Antarctica. The Southern Ocean plays a major role in the global ocean circulation and has a significant impact on present day climate. However, our understanding of its complex three-dimensional dynamics and the impact of its variability on the climate system and affect of seasonality remain to this day rudimentary. GoodHope is an internationally recognised research line aimed at studying the impact that climate change is having on the oceans south of South Africa – changes in ocean temperatures, salinity, nutrients, dissolved oxygen and carbon dioxide concentrations are all being studied by scientists onboard the SA *Agulhas* II. Achieving these lines allows the scientific community to gain a better understanding of the changes going on in the Southern Ocean and allows us the opportunity to compare summer and winter trends.

The scientific aim of the cruise was to collect oceanographic and biological data in the Southern Ocean in winter. The oceans are very much like trees in that there is a difference in their biological productivity between seasons. Trees grow leaves in summer and lose their leaves in winter and so it is with the oceans. Productivity changes, but by how much? Combined with the need to test the new ice vessel in hostile southern ocean conditions, the cruise presented a golden opportunity to extend the GoodHope line seasonally.

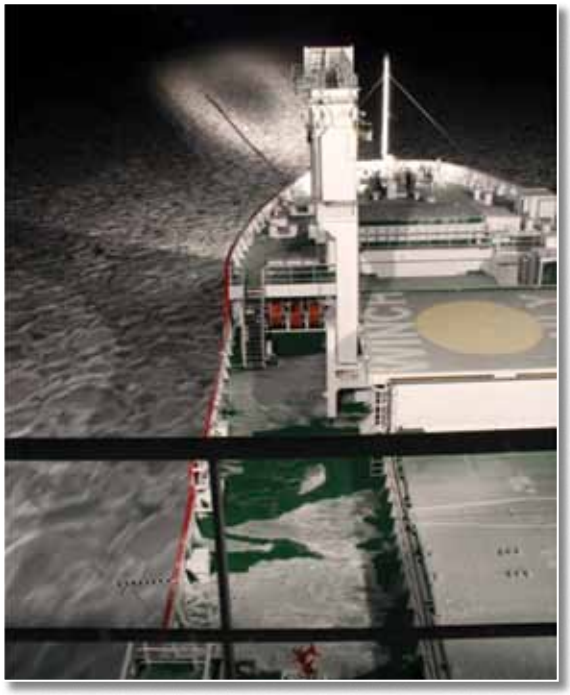
To achieve the scientific aims, we had to complete a large number of underway and stationary deployments in each watch. The underway measurements (expendable bathythermograph's (XBT) and underway conductivity, temperature, depth profilers (UCTD) (see below) were carried out when the ship was steaming, often at over 13 knots (24 km/h). The UCTD required three of us to stand outside on the back deck and drop a temperature and salinity probe over the side to a depth of 400 m and then winch it back. This often took about 20 minutes and in the big seas, especially at night, this often involved some heart stopping moments when leaning over the side of the ship with 8 m swells rocking the stern like a cradle.

Other work that we had to do in our watch was to help with the running of the conductivity, temperature and depth profiler (CTD), which collects sea water at various sample depths. It was always exciting to see the CTD deployed through the ships moon pool.

The moon pool looks like a chimney hole extending through the ship to the water. When it is opened the water rushes in and the CTD is lowered through it at 1 ms-1. It takes about 90 minutes for the CTD to be lowered to 2 000 m and then brought back up to the ship. Once the CTD is back on deck everyone rushes in to collect water samples for their research, which can be on the dissolved oxygen, nutrient, carbon dioxide, zooplankton concentrations in the top 2 000 m. The number of sample collected also provides us with an ideal opportunity to give a helping hand to the many scientists onboard who need help with sampling, filtering and measuring water samples. A helping hand at sea is always appreciated, especially when the work starts to become repetitive. This kind of training allowed us to experience the vast array of science that occurs on the ship. ▷▷

The CTD as it is lowered through the moon pool. Image: UCT Oceanography

The reality of working in an 8 m swell. Image: UCT Oceanography



The ice at night. Image: UCT Oceanography

There is always some time off. Image: UCT Oceanography

The dining room and the bar. Image: UCT Oceanography

Musical entertainment. Image: UCT Oceanography

At the ice! Image: UCT Oceanography

Life onboard

What is life like on board the SA *Agulhas* II? One major difference between life on land and life at sea is that the ship is constantly moving, with water sloshing over the back decks in the large swells.

In rough seas, we walked around like drunken sailors, holding onto every hand rail that we could find. This makes living and everyday actions extremely difficult – even frustrating! Everything has to be secured to stop it from flying around as the ship rolls. Chairs are often lashed to the desks, computers are tied down and special rubber mats have to be used on all the tables.

Another difference is that the ship generally works 24/7 with everyone having to work a 12 hour shift, either during the day or at night. Scientists need to be awake at odd hours to deploy oceanographic instruments, collect samples and process them in the laboratory. Living on the SA *Agulhas* II, we simultaneously operate along two timelines. The first is the normal one.

The days on the calendar change, the sun rises and sets, we eat meals at regular times and during the day the ship is a buzz of activity. Then there is the work timeline, the ship's timeline, which is not defined by the changing of days but by the changing of watches and the time it takes to complete either a stationary CTD or UCTD. The boundaries between the days become meaningless and getting into the swing of life at sea takes time. At the start of the cruise, most of us needed time to adjust to the pitching and rolling of the ship and the queasiness that quickly crept in as soon as the ship left the harbour. Once the sea sickness subsides you start getting into the lifestyle at sea – and so work begins. Being part of the night shift (midnight to midday) involves changing your sleeping pattern, which can be a challenge for the first few days, but over time your body adjusts and you find yourself wide awake at 3 am.

In between shifts and stations there was always time to read, play table tennis or watch a movie.

Getting hungry throughout your shift can become a bit of a problem if you are working at night. Meals are at set times on the ship and only leftovers, bread and cereals are available in the early hours. Having our honours course convenor Dr Isabelle Ansorge onboard meant that we had an endless supply of chocolate and popcorn for many hungry evenings and early mornings.

Food on board was excellent and there is plenty of it to go around. Meat seems to be the staple diet at sea. Every day we'd get the menu and plan our day around what meals we wanted to eat. The cold weather conditions, constant moving of the ship and long working hours means that you are always hungry and luckily with two options available for every meal no one is ever disappointed. There is also the added bonus of not having to do any dishes for the entire trip or paying for any meal, an ideal situation for any student. For those who are scared of putting on the kilograms, there is a gym on Deck 4.

The ship is not all about work – outside of your watch you have 12 hours of free time. Normally you are exhausted from working in the cold or collecting and filtering water samples so you tend to go straight to bed for a few hours. Feeling awake? There is always someone looking for company. Playing the guitar and learning new songs was a popular source of entertainment with some of the musicians (who are also scientists) often spending nights jamming together.

Onboard we also had some very

Iceberg and through the ice. Image: UCT Oceanography

knowledgeable bird watchers so it was always easy to grab a pair of binoculars and watch the beautiful albatrosses as they glided past the ship or even followed us along our voyage. Still bored? You can always disappear to the library or the Business Centre to check your emails and of course update your Facebook page. The ship is so modern and comfortable it feels like a real home away from home and you often forget you are in the wilds of the Southern Ocean.

Best experience

Getting to the ice edge and seeing how the ice changed from floating slush to pancake size and finally to ice floes was incredible. One of the main aims of this cruise was to test how the new ship would perform in the ice and also to see how fast she could break through it – according to Captain Gavin Syndercombe the SA *Agulhas* II managed to reach speeds of 13 knots.

A highlight for everyone on the ship was seeing the different types of ice and icebergs. Although it was very cold (about -10 °C), we braved the weather and managed to capture a few pictures, even though we stood on an ice covered deck in the freezing wind. The thrill of seeing an iceberg is completely unexplainable. Its size, colour and shape are absolutely beautiful and the sight of it is a once in a lifetime experience. Most people have to pay tourist companies US$1000s to experience such incredible scenery but as oceanography students we were getting this experience as part of our course.

On the return leg, we had time to work on our research projects but more importantly we had time to relax after 10 days of hard work. Going to sea is a great opportunity to explore places few people have visited. Having to travel through three different time zones in less than a month can be confusing and you can easily miss meals and be late or early for your watch. For most of us it was the first time we had been to sea and certainly the first time we had travelled as far south as 60°S. Life at sea is a big change from normal day life but it is part of a learning curve that improves and tests your independence as an individual. The work that we do may be tedious at times but it's a fascinating work place. Everybody onboard is united by a common purpose and it is that purpose that keeps us working, enables us to survive the discomforts and length of time away, and most importantly helps us all get along with each other so well. You learn a lot from all the different scientists on the ship and you get a good idea of the different types of opportunities in the oceanographic world. This was definitely an unforgettable experience, which all of us would happily recommend to learners eager to work in the marine sciences. Our time at sea and experience at the sea ice has contributed to one of the best learning experiences of our life. ❑

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Definitions

CTD: A CTD – an acronym for conductivity, temperature and depth – is the primary tool for determining the essential physical properties of sea water. It gives scientists a precise and comprehensive charting of the distribution and variation of water temperature, salinity, and density that helps us to understand how the oceans affect life. The CTD is made up of a set of small probes attached to a large metal rosette wheel. The rosette is lowered on a cable down to the seafloor and scientists observe the water properties in real time via a conducting cable connecting the CTD to a computer on the ship. A remotely operated device allows the water bottles to be closed selectively as the instrument ascends. A standard CTD cast, depending on water depth, requires two to five hours to collect a complete set of data. Water sampling is often done at specific depths so scientists can learn the physical properties of the water column are at that particular place and time. A U CTD is a smaller version of a CTD but one that can be towed behind the ship at speeds up to 13 knots.

XBT: XBTs – an acronym for expendable bathythermograph – have been used by oceanographers for many years to obtain information on the temperature structure of the upper layer (1 000 m) of the ocean. An XBT is a probe which is dropped from a ship and measures the temperature as it falls through the water. Two very small wires transmit the temperature data to the ship where it is recorded in real time. The probe is designed to fall at a known rate, so that the depth of the probe can be inferred from the time since it was launched. By plotting temperature as a function of depth, the scientists can get a picture of the temperature profile of the water. An advantage of XBT deployments over CTD operations is that vessel do not need to slow down or stop, saving on ships' time and cost. Container ships are now being used to deploy XBT probes along regular shipping routes enabling scientists to not only collect data across wide ocean basins but to measure seasonal differences in the oceans' top 1 000 m.