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KEYWORDS:

marine science; National Development Plan; SA *Agulhas II*; postgraduates; teaching and research platform

HOW TO CITE:

Ansoorge IJ, Brundrit G, Brundrit J, Dorrington R, Fawcett S, Gammon D, et al. SEAmester – South Africa's first class afloat. S Afr J Sci. 2016;112(9/10), Art. #a0171, 4 pages. <http://dx.doi.org/10.17159/sajs.2016/a0171>

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SEAmester – South Africa's first class afloat

The Department of Science and Technology's (DST's) 10-year Global Change Grand Challenge programme requires platforms to 'attract young researchers to the region and retain them by exciting their interest in aspects of global change; while developing their capacity and professional skills in the relevant fields of investigation'¹. In addition, in July 2014, President Zuma officially launched Operation Phakisa and announced that a key target of this Oceans Economy initiative would be 'for the Department of Higher Education and Training to drive alignment between theoretical and workplace learning'².

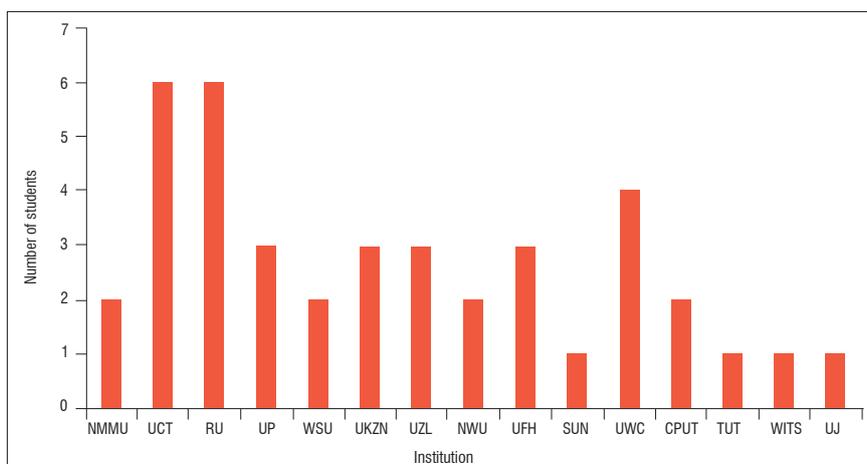
SEAmester – South Africa's recently established Class Afloat – achieves just that. SEAmester introduces marine science as an applied and cross-disciplinary field to students who have shown an affinity for core science disciplines. It identifies with government's National Development Plan³ on education, training and innovation – critical to South Africa's long-term development and investment in this sector.

SEAmester has a long-term vision aimed at building capacity within the marine sciences by coordinating and fostering cross-disciplinary research projects and achieving this goal through a highly innovative programme. The strength of SEAmester is that postgraduate students combine theoretical classroom learning with the application of this knowledge through ship-based, and more importantly, hands-on research. The state-of-the-art research vessel, SA *Agulhas II*, provides an ideal teaching and research platform for this programme; its size, comfort and shipboard facilities allow large groups of students and lecturers to productively interact over a period of 10 days.

Introduction

Marine science is a highly competitive environment. The need to improve the cohort of South African postgraduates, who would be recognised both nationally and internationally for their scientific excellence, is crucial. It is possible to attract students early on in their careers to this discipline via cutting-edge science, technology and unique field experiences. Through the engagement of students with real-life experiences such as SEAmester, universities supporting marine science postgraduate degree programmes can attract a sustainable throughput of numerically proficient students. By achieving a more quantitative and experienced input into our postgraduate degree programmes, we will, as a scientific community, greatly improve our long-term capabilities to accurately measure, model and predict the impacts of current climate change scenarios.

The short-term goal is to attract and establish a cohort of proficient marine and atmospheric science graduates who will contribute to filling the capacity needs of South African marine science as a whole. The SEAmester programme, by involving researchers from across all the relevant disciplines and tertiary institutions, provides an opportunity to build a network of collaborative teaching within the marine field. In doing so, these researchers will foster and strengthen new and current collaborations between historically white and black universities (Figure 1). The long-term objective of SEAmester is to build critical mass within the marine sciences to ensure sustained growth of human capacity in marine science in South Africa – aligning closely with the current DST Research and Development strategies and the Operation Phakisa Oceans Economy initiative.



NMMU, Nelson Mandela Metropolitan University; UCT, University of Cape Town; RU, Rhodes University; UP, University of Pretoria; WSU, Walter Sisulu University; UKZN, University of KwaZulu-Natal; UZL, University of Zululand; NWU, North West University; UFH, University of Fort Hare; SUN, Stellenbosch University; UWC, University of the Western Cape; CPUT, Cape Peninsula University of Technology; TUT, Tshwane University of Technology; WITS, University of the Witwatersrand; UJ, University of Johannesburg.

Figure 1: A histogram showing the range of universities represented on board the 2016 SEAmester cruise.

A nationwide call to postgraduate students

On 1 June 2016, a call through the South African Network for Coastal and Oceanic Research was opened for postgraduate students studying marine sciences or a similar discipline to join SEAmester. At the closure of the call on 8 June, SEAmester had attracted 132 applications from 18 universities across South Africa and Namibia. Each application was evaluated on academic merit. A total of 40 applications from students at honours, MSc and PhD levels was selected. A core element in the selection process was to ensure that SEAmester was transformative and inclusive, and hence opportunities were offered to students from institutions that traditionally do not offer ocean-going research in their curriculum (Figure 1).

In addition, 15 researchers and academics working in the Departments of Chemistry, Fine Art, Environmental and Geographical Science and Oceanography at UCT, Departments of Microbiology and Geography at Rhodes University, Department of Engineering at Stellenbosch University, Biodiversity Division at the Department of Agriculture, Forestry and Fisheries, Department of Marine Science at the Cape Peninsula University of Technology, Birdlife SA, South African Weather Service and South African Environmental Observation Network (SAEON) Egagasini Node joined the SA *Agulhas II* cruise as part of the lecturing cohort.

SEAmester provides students with a choice of academic stream

On the recent July 2016 cruise, the module 'Oceans in a Changing Climate' appealed to students wishing to learn more about the impact that the interactions between physical, chemical and biological ocean processes and change are having on marine ecosystems. The more

technically and data-minded students chose to learn techniques in data collection, marine instrumentation and the technology behind the ship-based physical and biological instrumentation under 'Tools of the Trade'. Underpinning both streams was a course in 'Ocean Dynamics', given to all students in order to provide a better understanding of the global ocean and atmospheric processes, as well as how the oceans contribute to earth's climate by storing and transporting heat and salt between ocean basins (Figure 2).

Learning during the SEAmester cruise included intensive daily classroom lectures and assignments (Figure 2). In addition to classes and coursework, students provided research support to scientists working on the Agulhas System Climate Array (ASCA) programme and obtained real hands-on training (Figure 3). ASCA is a partnership between South African and international marine science institutes and is coordinated by SAEON. The focus of the array is long-term monitoring of heat, salt and volume transport in the Agulhas Current. Given the importance of the Agulhas Current in global and regional climate, the long-term nature of the ASCA programme, the variety of instruments used and the potential for further studies with the data, ASCA provided an ideal learning platform for the inaugural SEAmester cruise.

Deck-based training consisted of working with oceanographic, atmospheric and biological ship-based instrumentation, as well as underway measurements and autonomous devices such as Argo floats. Training on ocean data analysis was provided, and technical experience was gained in data management such as salinity and oxygen sensor calibrations. In addition, student groups worked on a final project presentation related to their area of study interest and the scientific research undertaken during the voyage.

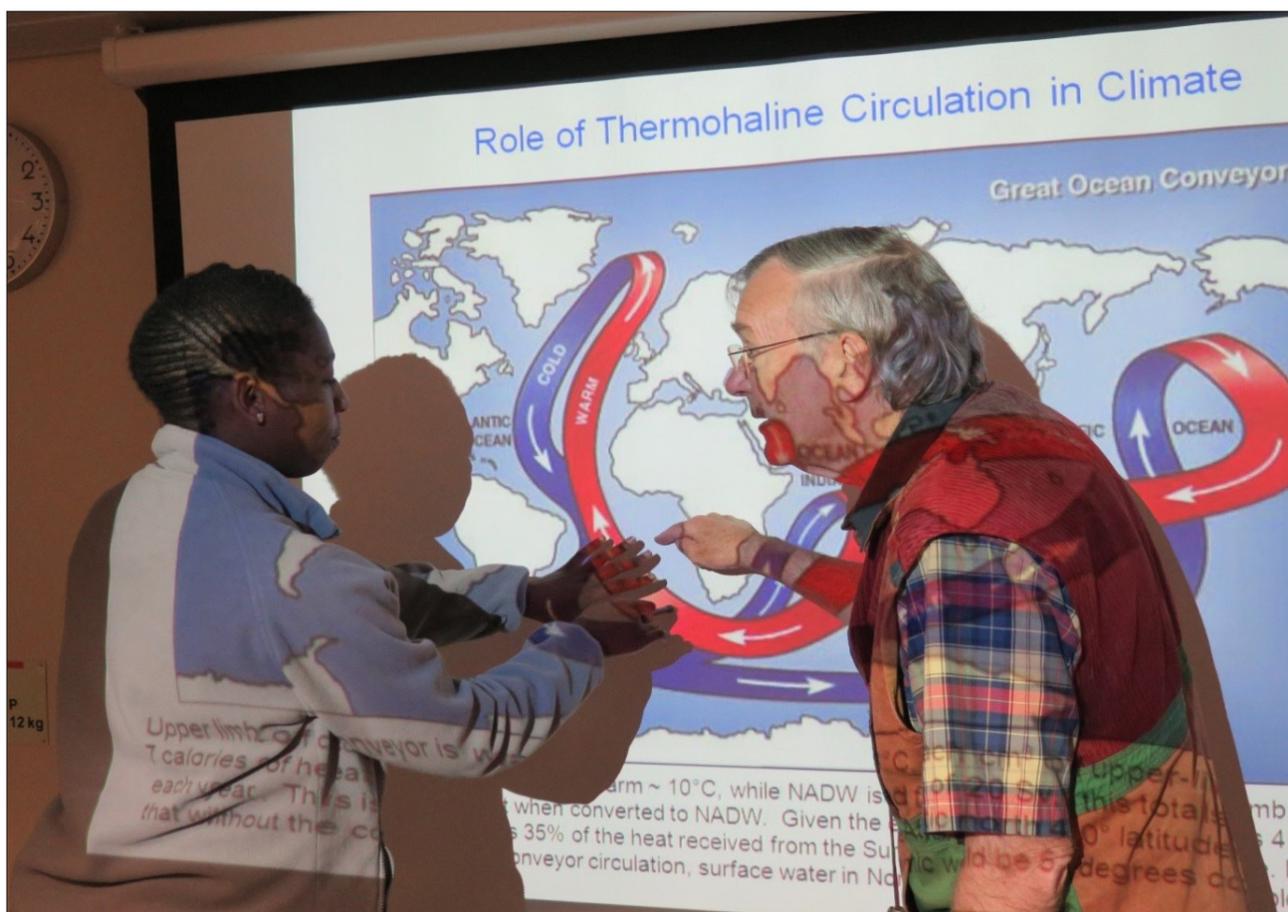


Photo: Jean Brundrit

Figure 2: SEAmester student Miss Tebogo Masebe from Rhodes University listening to Emeritus Professor Geoff Brundrit explain the role of the Global Conveyor Belt. Emeritus Professor Brundrit is a former Head of Oceanography at UCT and Special Advisor on ocean climate change to the Department of Environmental Affairs.



Photo: Jean Brundrit

Figure 3: SEAmester students getting the CTD (conductivity, temperature and depth) device ready for water sample collection at the next station. From left to right: Stephen Peel (UCT), Hermann Luyt (SUN), Sizakele Sibanda (UCT), Belinda Nhesvure (UFH), Thoko More (TUT) and Ntombi Nxiba (CPUT).

How important was SEAmester to each student?

SEAmester is a unique shipboard programme that integrates interdisciplinary coursework, hands-on ship-based experiences (Figure 3) and interaction with leading South African marine researchers. By aligning with the scientific ASCA programme, SEAmester also allowed students to collect data in an oceanic region of global importance and to be part of an international programme with data standards and protocols.

The long-term goal is to establish SEAmester as an annual premier tertiary programme for multidisciplinary marine research, teaching and training in southern Africa. Its continued role will be to attract numerically proficient students into the marine sciences by coordinating and fostering cross-disciplinary and interfaculty research projects and curricula, while training students at sea. Areas of particular development and capacity building within this programme will include marine meteorology; physical, biological and operational oceanography; and an ecosystem approach to marine biodiversity and biogeochemical studies. The success of the recent 2016 SEAmester cruise is evident in the following postgraduate student comments from the SEAmester evaluation form:

- *This programme has been the best experience in my life. It changed my outlook on how to gather knowledge, where to do research, how to think logically as well as to be creative and intuitive.*
- *SEAmester has made me realise that I have a passion for ocean-based research.*

- *I loved the way the content of SEAmester has helped me to link up all the theory that I have learnt over the years.*
- *I have been changed positively by this course – I am more motivated to tackle my studies.*
- *It was a time of my life that I will never ever forget.*
- *SEAmester has been a life changing experience for me.*

We believe that SEAmester offers an unparalleled opportunity to live and work in the marine environment, and in doing so leaves a tangible and lasting impression that postgraduate students are able to make a meaningful contribution to the field of marine science. The government's National Development Plan identifies education, training and innovation as being at the forefront of South Africa's long-term development, and specifically states³: 'Inadequate capacity will constrain knowledge production and innovation unless effectively addressed.' The central strategy behind SEAmester is not only of a training programme that aligns with core DST objectives, but more importantly, a programme designed to fill a burgeoning gap in the capabilities of our current cohort of marine students. It aims to build critical mass within the marine sciences, so as to ensure sustained growth in this field within South Africa and beyond.

Greater awareness of the ocean's physical, biogeochemical and ecological response to climate change, highlighted through ship-board experiences, has already started to inspire and attract students into

the marine sciences – a critical step if a new generation of southern African marine scientists with a far higher calibre in the sciences are to be trained, and a key objective of Operation Phakisa is to be realised. The success of the recent cruise on board the SA *Agulhas II* has confirmed to the scientific community that SEAmester – South Africa's Class Afloat – is able to achieve just that.

Acknowledgements

SEAmester is funded through the National Research Foundation (South Africa) and DST and logistically supported by the Department of Environmental Affairs (DEA). The Agulhas Systems Climate Array (ASCA) is funded through the DST/SAEON/DEA/NIOZ/RSMAS/NSF partnership. The successful completion of the survey would not have been possible without the invaluable assistance of the officers and crew of the SA *Agulhas II*. In particular, we thank Captain Gavin Syndercombe for his continued insight, support and guidance throughout the planning and execution of the SEAmester cruise. We also thank Dr Gilbert Siko and Tracy Klareenbeck from the South African National Antarctic

Programme and Bigboy Joseph and Nish Devanunthan from Antarctica and Islands Logistics (DEA) for their continued support. Our thanks also go to the senior technical electronics officer Angelo Marco for his invaluable assistance throughout the entire voyage. And finally, we thank all the cruise participants involved in ASCA who helped to collect data and provided additional deck training to the students.

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