

Cape Town GIFT 2022

Exploring our Oceans

Currents, Ecosystems, and Plastic Pollution

Cape Town, South Africa, 6-8 August 2022

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Map: Courtesy NOAA

Welcome!

The European Geosciences Union (EGU) is the leading organisation for Earth, planetary and space science research in Europe. With our partner organisations worldwide, we foster fundamental geoscience research, alongside with applied research that addresses key societal and environmental challenges. Our vision is to realise a sustainable and just future for humanity and for the planet.

In addition to publishing a number of diverse scientific journals, EGU organises topical meetings, and education and outreach activities.

The Committee on Education (CoE) of the European Geosciences Union (EGU) was created in 2002 with the aim of bringing state-of-the-art science into tomorrow's classrooms via high-school teachers.

The CoE has organised Geosciences Information for Teachers (GIFT) yearly workshops since 2003. These are normally two-and-a-half-day teacher enhancement workshops held in conjunction with EGU's annual General Assembly. There, selected top-level scientists working in the Earth sciences offer the invited teachers talks centred on a different theme every year. Teachers are also provided with teaching strategies and activities related to the theme.

Teachers from countries such as China, Japan, Mexico, Malaysia, and the USA were invited to the GIFT workshops. Teachers began to apply for second participation slots at the workshops and started to form networks beyond their national borders. With so many teachers wanting more access to research experience the European GIFT concept also became international, with the CoE helping to organise workshops at different locations worldwide.

In 2010, the first GIFT workshop in connection with an EGU Alexander von Humboldt Conference took place in Merida, Mexico. The EGU Committee on Education then teamed up with UNESCO to take the GIFT workshop idea to Africa. The first EGU-UNESCO GIFT workshop on African soil took place at the African Earth Observatory Network at the Nelson Mandela Metropolitan University in Port Elizabeth, South Africa in partnership with the African Applied Centre for Climate and Earth Systems Science. Some 40 teachers from all over South Africa, attended this workshop on climate change and human adaptation.

Out-of-Europe GIFT workshops were then organized in Penang (Malaysia), Merida (Mexico), Addis Ababa (Ethiopia), Cape Town (South Africa), ... with clear success.

To further increase the impact of our "out-of-Vienna" activities, a new type of EGU GIFT workshop is now offered to teachers on a "capacity-building" basis. Funding will be offered on a sliding scale over a four-year time span, with close to full funding provided in the first year, declining progressively until the fourth year. The aim of these series of workshop is to transfer as much as possible the achievements we have obtained at EGU to different countries worldwide, and vice-versa also to increase the input of the European workshops using successful educational approaches developed in these countries.

This workshop is the first one of this new series and will be followed this year by a second series, the Pan-American GIFT at Merida open to teachers in Central America and held at the new Parque Científico y Tecnológico de Yucatan in Mexico.

The success of this new series of workshops depends on you, dear teachers! We expect you first to provide a report on how you felt the different arguments treated at the workshop, what you would suggest for the next 3 years, and of course we expect you to diffuse all you have learned and the idea of the GIFT workshop among your fellow teachers.

Therefore, **we ask you:**

1. To fill out the evaluation form as soon as possible and send it back to us.
2. To make presentations of your experiences at GIFT to a group of your teaching colleagues soon after you return.
3. To send us reports and photographs about how you have used the GIFT information in your classrooms.

We also encourage you to write reports on the GIFT workshop in publications specifically intended for geoscience teachers.

Information on past and future GIFT workshops is available on the EGU homepage (<http://www.egu.eu/education/gift/workshops/>): At this link it is possible to download brochures (.pdf) of the workshops, presentations given at the GIFT workshops for the last 18 years (.pdf). Since 2009, web-TV presentations were also included, which may be freely used in your classrooms.

Like in every great endeavour there are eminent people in the background supporting us and pulling the necessary strings. We are deeply indebted to Carlo Laj from the Committee on Education of the EGU, Isabelle Ansorge from the Department of Oceanography at the University of Cape Town and Hylton Arnolds, the Director of the Education Department at Iziko Museums.

And now, we are privileged to welcome you at the first Capacity-building GIFT workshop organized by UCT, Iziko Museums and EGU!

And we sincerely hope you enjoy the GIFT workshop in Cape Town!

The Organizing Committee
of the Cape Town GIFT Workshop

Acknowledgements

The GIFT 2022 Workshop in Cape Town has been organized by the Committee on Education of the European Geosciences Union. EGU has supported the major share of the expenses, but the workshop has also benefited from the generous help of:

westermann

Westermann Publishing
House



Geological Society of
South Africa



Geological Society of
South Africa, Western
Cape Branch

And we thank all the speakers who have contributed to this educational workshop and their institutions!

Organizing Committee

Friedrich Barnikel

European Geosciences Union, Committee on Education; Educational Coordinator for Geography, City of Munich, Germany



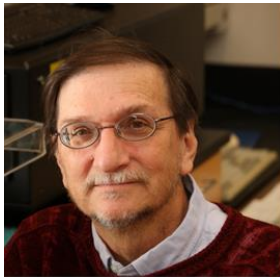
Wendy Taylor

Honorary Research Associate, Dept. of Geological Sciences, University of Cape Town, Cape Town, South Africa



Stephen Macko

European Geosciences Union, Committee on Education; Professor, Department of Environmental Sciences, University of Virginia, USA



Thandí Nqubelani

Education Manager, Natural History, Iziko South African Museum, Cape Town, South Africa



Andrew Petersen

Education Specialist, Schools Development Unit, University of Cape Town, Cape Town, South Africa



Susan Brundrit

Outreach Manager, Evolutionary Studies Institute, University of Witwatersrand, Johannesburg, South Africa



Gilbert Dolo

Education Specialist, Schools Development Unit, University of Cape Town, Cape Town, South Africa



Programme

DAY ONE: Saturday 6 August 2022

THEME: Oceanography and ecology of South Africa's coasts

LOCATION: Iziko South African Museum, Cape Town

Time	Task	People
8:30 am	Teachers arrive; Iziko Museum Education Center	Organizing Committee
9:00	Welcome presentation (15 min)	Organizing Committee
9:15	Objectives and purposes of the capacity building GIFT workshop (30 min)	Friedrich Barnikel, EGU
9:45	Teachers meet and greet (round-robin introductions; 30 min)	All teachers & staff
10:15	Coffee break (15 min)	All teachers & staff
10:30	Overview to South Africa's marine biodiversity and resources (45 min)	Dr. Wayne Florence; Iziko Museum Marine Science
11:15	Questions and comments (15 min)	All teachers & staff
11:30	Overview of marine science at Iziko; school programs and exhibit tour (90 min)	Thandi Nqubelani and Marine Science staff, Iziko Museum
1:00 pm	Lunch (60 min)	All teachers & staff
2:00	The great thermohaline circulation and introduction to South Africa's oceanographic setting (45 min)	Dr. Moagabo Ragoasha, UCT Oceanography
2:45	Questions and comments (15 min)	All teachers & staff
3:00	Plastic pollution on the beaches of Cape Town (45 min)	Dr. Takunda Chitaka, Univ. Western Cape
3:45	Wrap up discussion and reflection (15 min)	All teachers & staff
4:00	End of day and departure	

DAY TWO: FIELD EXPERIENCE Sunday 7 August 2022**THEME: Rocky shore ecology, conservation and plastic pollution****LOCATION: Sea Point and Two Oceans Aquarium, Cape Town**

Time	Task	People
8:00 am	Teachers meet at Iziko Museum parking lot and board bus	Organizing Committee
8:15	Depart and drive to Mouille Point (15 min)	All teachers & staff
8:30	Arrive at Point and unload bus (15 min)	All teachers & staff
8:45	Meet Prof. Peter Ryan and Two Oceans staff; welcome and separate into two groups (15 min)	All teachers & staff
9:00	Group 1 – Beach clean-up and analysis; Group 2 – Tide pool explorations (45 min)	Prof. Peter Ryan, UCT & Two Oceans staff
9:45	Groups swap (15 min)	Two Oceans staff
10:00	Group 2 – Beach clean-up and analysis; Group 1 – Tide pool explorations (45 min)	Prof. Peter Ryan & Two Oceans staff
10:45	Groups meet for discussion and wrap up (15 min)	Prof. Peter Ryan & Two Oceans staff
11:00	Board bus and drive to Sea Point Contact (15 min)	All teachers & staff
11:15	Overview of Sea Point Contact (30 min)	Dr. John Rogers
11:45	Boxed lunch at Sea Point Contact (45 min)	All teachers & staff
12:30 pm	Load bus and drive to Two Oceans Aquarium (15 min)	All teachers & staff
12:45	Arrive at Two Oceans and unload, enter facility (15 min)	All teachers & staff
1:00	Welcome and exhibit tour (60 min)	Two Oceans staff
2:00	Group splits; Group 1 – Seal platform and Group 2 – Turtle rehabilitation area (30 min)	Two Oceans staff
2:30	Groups swap (15 min)	Two Oceans staff
2:45	Group splits; Group 2 – Seal platform and Group 1 – Turtle rehabilitation area (30 min)	Two Oceans staff
3:15	Tours end and wrap up (15 min)	Two Oceans staff
3:30	Free time at the Two Oceans Aquarium (60 min)	All teachers & staff
4:30	End of program, teachers meet at entrance and depart	

DAY THREE: Monday 8 August 2022**THEME: Rocky shore ecology, conservation and plastic pollution****LOCATION: Iziko South African Museum, Cape Town**

Time	Task	People
8:30 am	Teachers arrive; Iziko Museum Education Center	Organizing Committee
9:00	Welcome and reflections on the field experiences (15 min)	Friedrich Barnikel, EGU
9:15	Hands-on activity on microplastics (45 min)	UCT and Iziko Museum staff
10:00	Questions and comments (15 min)	
10:15	Coffee break (15 min)	
10:30	Hands-on oceanographic, climatological and geological activities (90 min)	EGU & UCT education staff, Iziko Marine Science Division staff
12:00 pm	Questions and comments (15 min)	
12:15	Showcasing ICT classroom resources: Marine Science Curriculum and the Climate Change and Sustainability Digital Library (45 min)	UCT & SDU staff
1:00	Lunch (60 min)	
2:00	<i>Oceans: The mystery of the missing plastic (video; 53 min)</i>	Java Films
3:00	Community Engagement through puppetry and performance: Teaching ocean conservation featuring “The Whale Show” https://jungletheatre.co.za/whale-show/ (45 min)	Vincent Meyburgh, Jungle Theatre Company
3:45	Questions and comments (15 min)	
4:00	Wrap and reflection: marine science, oceanography and conservation resources and programs (15 min)	Iziko marine science staff / education staff, UCT, 2Oceans, & EGU
4:15	Presentation of certificates and final remarks (45 min)	Friedrich Barnikel, EGU
5:00	End of day – banquet dinner at the Eighty-Ate Restaurant	

Speakers



Friedrich Barnikel

Dr.
Director of Studies
Educational Coordinator for Geography
City of Munich, Germany
Committee on Education
European Geosciences Union
friedrich.barnikel@awg.musin.de

EDUCATION AND CAREER:

Since 2010: Educational Coordinator for Geography, City of Munich, Germany
2003: PhD in Geography, Natural Hazards Research, University of Goettingen
Since 2002: Member of the Committee on Education, European Geosciences Union
2000 – 2008: Lecturer for Geography, University of Munich
Since 2000: High school teacher (tenure) for Geography, History and English in Munich

RESEARCH INTERESTS:

Spatial Orientation, Bilingual Studies, Natural Hazards Research

PUBLICATIONS:

Schoolbooks with teaching units from GIFT Workshops

BARNIKEL, F. & T. HECKMANN (eds., 2018): Diercke Naturgefahren – Methoden und Aufgaben (Braunschweig).

BARNIKEL, F. & H. SUMMESBERGER (eds., 2017): Diercke Natürliche Ressourcen – Methoden und Aufgaben (Braunschweig).

BARNIKEL, F. & M. VETTER (eds., 2015): Diercke Ressource Wasser – Methoden und Aufgaben (Braunschweig).

Scientific papers

BARNIKEL, F., WILLEMS, F. & R. PLÖTZ (2019): Describe! Analyze! Act! Geomedia and Sustainability: Results from a European School Project.-In: A. Car, J. Strobl, T. Jekel & G. Griesebner [eds.]: GI_Forum 2019 – The Spatial View, Issue 2, pp. 144-152.

BARNIKEL, F., S. ANTILA-MUILU & H. PEREIRA (2017): Urban Studies in Secondary Education – from Description to Participation, Urban Design, 1/1, pp. 12-22.

BARNIKEL, F., H. ELLBRUNNER & M. VETTER (2014): Teaching Spatial Competence Today – From Analogue Maps to Geocaching, Journal of Cartography and Geographic Information, 5/64, pp. 257-262.

BARNIKEL, F. & M. VETTER (2012): Earthquakes in history – Ways to find out about the seismic past of a region.-In: D'Amico, S. [ed.]: Earthquake Research and Analysis – Seimsology, Seismotectonic and Earthquake Geology (Rijeka), pp. 1-20.

BARNIKEL, F., & E. GEISS (2008): The BASE-Project – An open-source catalogue for earthquakes in Bavaria, Germany, Natural Hazards and Earth System Sciences 8/6, pp. 1395-1401.

BARNIKEL, F. & A. v. POSCHINGER (2007): How historical data can improve current geo-risk assessment, Zeitschrift für Geomorphologie N.F. 51/1, pp. 31-43.

BARNIKEL, F. (2004): The value of historical documents for hazard zone mapping, Natural Hazards and Earth System Sciences 4/4, pp. 599-613.

BARNIKEL, F. & M. BECHT (2002): Pluvial phases in the Sahara during the Holocene: A multi-disciplinary comparison, Geophysical Research Abstracts, Volume 4, EGS02-A-02636, 27th General Assembly EGS, Nice.

AWARDS:

Munich Environmental Award (for the Adolf-Weber-Gymnasium), City of Munich (2019)
Best university lecturer award in Geography, University of Munich (2008)



Stephen Macko

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EDUCATION

B.S Chemistry, Carnegie Mellon University
M.S. Oceanography, University of Maine
Ph.D. Chemistry, University of Texas

CAREER

Assistant to Associate Professor Earth Sciences, Memorial Univ. St. John's, NF, Canada
Associate to Professor, Environmental Sciences, Univ. Virginia, Charlottesville, VA, USA

RESEARCH INTERESTS

Origin and history of organic matter in ocean sediments and petroleum
Origins and evolution of Life on the prebiotic Earth
Evaluating impacts of ocean acidification
Identifying sources and fates of ocean pollution

PUBLICATIONS AND SERVICES

Engel, M.H. and S.A. Macko, eds. (1993). Organic Geochemistry, Principles and Applications. Plenum Publ., New York, NY, 861p.
Engel, M.H. and S.A. Macko (1997) Isotopic evidence for extraterrestrial nonracemic amino acids in the Murchison meteorite. *Nature* 389:265-268.
Engel, M.H., S.A. Macko and J.A. Silfer (1990). Carbon isotope composition of individual amino acids in the Murchison meteorite. *Nature* 348:47-49.
Engel, M.H. and S.A. Macko (1986). Application of stable isotopes for evaluating the origins of amino acids in fossils. *Nature* 323:531-533.
Macko, S.A. and A.E. Aksu (1986). Amino acid epimerization in planktonic foraminifera suggests slow sedimentation rates for Alpha Ridge, Arctic Ocean. *Nature* 322:730-732.

AWARDS AND HONORS

Fellow, Geochemical Society
Fellow, European Association of Geochemistry
Outstanding Teaching Award, University of Virginia
State of Virginia SCHEV, Teacher of the Year
President's Award for Outstanding Research, Memorial University
Program Director, Geobiology, US National Science Foundation
Visiting Scholar, Smithsonian Institution, Washington D.C.
Committee on Education (and Human Resources) EGU and AGU for over 25 years

TWENTY YEARS OF GEOSCIENCE INFORMATION FOR TEACHERS WORKSHOPS

Friedrich Barnikel, Stephen Macko & the Committee on Education

European Geosciences Union
education@egu.eu

The European Geosciences Union (EGU) is the leading organisation for Earth, planetary and space science research in Europe. With our partner organisations worldwide, we foster fundamental geoscience research, alongside applied research that addresses key societal and environmental challenges. Our vision is to realize a sustainable and just future for humanity and for the planet. EGU is a non-profit international union of scientists with about 18,000 members from all over the world.

In the year 2002 the Committee on Education (CoE) was founded under the leadership of Carlo Laj to support active school teachers in (mostly) secondary education, to provide them with up-to-date scientific findings by hands-on activities on the one and top-notch presentations given by experts in the field on the other hand and to enable networking amongst the teachers themselves.

The CoE established Geoscience Information for Teachers (GIFT) workshops, which are being held during large geoscience conferences such as the General Annual Assembly of the EGU in Vienna and numerous scientific meetings all over the World. In its 20 years of its existence, the GIFT workshop initiative has influenced thousands of teachers and tens of thousands of pupils across Europe and worldwide. The EGU web page gives an idea of its major activities: <http://www.egu.eu/education/gift/workshops/>.

Apart from the two virtual workshops during the Covid pandemic in the years 2021 and 2022 the CoE has organized 15 on-site workshops in Vienna/Austria, two workshops in Nice/France, two in Merida/Mexico, and one each in Addis Ababa/Ethiopia, Istanbul/Turkey, Cusco/Peru, Penang/Malaysia and Port Elizabeth/South Africa.

And in the years 2016 and 2017 EGU has already conducted two GIFT workshops in Cape Town, one in cooperation with the 35th International Geological Congress and one in cooperation with the IAPSO-IAMAS-IAGA Joint Conference. In order to follow up on the enormous success of these two workshops EGU decided to establish a series of capacity building workshops in South Africa, starting in 2022. These workshops have been devised to support the regional teaching community to enable them to independently organize and conduct comparable workshops for teachers in the future.

Driving force behind the creation of these workshops has always been emeritus researcher Carlo Laj from the École Normale Supérieure in Paris/France. For most of the twenty years of existence of the CoE he served as their Chair. The idea of a capacity-building workshop was also his project, a second issue of which is planned to take place in Merida/Mexico in autumn 2022.

Another staunch supporter of workshops in South Africa was the late professor emeritus Chris King from Keele University/United Kingdom, also former Chair of the CoE. His legacy will be remembered in some hands-on activities on Day 3, taken from his superb website www.earthlearningidea.com. Check it out!



Wayne Florence

Dr.
 Director of Research and Exhibitions
 Iziko Museums of South Africa
 Twitter: @Dr_Flo_MB

EDUCATION

PhD - Biodiversity and Conservation Biology – Marine Biology (2000 – 2006) University of the Western Cape

CAREER

Curator/Scientist - Marine Invertebrate Collection (2007-2021) Iziko South African Museum
 Head of Department – Natural History (3 month secondment during 2017) Iziko South African Museum

Manager – Natural History (8 month secondment during 2018/2019) Iziko South African Museum

National Research Foundation Designated Authority – Research & Exhibitions (2018-Present) Iziko South African Museum

Director – Research and Exhibition (2021-present) Iziko South African Museum

RESEARCH INTERESTS

Public (SCIENCE) Engagement

- Multiple Public Lectures: eg., Biodiversity, Wet Collections. etc
- Multiple Popular Articles: eg., Lace Corals: True or False?
- Multiple Media interviews including 50/50, SABC News, EWN and regional and national radio

regarding Squid discovery, museum night and exhibitions

- Biodiversity explorer webpage content on Marine Invertebrates and SeaKeys Species Pages
- Several interactive lectures with school groups at Iziko and in situ.

Exhibitions, Educational and Outreach Activities

- JellyWorld Exhibition - raises an appreciation and awareness around the role of jellyfish
- H2O Today Exhibition – Interactive exhibition that focusses on water as the source of life.
- Tata Madiba; Father of our Nation Exhibition – Multi-disciplinary exhibition about Nelson Mandela
- The Sea and Us – Interactive exhibition highlighting the bi-directional effects of man and the sea.
- SeaKeys – An interactive exhibition/educational activity on Oceans research for school learners.
- SeaKeys Project – Showcase of this project that improved decision making towards societal benefit.
- Marine Science – exhibition/educational activity for disadvantaged school learners.
- pHuture Oceans – This exhibition raises awareness about Ocean Acidification (OA).
- Life in the Dark – Exhibition that immerses the visitor into the darkness of the ocean.
- #MyMotherTongue – Social media campaign – public share scientific terms in their mother tongue
- Amanzi e Afrika – Education activity highlights Afrika's water resources.

- Numerous other displays for National Marine Week, Heritage Day, National Museum Day etc.
- The Rocky shore ecology field lectures

PUBLICATIONS AND SERVICES

- W.K. FLORENCE, P.A. HULLEY, B.A. STEWART & M.J. GIBBONS. 2002. Genetic and Morphological Variation of the Lanternfish, *Lampanyctodes hectoris*, (Myctophiformes: Myctophidae) Around Southern Africa. *South African Journal of Marine Science*, 24:193-203
- W.K. FLORENCE, P.J. HAYWARD & M.J. GIBBONS. 2007. Taxonomy of the Shallow Water Bryozoans of the west coast of South Africa. *African Natural History*, 3: 1-58.
- P.D. TAYLOR, A. WAESCHENBACH & W.K. FLORENCE. 2011. Phylogenetic position and systematics of the bryozoan *Tennysonia*: further evidence for convergence and plasticity in skeletal morphology among cyclostome bryozoans. *Zootaxa*, 3010: 58–68.
- W.K. FLORENCE. 2016: Some deep-water cheilostome Bryozoa from the south coast of South Africa. *African Natural History* 12: 05-11.
- ORR, R.J., HAUGEN, M.N., BERNING, B., BOCK, P., CUMMING, R.L., FLORENCE, W.K., HIROSE, M., DI MARTINO, E., RAMSFJELL, M.H., SANNUM, M.M. AND SMITH, A.M., 2020. A genome-skimmed phylogeny of a widespread bryozoan family, Adeonidae. *BMC Evolutionary Biology*, 19(1), pp.1-10.
- GIBBONS, M.J., FLORENCE, W.K., MUSSON, M., BARWISE, C. AND THIBAUT, D., 2020. Creating opportunities through science symposia. *South African Journal of Science*, 116(3/4).
- BOONZAAIER-DAVIDS, M.K., FLORENCE, W.K. AND GIBBONS, M.J., 2020. Novel taxa of Cheilostomata Bryozoa discovered in the historical backlogs of the Iziko South African Museum. *Zootaxa*, 4820(1), pp.zootaxa-4820.
- BOONZAAIER-DAVIDS, M.K., FLORENCE, W.K. AND GIBBONS, M.J., 2020. Zoogeography of marine Bryozoa around South Africa. *African Journal of Marine Science*, 42(2), pp.185-198.
- HAUPT, T., CEASAR, J., STEFANOUDIS, P., VON DER MEDEN, C., PAYNE, R., ADAMS, L., ANDERS, D., BERNARD, A., COETZER, W., FLORENCE, W. AND JANSON, L., 2022. The WIO Regional Benthic Imagery Workshop: Lessons from past IIOE-2 expeditions. *Research Ideas and Outcomes*, 8, p.e81563.
- Book Chapters**
- BOONZAAIER, M.K., FLORENCE, W.K. and JONES, M.S., 2014. Historical review of South African bryozoology: a legacy of European endeavour. *Annals of Bryozoology*, 4, pp.1-34.
- W.K. FLORENCE & L. ATKINSON. 2018: Phylum Bryozoa In: Atkinson LJ and Sink KJ (eds) *Field Guide to the Offshore Marine Invertebrates of South Africa*, Malachite Marketing and Media, Pretoria, pp. 227-243.
- SAMAAI, T., SINK, K., KIRKMAN, S., ATKINSON, L., FLORENCE, W., KERWATH, S., PARKER, D. AND YEMANE, D., 2020. The Marine Animal Forests of South Africa: Importance for Bioregionalization and Marine Spatial Planning. In *Perspectives on the Marine Animal Forests of the World* (pp. 17-61). Springer, Cham.

OVERVIEW TO SOUTH AFRICA'S MARINE BIODIVERSITY AND RESOURCES

Wayne K. Florence

South Africa is considered a megadiverse country in respect of its biodiversity. Despite its relatively small coastline the marine biota supported here is diverse, unique and abundant. At last count, around 12 000 species of marine organisms inhabit our waters of which a high proportion only occur here.

This biodiversity is driven by the dynamic environmental conditions that is influenced by the Agulhas and Benguela Large Current Systems. We have some of the best legislation in the world protecting our marine biodiversity and rely heavily thereon to ensure food security, sustainable agricultural practices, discovery of novel biomedicines, environmental health and climate change and pollution mitigation.

This lecture explores what we know about South African Marine Biodiversity with a special focus on foundational marine biodiversity data associated with natural science collections and what societal benefit is derived from making this information accessible to science and society.



Thandekile Nqubelani

Senior Educator
Iziko Museums of South Africa
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Tel 021-440 3840

EDUCATION: National Diploma in Education
National Diploma in Human Resources and Training Management

CAREER: Senior Educator at Iziko Museums of South Africa

RESEARCH INTERESTS:

Participates in an ongoing research on how Education plays a role in development of Exhibitions

Participated in research on bringing innovative and creative ways in how museums improve its outreach programmes

Participated in research on how to decolonise Museums

Participated in research on audience development for the Museums

Participated in research on how to maximise use of collections in Museum Education

I would very much love to learn effective ways to employ when teaching special needs learners in a Museum setting.

AWARDS AND HONORS

In 2019 I was nominated as one of the pre-jury candidates for the Goethe Science Film Festival in Africa.

In 2021 I was one of the Line Managers who coordinated the Presidential Employment Stimulus Programme for Interns, at Iziko Museums, natural history.



Wendy L. Taylor

Dr.

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Arizona State University
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EDUCATION

Ph.D., M.S. Geosciences, University of Rochester, Rochester, New York, USA
B.S. Geosciences, State University of New York, Fredonia, New York, USA

CAREER

1995-1999, Collections Manager, Paleontological Research Institution, Ithaca, New York, USA
2000-2002, Collections Manager, Field Museum of Natural History, Chicago, Illinois, USA
2002-2006, Project and Collections Manager, University of Chicago, Chicago, Illinois, USA
2006-present, Researcher and Learning Designer, Arizona State University, Tempe, Arizona, USA
2013-present, Honorary Research Associate, University of Cape Town, Rondebosch, South Africa

RESEARCH INTERESTS

Invertebrate paleontology focusing on the evolution of early life (northern Norway and South Africa), geoscience education and literacy, learning design, and virtual field trips (VFTs)

PUBLICATIONS AND SERVICES

Lead SME (subject matter expert) for the award winning online game, *Surviving Extinction*, Arizona State University; <https://vft.asu.edu/survive/> (game link) and <https://mediaplus.asu.edu/lti/embedded?id=a1003521-bb1e-4543-81ae-b7b8c4ccc11b&siteId=61e0606e-415d-4001-8206-ffde48430c64> (game trailer)
Mead, C., Buxner, S., Bruce, G., Taylor, W.L., Semken, S. and Anbar, A.D., 2019, Immersive, interactive virtual field trips promote science learning, *Journal of Geoscience Education*, 67(2), 131-142. Outstanding Paper Award 2020, DOI: [10.1080/10899995.2019.1565285](https://doi.org/10.1080/10899995.2019.1565285)

AWARDS AND HONORS

2022 Geological Society of South Africa, IGC35 Legacy Foundation Grant, *Science storytelling through puppetry: Pterosaurs take to the skies to inspire young learners*, Univ. of Cape Town, RSA
2022 African Scholars Award, *Safeguarding African type collections: The Field Museum as a supporter of museum capacity building in southern Africa*, Field Museum of Natural History, USA
2021 Paleontological Society Education Grant, *Science storytelling through puppetry*, USA
2020 NRF-DST Centre of Excellence in the Palaeosciences Grant, *Stratigraphy, palaeontology and geochemistry of the lower Nama Group near Vioolsdrif, Northern Cape*, South Africa, Univ. of Cape Town, RSA

2020 NRF-DST Centre of Excellence in the Palaeosciences Grant, *Puppet Planet Adventures: Science storytelling theatre & video project*, Univ. of Cape Town, RSA
2020 NRF-DST Centre of Excellence in the Palaeosciences Grant, *Museum Technical Education and Communications Hub (MTECH): An online training academy for South Africa and beyond*, now called *PalaeoLink*, Univ. of Cape Town, RSA



Andrew Petersen

University of Cape Town

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EDUCATION:

BSc Honours, PGSDE, MPhil

CAREER

Over the past decade my work has focused on curriculum development, facilitation of teacher professional development programmes and materials development. Working in primary and secondary and teacher education programmes in support of education 2030 and the UNESCO SDG goals. Various approaches were explored in various disciplines including inquiry-based learning, transformative environmental learning and 21st century digital literacy. More recent projects included the development of a Moodle LMS for educators, establishing a global online forum for teacher educators, and the development of a Climate Change and Sustainability Digital Library (CCSDL) for educators.

RESEARCH INTERESTS

Constructivist and Inquiry based learning, climate change education and 21st century digital literacy.

RECENT PUBLICATIONS

2022 in press: Schudel I., Down L., McKeown R., Baumann S., Petersen A. and S. Urenje.

Supporting Education for Sustainable Development through an Online Global Forum for Teacher Educators: An Emerging Community of Practice. Book chapter in volume entitled At school in the world: Developing globally engaged teachers.

2018 Brundrit S., Mukanya R., Petersen A., Swanepoel K. and W. L. Taylor. *The influence of an Education for Sustainable Development eLearning Moodle training course on the pedagogical content knowledge of Intermediate Phase Natural Science teachers in the Western Cape, South Africa.* paper presented at EEASA (Environmental Education Association of Southern Africa) 36th Annual conference, 17-21 September, Livingstone, Zambia.

2017 Urenje S., Brunner W. and A. Petersen. *Development of Fundisana Online: An ESD E-Learning Programme for Teacher Education.* In: Lotz-Sisitka H., Shumba O., Lupele J., Wilmot D. (eds) *Schooling for Sustainable Development in Africa.* Schooling for Sustainable Development. Springer, Cham

2017 Petersen A., Taylor, W. L. and S. Brundrit. *Education for Sustainable Development (ESD) eLearning Moodle Platform for Intermediate Phase Educators.*

2014 Petersen, A., *Computer Supported Collaborative Learning for Climate Change and Sustainability Education.* Short paper accepted for presentation at the 22nd conference of the South African Association for Research in Mathematics, Science and Technology Education. January 2014, Port Elizabeth.

MEMBERSHIP OF RESEARCH ASSOCIATIONS - SAARMSTE, EEASA

- Participation in local, national and international forums on education
- Online Global Forum on Education for Sustainable Development for Teacher Education



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EDUCATION

M.Ed., Environmental Education, Rhodes University, Makhanda, South Africa
B.Ed., University of Cape Town, Cape Town, South Africa
HDE(PG)Primary, University of Cape Town, Cape Town, South Africa
B.Sc., Statistics and Psychology, University of Cape Town, Cape Town, South Africa

CAREER

2004 – date Mathematics and Science Education Specialist, SDU, UCT
This has involved teaching on academic courses and UCT-approved short courses both for in-service teacher training as well as textbook and resource development. Much of the work also involves school-based projects and project management.

1989 – 1997 Project Manager, Old Mutual Computer Centre, St. Francis Adult Education Centre, Langa, Old Mutual Corporate Social Responsibility

RESEARCH INTERESTS

Sustainability education focusing on the use of transformative pedagogies in developing teacher competencies and global citizenship.
Teacher pedagogical content knowledge use in planning for teaching mathematics and science

PUBLICATIONS AND SERVICES

- 2020 Book Chapter. Title: *Teacher contexts as amplifiers and filters to environmental PCK within a professional development system*. Authors: Susan Brundrit and Dr Ingrid Schudel.
- 2019 Paper presented at WALs2019 (World Association of Lesson Study) 3-6 September, Amsterdam, Netherlands. Title: *Case study of teachers crafting Mathematics lessons using a learning study model in two South African schools*. Authors: Susan Brundrit and Anthea Roberts.
- 2018 M.Ed Thesis. Title: *A case study of emergent environmental pedagogical content knowledge in a Fundisa for Change teacher professional development course*.
- 2018 Lead author on paper presented at EEASA (Environmental Education Association of Southern Africa) 36th Annual conference, 17-21 September, Livingstone, Zambia. Title: *The influence of an Education for Sustainable Development eLearning Moodle training course on the pedagogical content knowledge of Intermediate Phase Natural Science teachers in the Western Cape, South Africa*. Authors: Susan Brundrit, Ronald Mukanya, Andrew Petersen, Khuthala Swanepoel, Wendy L. Taylor



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EDUCATION

BSc.(Ed), BEd.(HONS), MEd.(Science), University of the Western Cape, Bellville, SA

CAREER

1996 – 1998: Laboratory assistant in experimental research and data analysis at Nuclear Physics Division, National Accelerator Centre (NAC) currently known as ITHEMBA LABS - (University Vacation job)

1996 – 1998: Physics 101 assistant demonstrator at the Physics Department – 1st Year Lab, University of the Western Cape - (Work-study post)

1997 – 1999: Physical Science (NQF4) & Mathematics (NQF2) teacher at Luyolo Adult Learning Centre, Gugulethu (Part-time teaching)

2000 – 2013: Mathematics (NQF 2), Physical Science (NQF 4) and Mathematics & Mathematical Sciences; Natural Sciences (ABET Level 4) at Nolungile Adult Learning Centre, Site C, Khayelitsha (Part-time teaching)

2002: Mathematics (Grade 8 & 10) teacher at Harry Gwala Secondary School, Khayelitsha

1999 – 2006: Mathematics (Grade 8) & Physical Science (Grade 10-12) teacher at Simunye High School, Delft Main Road, Delft South. Acting HOD in Maths & Science Department by internal arrangements in 2005

2007 – present: Education Specialist at Schools Development Unit, University of Cape Town performing duties that includes lecturing and convening an Advanced Certificate in Education (ACE) courses; External moderator for the PGCE Physical Science module(s) of the University of Stellenbosch (US), Cape Peninsula University of Technology (CPUT) and University of the Western Cape (UWC); Materials development and research; Field work delivery such as teacher training courses at CTLI; Manager of the university's Short Courses from January 2020; Stream leader of the Natural Sciences at the Intermediate to Senior Phase levels from January 2021 etc.

RESEARCH INTERESTS

Implementing transformative pedagogies to support an integration of Energy and Change topics with Environmental Education in the Senior Phase.

PUBLICATIONS AND SERVICES

Dolo, G., Haglund, J., & Schönborn, K. J. (2018). Thermal Cameras as a Semiotic Resource for Inquiry in a South African Township School Context. *Designs for Learning*, 10(1), 123–134. DOI: <http://doi.org/10.16993/dfl.96>



Moagabo Ragoasha

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EDUCATION

Co-badged Doctor of Philosophy (PhD) in Physical Oceanography

January 2020

University of Cape Town (UCT), South Africa and Université de Bretagne Occidentale (UBO), France

Master of Science (MSc) in Ocean and Climate Dynamics

2015

University of Cape Town (UCT), South Africa

Bachelor of Science (BSc) Honours (First Class) in Ocean and Atmosphere Science

2013

University of Cape Town (UCT), South Africa

Bachelor of Science (BSc) in Environmental and Geographical Sciences, Ocean and Atmosphere Science

2012

University of Cape Town (UCT), South Africa

Matriculated: National Senior Certificate

2009

St. Bede's High School, South Africa

CAREER

University of Cape Town, Department of Oceanography & Biological Sciences

April 2021- present

Lecturer

Marine and Antarctic Research for Innovation and Sustainability, UCT

August 2020 - present

Marine consultant

SAEON-NRF

Jul 2020- Feb 2021

Postdoctoral Research Fellow

University of Cape Town, Department of Oceanography

Feb 2020 - Jun 2020

Postdoctoral Research Fellow

Rhodes University, DIFS

Oct 2020 - present

Visiting Lecturer

University of Cape Town, Department of Oceanography

Feb 2014 – Nov 2014

Student Tutor for SEA2004F and SEA2005S course

South African National Antarctic Programme

Apr – May 2013-2014

Physical Oceanographer

RESEARCH INTERESTS

My research interests include the ocean & atmospheric modelling of the South African economic exclusive zone (EEZ), the physical connectivity between Agulhas and the Benguela system, and the anthropogenic influences on the coastal environment. I study the ocean currents on the west coast of South Africa, what drives them and their influence on important ecological processes, including the dispersal of marine larvae.

AWARDS AND HONORS

- • MG200 Young South African Finalist - 2020
 - • Oceanography Departmental Postdoctoral Fellowship - 2020
 - • NRF Innovation Postdoctoral Award - 2020
 - • Golden Key Honour Society - 2016
 - • DAAD-NRF in-Country PhD Scholarship - 2015
 - • “Allocations de recherche pour une thèse au Sud” IRD PhD Grant - 2015
 - • Carnegie Undergraduate Scholarships for Women in Science and Engineering – 2011
 - • Science Faculty Entrance Scholarship - 2010
- .

WHEN THE WARM EAST MEETS THE COLD WEST: REGIONAL OCEAN CURRENTS

Moagabo Ragoasha

The ocean is in motion in the form of currents, waves and tides. Ocean currents are like highways for marine life, ushers of heat, and drivers of storms. Ocean currents don't just move water. They also move people and goods, as well as pollution and debris. To better understand and how the currents move people and things, there is a need for currents and tides data. This data guides safe navigation of coastal waters, search and rescue missions, disaster clean-ups and the designs of coastal development projects.

There are two types of ocean currents: 1) the swift wind-driven surface currents which are confined in the upper 1-km depth, and 2) the density-driven circulation that is full depth and slow. The ocean currents are influenced by the atmosphere.

In this talk, the regional surface ocean currents namely the warm Agulhas Current system and the cold Benguela Current system are presented. The Agulhas Current is found on the western side of the south Indian Ocean and is responsible for the transport of the equator to the polar region. While, the Benguela Current is located on the eastern side of the south Atlantic Ocean and it transport cold water from the poles towards the equator. Both currents have an influence of both the regional weather and climate. The Benguela Current system is very productive and supports large fisheries.



Takunda Yeukai Chitaka

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EDUCATION

2016 – 2020 | University of Cape Town | PhD in Chemical Engineering
2014 – 2015 | University of Cape Town | MPhil Specializing in Sustainable Mineral Resource Development
2010 – 2013 | University of Cape Town | BSc (Hons) in Chemical Engineering

CAREER

2021 – present | African Circular Economy Network | Postdoctoral Research Fellow
2020 – present | University of the Western Cape | Postdoctoral Research Fellow
2019 – 2020 | Massey University | Visiting PhD Fellow

RESEARCH INTERESTS

Marine plastic pollution
Life cycle management
Waste management
Circular economy

PUBLICATIONS AND SERVICES

Chitaka, T.Y., and von Blottnitz, H. 2019. Accumulation and characteristics of plastic debris along five beaches in Cape Town. *Marine Pollution Bulletin*, 138, pp 451 – 457.
Chitaka, T.Y. and von Blottnitz, H. 2021. Development of a method for estimating product-specific leakage propensity and its inclusion into the life cycle management of plastic products. *The International Journal of Life Cycle Assessment*, 26, pp 1431 – 1438

AWARDS AND HONORS

2019 Association of Commonwealth Universities Blue Charter Fellowship
2019 PETCO Excellence in Academia Award

PLASTIC POLLUTION ON THE BEACHES OF CAPE TOWN

Takunda Chitaka

Marine plastic pollution has been a global concern for many decades. In South Africa, an estimated 15 000 – 40 000 tonnes of pollution flows into the ocean per year. Beach accumulation surveys are often used to estimate plastic flows into the marine environment. They can be used to estimate the quantity and characteristics of litter at a particular point in time or to estimate litter flows into the marine environment.

In our work, situated in Cape Town, two series of beach surveys were conducted across five beaches with varying catchment area characteristics in Cape Town, over two periods in 2017 and 2018 – 2019 respectively. Daily accumulation rates varied across all sites ranging from 38 – 2962 items.day⁻¹.100m⁻¹ during the first sampling period and 305 – 2082 items.day⁻¹.100m⁻¹ during the second. Plastic was the major contributor accounting for 85.6 – 98.9% of all items by count.

Despite the variations in litter accumulation rates and composition, there was significant commonality in the items which were identified as major contributors. The top 12 most prevalent and abundant identifiable plastic items accounted for 43 – 66% during the first sampling period, and 41 – 73% during the second. The majority were associated with food consumed on-the-go, including beverage bottle lids, polystyrene food containers, single sweet wrappers, snack packets and straws. This indicates the high litterability of these items.





Peter Ryan

Professor

Director of the FitzPatrick Institute of African Ornithology
University of Cape Town

RESEARCH INTERESTS:

My research mainly focuses on understanding and managing environmental issues, primarily those that affect birds, including plastic pollution at sea, island restoration, impacts of fisheries on seabirds, and collision risk of power-lines and other infrastructure for large terrestrial birds. My main scientific contributions have been on:

- 1) the impact of ingested marine debris on seabirds and the broader marine debris question;
- 2) the impacts of long-lining and other seabird-fishery interactions on seabird populations, and promotion of measures to reduce seabird bycatch; and
- 3) the impacts of invasive species on island birds, and their recovery following restoration.

PLASTIC-RELATED COMMITTEES AND ACTIVITIES:

Member of NOAA Technical Advisory Committee on Marine Debris Monitoring in APEC countries (2022)

Member of the UN's GESAMP Working Group 40 on sources, fate and effects of plastics (2021-23)

Member of IOCCG Task Force on Remote Sensing of Marine Litter and Debris (2021-2022)

Scientific Advisory Committee for the EUROpean Quality Controlled Harmonization Assuring Reproducible Monitoring and assessment of plastic pollution (EUROqCHARM, 2020+)

Chair of the Group of Experts on Marine Litter for WIOMSA/UNEP (2019-present)

Member: UN Environmental Assembly Expert Group on Marine Litter and Microplastics (2019)

Member of the SCOR Working Group 153: Floating Litter and its Oceanic Transport Analysis and Modelling (FLOTSAM) (2017-present)

Member of the UN's GESAMP Working Group 40 on monitoring plastics (2017-19)

Member of the UN's GESAMP Working Group 40 on microplastics (2012-14)

Member of the Editorial Board, Marine Debris Worldwide (1995-96)

Chair, working group on plastic impacts at the Third International Conference on Marine Debris (1994)

SELECTED RECENT PUBLICATIONS ON PLASTICS IN THE ENVIRONMENT

I have published over 480 papers in peer-reviewed journals (H-index 79), including 70 on plastics in the environment. The following lists relevant papers published since 2021.

Honorato-Zimmer, D., Weideman, E.A., Ryan, P.G. and Thiel, M. in press. Amounts, sources, fates and ecological impacts of marine litter and microplastics in the western Indian Ocean region: a review and recommendations for actions. *Oceanography and Marine Biology: an Annual Review*

Robuck, A.R., Hudak, C.A., Agvent, L., Emery, G., Ryan, P.G., et al. 2022. Birds of a feather eat plastic together: High levels of plastic ingestion in Great Shearwater adults and juveniles across their annual migratory cycle. *Frontiers in Marine Science* (719721)

Maclean, K., Weideman, E.A., Perold, V. and Ryan, P.G. 2021. Buoyancy affects stranding rate and dispersal distance of floating litter entering the sea from river mouths. *Marine Pollution Bulletin* 173: 113028.

Yamashita, R., Hiki, N., Kashiwada, F., Takada, H., Mizukawa, K., et al. 2021. Plastic additives and legacy persistent organic pollutants in the preen gland oil of seabirds sampled across the globe. *Environmental Monitoring and Contaminants Research* 1: 97-112

Ryan, P.G., Weideman, E.A., Perold, V., Hofmeyr, G.J.G. and Connan, M.L. 2021. Message in a bottle: assessing the sources and origins of beach litter to tackle marine pollution. *Environmental Pollution* 288: 117729.

Connan, M., Perold, V., Dilley, B.J., Barbraud, C., Cherel, Y. and Ryan, P.G. 2021. The Indian Ocean 'garbage patch': empirical evidence from floating macro-litter. *Marine Pollution Bulletin* 169: 112559.

Ryan, P.G. and Perold, V. 2021. Limited dispersal of riverine litter onto nearby beaches during rainfall events. *Estuarine, Coastal and Shelf Science* 251: 107186.

WHAT A WASTE – PLASTIC POLLUTION UPDATE

Peter Ryan

We're addicted to plastics, the diverse and versatile array of synthetic polymers that are essential to virtually all aspects of modern society. From food security and medicine to construction and transport, we rely on plastics to keep our technology-rich world turning. But the low cost of plastics means that we don't value waste plastics enough to re-use or recycle them. More than 100 million tonnes are used for packaging and other single-use applications every year, creating massive volumes of waste plastic. Much of this ends up in our wetlands and the sea, where it has a host of environmental and economic impacts.



Widespread attention from the media, scientists and even politicians has made plastic pollution one of the hottest conservation issues. Much of the concern centres on the long lifespan of waste plastics, which means that more and more plastic is accumulating in the environment. Plastics degrade very slowly, especially when protected from UV light. In the absence of biological agents, it is likely they will take hundreds or even thousands of years to break down in the cold, dark environments found on the seabed.

Below: Leshia Upfold found these three Cape Gannets entangled in fishing line at Bird Island, Algoa Bay, in November 2006. The central bird was foul hooked by the fishing lure on its breast, and the other two birds were presumably snared subsequently. Such records blur the line between accidental fisheries bycatch and entanglement. It's possible that the struggles of the first gannet contributed to the other two becoming entwined;

Kees Camphuysen reported seeing how four Northern Gannets struggling to free themselves from a net fragment attracted other gannets that then also became caught.



Interestingly, there are indications that plastics might not be entirely immune to biological attack. A bacterium isolated at a Japanese recycling depot has developed a taste for polyethylene terephthalate (PET) and a mutant lab strain is reported to be able to break down plastic bottles in a matter of months. Floating plastic fragments in the mid-ocean gyres have been found with small pits that appear to have been made by bacteria. This might explain why there are fewer very small plastic fragments floating at sea than we expect, given the estimates of how much plastic enters the oceans each year. Plastic-eating bacteria might help to solve our problem with waste plastic, but would create a host of other challenges if plastics designed to last for decades, such as in aircraft or the construction industry, start to decay!

There are other possible explanations for the paucity of small floating fragments at sea. These sediment out of surface waters faster than larger items as they have a greater surface area relative to their volume on which to accumulate a 'biofilm' of marine organisms, increasing their density to the point at which they start to sink. Filter-feeding zooplankton also consume microplastic particles. Animals like copepods excrete plastic in dense faecal pellets that sink into the ocean depths. Similarly, larvaceans trap microplastics in their mucous 'nets', which are sloughed off every day and sink. It seems that most waste plastic ultimately ends up on the seabed.



Left: Rivers carry a great deal of plastic waste from land into the sea, but they also intercept a lot of litter. This tree on the banks of the Jukskei River in Gauteng lies downstream from Alexandra Township and traps vast amounts of waste. One of the impacts of litter is blocking drains, exacerbating flooding during heavy rain.

When it comes to statistics, the sheer volumes of plastic are not in dispute. Around 8300 million tonnes have been manufactured since the 1950s, half of which was made after 2005. Only a quarter is still in use; the other 6300 million tonnes have been written off as waste. Of that, barely a fifth has been recycled, incinerated or converted into liquid fuels through pyrolysis; some 4400 million tonnes are either buried in landfills or floating around in the environment.

Global plastic production continues to grow at about eight per cent per year, with currently some 400 million tonnes being made each year (including roughly 50 million tonnes of synthetic fibres). About 40 per cent is manufactured for single-use applications, mainly packaging, which is typically discarded after use. Africa is responsible for only one per cent of all single-use plastics produced, but five African nations are listed in the top 20 contributors of plastic waste into the sea. South Africa is number 11 on the list of shame, thanks to its combination of a sophisticated packaging environment and poor solid-waste management practices. More than half of all solid waste in South Africa is regarded as mismanaged, compared to 11 per cent in Brazil and only two per cent in the USA.



Above: A 2015 study listed South Africa as the 11th worst nation worldwide for dumping plastic into the sea, mainly because of poor solid-waste management. The UN estimates that more than half of all solid waste in South Africa is mismanaged. Much of the plastic that arrives at landfill sites blows away. This litter-strewn veld is outside the dump in Calvinia. The problem is getting worse as many South African municipalities struggle to cope with the deluge of solid waste.

DOES IT MATTER?

We've known since the 1960s that plastics are damaging to marine animals. Virtually all animals are at risk of becoming entangled in persistent plastic waste. Lost and discarded fishing gear is the main culprit, but other everyday items can cause problems, and not just at sea. In the 1980s, South Africa was proactive in banning six-pack rings, a common source of entanglement for seabirds, ducks, turtles and fish. Balloon ribbons are another largely

avoidable threat, particularly when hundreds of balloons are released en masse. In addition to a host of seabirds and waterbirds, owls and even finches have been found tangled up in these ribbons.

In agricultural areas, discarded twine from hay bales often ends up in the nests of crows and ospreys; in some parts of North America they are known to kill up to 12 per cent of Western Osprey chicks. Kite strings can be equally dangerous, especially in Asia, where ‘manja’ kites with powdered glass glued to their strings maim or kill a host of birds, from vultures to hornbills. To date, more than 260 bird species have been recorded as being entangled in plastic litter, typically condemning the creatures to a slow death unless they are lucky enough to be rescued.

Right: Some birds incorporate plastics into their nests, usually as part of the construction process, but on occasion seemingly for decoration. The Common Noddies that breed on Inaccessible Island, Tristan da Cunha, often bring rope fragments to their nests, sometimes draping them nearby. They are very specific in their colour choice: yellow rope is used more often by the local fishery, but the noddies have only been seen to select green ropes. Using rope and fishing line for nesting material can be dangerous. In 2012, researchers on Robben Island found a Bank Cormorant fledgling that had fallen out of its nest after becoming entangled in fishing line. The chick couldn’t be reached without risking other chicks abandoning their nests, so the researchers could only document its slow death over the next four days. Gannet, osprey and crow chicks often suffer similar fates, although Cape Gannets are much less prone to including plastic items in their nests than their North Atlantic and Antipodean cousins.



Above: Virtually all Great Shearwaters contain some ingested plastic, but this bird trailing a piece of fishing line either was caught on fishing gear or swallowed a hook discarded with fish waste.

But few species are entangled often enough to compromise their populations. The ingestion of plastic items is a more pervasive threat because virtually all individuals in some species eat plastic. Plastic items can block or injure the digestive tract, while large plastic loads can reduce the effective stomach volume, shrinking meal size through a false sense of satiation. However, the most serious issue is thought to be the transfer of toxic compounds to animals. Some plastics contain chemical additives such as plasticisers and flame retardants, and all plastics gradually accumulate persistent organic pollutants as they drift at sea. When ingested, these diffuse into the animals, disrupting their hormone balance and potentially triggering cancers.

The magnitude of this impact depends in part on the time that plastics are retained in the digestive tract and the composition of the gut contents. Species such as petrels and phalaropes that retain plastic in their stomachs for extended periods are at greater risk than those that rapidly regurgitate (for example, gulls and skuas) or excrete ingested plastics (ducks).



Left: A selection of plastic items collected from Brown Skua pellets containing the remains of Great Shearwaters on Inaccessible Island in 2004. Great Shearwaters mostly ingest hard plastic fragments, with only a few fibres and no plastic bags.

The proportion of industrial pellets (bottom right) has decreased steadily since the 1980s.

Waste plastics also impact on people. They reduce the aesthetic appeal of natural areas, affecting tourism and the businesses that rely on coastal recreation. In South Africa alone, we spend more than R100-million a year cleaning beaches. Waste plastics also block storm-water drains, exacerbating flooding during rain storms. Perhaps most worryingly, they affect human health. Informal burning of plastic waste releases toxic gases such as dioxin and furan into the environment. And as top marine predators, we are exposed to the toxic compounds that plastics introduce into marine food webs.

Right: Not all plastics float: drinks bottles (PET), disposable cutlery (polystyrene) and cable ties (polyamide) are all denser than seawater. They don't disperse as far from source areas as litter items made from less dense polymers, but are joined by other litter items that become weighed down by fouling organisms after a few weeks in the sea. This foul mess is easily overlooked as it swills around on the sea floor in bays close to urban centres, but intense upwelling occasionally pushes it ashore. This collection of more than 8000 plastic items washed ashore on just 130 metres of rocky shoreline at Muizenberg corner in November 2017. We usually only find about 300 litter items in monthly clean-ups at this site.



Below: In many urban areas, if you dive offshore you are more likely to see plastic than fish.



Every breath you take... Microfibres are everywhere

Richard Thompson from the University of Plymouth and his colleagues drew the world's attention to microplastics in the early 2000s. They found tiny pieces of plastic that are too small to see in plankton and sediment samples collected throughout the world's oceans. Many of these items were fibres from clothing – a mix of polyester (including PET), acrylics, polypropylene and polyamide ('nylon') – that get into waste water when clothes are washed. Some fibres are removed in water treatment works; a recent study found that up to 90 per cent of microplastics are retained in sewage sludge. This is often used as fertiliser, with an estimated 60 000 tonnes of plastic going onto agricultural land in Europe each year. To put this in context, the entire Pacific garbage patch contains around 70 000 tonnes of plastic! We have very little idea of what the impact of all that plastic is on soil biotas. Microfibres are ubiquitous at sea. About 70 per cent of small pelagic fish in the Benguela upwelling region contain fibres in their guts. But fibres are continuously being released from our clothes and other materials to the extent that microplastic researchers have to take special precautions to prevent aerial contamination of their samples. Microfibres are found in most samples of tap water, beer and table salt, and we doubtless breathe them in every day.

Left: Microfibres filtered from 20 litres of the Southern Ocean during the Antarctic Circumnavigation Expedition in 2017/2018. A recent study found that polar waters have the highest concentrations of microfibres globally. Many of these fibres seem to be from natural products like cotton and wool. We surmise that even natural fibres take a long time to degrade in cold polar waters.

MAKING A DIFFERENCE

Many people equate tackling the plastic problem with banning the use of plastics in high-risk applications. This can be effective; consumer pressure has pushed some manufacturers to phase out the use of microbeads in cosmetics and hopefully this year Johnson & Johnson will stop producing plastic earbuds, which are so commonly found littering many beaches. The 'Strawless in Seattle' campaign used endorsements by celebrities and professional sports franchises to have straws banned from hundreds of venues, giving impetus to similar anti-straw initiatives around the world. And after a protracted legal battle, New York has finally succeeded in prohibiting the use of polystyrene clamshells in the fast-food industry.

Plastic carrier bags have attracted most attention. Globally, we use in excess of one trillion bags each year. This rate of use is enough to create a line of bags encircling the earth every hour. To date, more than 60 countries have instituted measures to limit the use of plastic bags. South Africa was one of the first to do so, requiring a minimum charge for carrier bags in 2003. This initially reduced the numbers of bags being issued by retailers, but a lack of enforcement and the failure of the price levied on bags to keep pace with inflation have resulted in a steady upward creep in carrier bag use.

Activists are calling for a complete ban on carrier bags, but these comprise only three per cent of the flexible packaging washing up on South African beaches. To make a real difference, we have to rethink the way we package products and how we manage our solid waste. Costa Rica plans to phase out all single-use plastics by 2021, but this fails to acknowledge that plastics are often the best material, even in single-use applications. For example, plastic contributes materially to food security by increasing the shelf life of fresh produce. Replacing plastics with alternative products will have an even greater environmental impact. The problem lies with people, not with plastics.



Above: Plastic pellets or 'nurdles' look like hail in Durban Harbour after 49 tonnes of pellets were lost from a container ship during a storm on 10 October 2017. Most of the pellets were swept out to sea and spread along the coast as far as the Western Cape and central Mozambique.

Pellets are the first step in the plastic production chain and are shipped from manufacturers to converters, who use them to make the plethora of plastic consumer products. Numerous small spillages during shipping and handling made pellets the most abundant plastic pollutants at sea during the 1970s and 1980s, but programmes such as Operation Clean Sweep initiated by the plastics industry have greatly reduced their loss in recent years. Partly as a result of this intervention and partly because fragments of other plastic items have become more common at sea, the proportion of pellets ingested by seabirds and baby turtles has decreased sharply over the past few decades.

Pellets – many of them dating back to the 20th century – remain common on some beaches, but the 2017 spill dumped roughly two billion pellets into the sea, more than the total number of pellets on all South African beaches. Despite a protracted clean-up effort, fewer than 15 tonnes were recovered.

Tackling waste plastic is a ‘wicked’ problem; there is no simple solution. It will require concerted efforts from all sectors of society to transform. Government has a key role to play at both national and local levels to change how we deal with solid waste. Municipalities are pivotal – they need to make it easy for everyone to sort their rubbish at source for reuse and recycling and to provide strong incentives to do so. And it’s in their interest to do so, as landfill becomes increasingly costly in many cities. Manufacturers need to be held responsible for their products beyond the point of sale, the so-called extended producer responsibility. Many products are very difficult to recycle because they consist of layers of different materials or are heavily inked.

Consumers have the power to influence retailers by refusing to buy inappropriately packaged products. The current focus on plastic pollution is long overdue. However, I can’t help but think there’s an element of displacement activity, of fiddling while Rome burns. Plastic pollution is a significant environmental problem, but it’s not in the same league as human population growth, consumerism and climate change. Maybe if we can all pull together to tackle the plastic problem, we can set our sights on the really big issues confronting humanity and the future of life on earth.

Right: The gizzard or muscular hind-stomach of a White-chinned Petrel packed with plastic fragments. Petrels have a constricted pyloric sphincter between the stomach and small intestine that restricts the passage of hard prey remains and plastic. A recent study found that Northern Fulmars can regurgitate plastic from their fore-stomach and this might help to explain why ingested plastic loads in seabirds have remained more or less constant over the past few decades.



DO MORE...

If you want to get your hands dirty, start a local clean-up programme. Beach clean-ups are popular and serve two important functions. Firstly, they are a great way to sensitise people to the problem. After you've spent a few hours picking up hundreds of straws, lids, earbuds and sweetwrappers, you are more likely to think twice before littering. But more importantly, clean-ups intercept litter before it has the chance to break down into microplastics. Once that happens, it is almost impossible to capture.

If you don't live near the coast, don't despair – you can do clean-ups anywhere and also make a difference. Adopting a stretch of river is a great idea, because river litter typically ends up in the sea. But even your local area would benefit from a regular clean-up. If left in the street, litter eventually washes down storm-water drains and into rivers. Challenge your neighbours to join you for a clean-up – you'll build a sense of community while you're helping the environment.

READ MORE...

There's a wealth of information on plastics and their environmental impacts – some good, and some decidedly sensationalised.

If you want a balanced overview of the impacts and abundance of plastics in the sea, download a copy of Melanie

Bergmann, Lars Gutow and Michael Klages's 2015 openaccess book Marine Anthropogenic Litter (<https://link.springer.com/book/10.1007/978-3-319-16510-3>).

Although it's already a bit dated in the fast-paced world of marine plastic research, it provides an overview of the science of plastics in the sea. Michael Wagner and Scott Lambert's 2018 book, Freshwater

Microplastics: Emerging Environmental Contaminants?

(<https://link.springer.com/book/10.1007/978-3-319-61615-5>)

summarises the much smaller amount of literature on freshwater systems.

In 2018, the UN Environment Programme released two very useful and readable reports. Single-use Plastics: A Roadmap for Sustainability (<http://wedocs.unep.org/handle/20.500.11822/25496>) addresses the problem of single-use plastics, pulling together case studies from around the world.

Exploring the Potential for Adopting Alternative Materials to Reduce Marine Plastic Litter (<http://wedocs.unep.org/handle/20.500.11822/25485>)

examines the options for replacing plastics in litter-prone applications. It highlights

exciting new packaging options derived from plant wastes, seaweed and even fungi. However, it also cautions against

excessive reliance on so-called bioplastics, most of which break down slowly under environmental conditions and

compromise mixed-plastic recycling efforts. They should not simply be substituted for plastics in litter-prone applications.



John Rogers

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University of Cape Town
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EDUCATION

Schooling in England, Northern Ireland and South Africa (Free State).
South African Navy training.
BSc and BSc (Honours) in Geology at UCT. MSc and PhD in Marine Geology at UCT.

CAREER

Research Officer at UCT in Marine Geoscience Unit, taking part in numerous research cruises aboard UCT's research vessel, the THOMAS B. DAVIE, sampling the seafloor sediments and rocks from Mozambique to Angola off South Africa and Namibia.

Senior Geologist in the Council for Geoscience of South Africa (formerly the Geological Survey of South Africa). Led research programme, based on hundreds of boreholes in Cenozoic sediments of the coastal plain of the Western Cape.

Senior Research Officer and Lecturer at UCT, studying manganese nodules in deep-sea sediments SW of Cape Town and lecturing both Geology and Civil Engineering students from first-year to fourth-year (Honours). Supervised MSc and PhD students.

RESEARCH INTERESTS

Sediments of the coastal plain and the continental margin, as well as manganese nodules on the continental rise and the abyssal plain.

PUBLICATIONS AND SERVICES

Geological Adventures in the Fairest Cape: Unlocking the Secrets of its Scenery.
Council for Geoscience: Pretoria, 323pages. Published in June, 2018. 800 copies printed.
Sold out April, 2022.

AWARDS AND HONOURS

Fellow of the Geological Society of South Africa.

Life Member and Co-Founder of the Western Cape Branch of the Geological Society of South Africa.

OVERVIEW OF SEA POINT CONTACT

John Rogers

The Sea Point Contact is a world-famous GeoSite for several reasons.

In the 19th Century (1800s) there was a bitter controversy, in the early years of the discipline of Geology.

A highly respected sedimentologist and mineralogist in Freiberg (Germany), Professor Abraham Gottlob Werner, founded the school of thought called Neptunism. The name came from Neptune, the Roman God of the Sea, because Werner believed that each and every rock in the world was deposited under the sea.

The opposing school of thought, led by the 18th Century Scottish pioneer geologist, Dr James Hutton, was named Plutonism, after Pluto, the Greek God of the Underworld, which is a very hot place!

The Plutonists believed, from studying active, red-hot volcanoes and cooled volcanic rocks like basalt, abundant in the Drakensberg, that some rocks had been intruded as red-hot magma (molten rock).

The Sea Point Contact provides excellent outcrops of siltstones of the Malmesbury Group's Tygerberg Formation, about 560 million years old, intruded, deep within the continental crust (about 35 km thick) by the younger Cape Granite (540 million years old). We shall see this evidence at the Sea Point Contact.

Professor Sharad Master of the University of the Witwatersrand's School of Geosciences published a paper in 2009, explaining the global importance of the Sea Point Contact:

<https://www.cambridge.org/core/journals/earth-and-environmental-science-transactions-of-royal-society-of-edinburgh/article/abs/plutonism-versus-neptunism-at-the-southern-tip-of-africa-the-debate-on-the-origin-of-granites-at-the-cape-17761844/F63CFB72AE9CE2B8931B1F5239560918>

It is important to know that Charles Darwin, the main protagonist of the Theory of Evolution, at the time a self-educated geologist, visited the Sea Point Contact in June, 1836. This was during the final leg of the 5-year, round-the-world voyage of Her Majesty's Ship (H.M.S.) BEAGLE.

By then he had personally witnessed a highly explosive volcano erupting in Chile on the SW coast of South America, as well as a violent earthquake, also in Chile.

I have seen the sample of Migmatite that Darwin collected at this contact, in the Sedgwick Museum of Earth Sciences in Cambridge in England.

So, we tread in the footsteps of Geological Giants at the Sea Point Contact!

DARWIN AS A GEOLOGIST

John Rogers

When one thinks of the ‘naturalist’ Charles Darwin, it is his contribution to our understanding of how living creatures evolved that casts anything else he might have done into the shadows. But Darwin’s skills were certainly not limited to theorising on the survival of the fittest nor were his eyes fixed only on living creatures as he embarked on his epic voyage on the HMS Beagle in 1831. He was, in fact, a skilled and influential geologist whose work continues to resonate in the field. He was, for example, the first to make a geological cross-section of the Andes mountains in South America. He also made important observations on the development of volcanoes and was able to add to the explanations around the occurrence of coral atolls.

Darwin was born just over 200 years ago on 12 February 1809 and lived as a child in Shrewsbury on the eastern border of North Wales. He went to Edinburgh University at the age of 16, to train as a medical doctor like his father and grandfather before him. While there, he attended lectures in geology, palaeontology, crystallography and mineralogy. Unfortunately, one geology professor, Robert Jameson, was so tedious and dull that Darwin vowed never again to read a book on the subject. Not enjoying his medical studies, he dropped out of Edinburgh University in 1827, at the age of 18. He then went to Cambridge University to study for a BA. His mentor was Professor John Henslow, a mineralogist and botanist, who often invited Darwin to his home to meet famous scientists and often went on long walks with him, so much so that other professors called Darwin, ‘the man who walks with Henslow’. Henslow persuaded Darwin that he simply had to have a foundation in geology and offered to train him privately. Darwin then bought a clinometer and practised using it by tipping the tables in his room, back home in Shrewsbury, to many different angles, so that he could write to Henslow, ‘I will venture to say I have measured them as accurately as any Geologist could do’.

During the summer of 1831, Henslow asked Adam Sedgwick, then in his heyday as a professor of geology at Cambridge, to take Darwin with him to North Wales, despite Darwin never having attended Sedgwick’s lectures. In early August of that year, Sedgwick and Darwin rode on horseback into the Welsh hills, where Sedgwick trained Darwin to become a field geologist. He later wrote to Henslow from Rio de Janeiro in Brazil in May 1832 ‘...(Sedgwick) does not know how much I am indebted to him for the Welch (sic) expedition, – it has given me an interest in geology, which I would not give up for any consideration...Tell him that I have never ceased being thankful for that short tour in Wales’. At about the same time, the first volume of the first edition of Charles Lyell’s famous book *Principles of Geology* was published. This became Darwin’s geological Bible.

On returning home, Darwin received a very important letter from the Admiralty, via Henslow, inviting him to participate in a two-year circumnavigation of the world, at his own expense, aboard the HMS Beagle, as a gentleman companion to the hydrographer, Captain Robert Fitzroy. The invitation was from Francis Beaufort, the Hydrographer of the Admiralty. Darwin accepted the invitation and the voyage began on 7 December 1831 in Plymouth and lasted, in the end, for nearly five years. The journey, which came to an end on 2 October 1836, included an 18-day stopover in Simon’s Town. The epic journey on the HMS Beagle had some extraordinary geological highlights for Darwin including the discovery of a giant extinct sloth in soft rock off the coast of Chile and personal experiences of both a massive earthquake and an erupting volcano. He was not only the first scientist to make a geological

crosssection of the Andes, he also found a forest of silicified trees, since dated by South American geologists as Triassic, still known as the Darwin Forest.

The forest is still marked with an appropriate plaque, erected in 1909, honouring Carlos Darwin, 100 years after his birth. Darwin had longed to see a coral reef and, around the Polynesian island of Moorea, he saw surf breaking on a fringing reef and a lagoon with transparent water surrounding a volcanic island. Darwin had studied Lyell's views on corals, the living polyps of which can only live in the warm, transparent, illuminated surface waters of the ocean. In Lyell's view their circular shape meant that they grew around the rims of submerged volcanic craters. In contrast, Darwin modified his mentor's ideas and concluded that the atolls originally were fringing reefs around a since-sunken volcanic island. After leaving the Cocos Islands, off Indonesia, the Beagle crossed the Indian Ocean to reach Mauritius off the east coast of Madagascar on 24 April 1836. Being on the homeward leg of the voyage, Darwin was starting to think of his post-Beagle future. He wrote from Mauritius to his sister, Caroline: 'I am in high spirits about my geology, – and even aspire to the hope that my observations will be considered of some utility by real geologists'.

Two centuries later, real geologists consider Darwin's contribution to their field to have been very significant indeed.



Vincent Meyburgh

Founder and Artistic Director
Jungle Theatre Company
22 Wherry Road, Muizenberg
Tel. 7945 082 253 9619
Email: vincent@jungletheatre.co.za

EDUCATION AND QUALIFICATIONS:

- 1993 Performers Diploma, University of Cape Town.
- 1991 Acting Diploma from Mountview Academy of Theatre Arts London, UK.
- 1990 Matriculated from Pretoria Boys High School

PROFESSIONAL DEVELOPMENT WORKSHOPS AND TRAINING ATTENDED (SINCE 2011):

- 2013/4 Landmark Forum – Introduction / Advanced / seminar series
- 2011 Children's Right workshops at PASCAP
- Participation in ASSITEJ Conference in Malmo, Copenhagen
- ACT Master Class - Introduction to Leadership in the Arts

PROFESSIONAL ACTING/DIRECTING/MENTORING (SINCE 2011):

Directed and performed *Healthy Bird*

- 2020 Directed audios of *River of Life & The Magic Shell*
- 2019 Mentored JTC Capacity Training Programme including two new JTC productions
i.e. *Mantis and the Bee* and *Dassie's Tale*
- 2018/9 Mentored JTC's performing arts clubs
- 2019 Performed *Python and the Qunube Tree* at the Zabalaza Festival
- 2018 Directed "How Elephant Got its Trunk"
- 2018 Directed *"Toe Leeu Kon Vlieg"* schools tour 2017 Performed *"The Magic Shell"*
Masque Theatre
- 2016 Directed and performed *"Butterfly Dreams"* National Arts Festival Main
Festival
Researched, scripted and Directed *"When Lion Had Wings"* Cape Town Fringe
Festival
Performed *"The Whale Show"* for City of Cape Town environmental department
Mentored George Mkhululi Smith and Aspihe Lili in the development of a new work
called *"Ngannono"*
- 2015 Scripted and performed *"How Stories Began"* Masque Theatre
Scripted and directed *"Hoerikwaggo"* schools tour
Scripted and performed *"The Whale Show"* schools tour 2014 Performed
"Hoerikwaggo" schools tour
Scripted *"When Lion Could Fly"* published by Junkets.
Directed, Scripted and performed *"!Kai – A Little Death"* festival tour
- 2013 Mentorship of emerging director: *"Sister Earth"*

- Scripted and performed ***“Indlovu People”*** at the Milnerton Playhouse
 Directed and Scripted ***“Spirit of Fire”*** & ***“Spirit of Water”*** in Cape Metropolitan at risk communities
 Performed ***“Falling Moon”*** at National Arts Festival Scripted and directed ***“Top Dog”***, which toured to Soweto Performed ***“Hoerikwaggo”*** at Kalk Bay Theatre
- 2012 Scripted and directed ***“Jungle Jive”*** in the Overstrand Municipality
 Redeveloped ***“Moon In The Sky”*** to the Afrikaans version ***“Vallende Maan”*** – performed at KKNK in Oudsthoorn
 Scripted and directed ***“Metamorphosis”*** at KKNK in Oudsthoorn Performed ***“Vinnie from Zok”*** at the Constantia Waldorf School
- 2011 Directed ***“River of Life”*** and ***“Metamorphosis”***.

FACILITATING / TEACHING EXPERIENCE (SINCE 2011):

- 2019 Facilitated Creating Theatre with Children Module
 2019 Facilitated Youth Performing Arts Programme
 2018 Facilitated Waldorf Intercultural Programme
 Facilitated African Storytelling workshops
- 2017 Facilitated Afterschool Game Changer workshops
 Facilitating Creating Theatre with Children Module
- 2016 Facilitated princess Vlei drama workshops
 Facilitated Muizenberg Performing Arts Club
- 2015 Developed Movement & Mime and Storytelling workshops
 Facilitated princess Vlei drama workshops
- 2014 Facilitated Leopard Toad and Princess Vlei drama workshops
- 2013 Facilitated Muizenberg Intercultural drama programme
 Mentored Fountain of Hope workshop programme
- 2012 Facilitated drama workshops at UNIMA
- 2011 Completed 2 years of training young emerging theatre makers.
 Facilitated drama workshop for young adults working with children at UNIMA

THE WHALE SHOW

Vincent Meyburgh

The Wondering Whale Watchers are crazy characters on a quest to become like whales with hilarious consequences. They swirl the audience into a high-energy comedy adventure juggling to catch food, bubbling under-water music, receiving e-whales from a giant whale puppet called Wanda.

The Whale Show is a family production that uses a large puppetry to enlighten and entertain the audience. The two protagonists have spent so much time with whales they behave just like them and even speak whale language, sharing their awe and wonder of these magical creatures. Themes include similarities and differences between whales and humans, threats to whales and whale facts and figures. The audience is encouraged to think critically about their values and the importance of whale conservation when the audience is invited to stop the giant harpoon.

The Whale Show is 45 minutes in duration and is suitable for Grades R – 3. An accompanying drama skills workshop of 45 minutes is also available.

After a 3 year hiatus The Whale Show, based on Heathcote Williams' 'Whale Nation', returned to the stage in 2011 opening with a run at Kalk Bay Theatre. Created in 2001, the play has toured the National Arts Festival; Out The box festival, the Whale Festival in Hermanus; and numerous schools as part of International Fund for Animal Welfare's (IFAW) outreach education and awareness campaigns including twinning programmes with underprivileged and privileged schools. It has also been included in the YES programme for Marine Week and enjoyed successful public runs in Knysna, Plettenberg Bay and Muizenberg in 2008. In October 2015 The Whale Show traveled to the Overstrand region where it was performed for learners from local schools. The show was last performed at the City of Cape Town, Biodiversity Management Staff at our year end function in November 2016.

Currently starring: Vincent Meyburgh and Ntombifuthi Mhkasibe.

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Department of Arts & Culture

"A most enjoyable experience." Laerskool Gansbaai 2015