

Title: Drivers influencing sponge distribution along South Africa's southern and western shores

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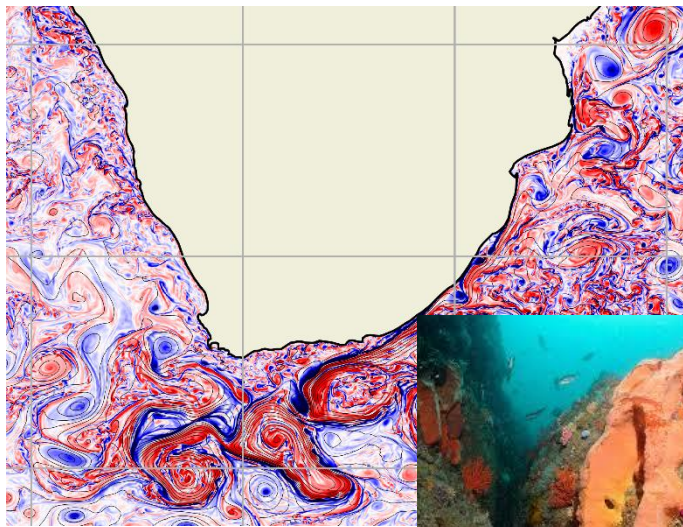
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Keywords: Physical oceanography, ocean models, Lagrangian circulation, particle tracking, sponge connectivity, benthic circulation, Marine Protected Areas

Project Description:

Marine sponges shape marine benthic ecosystems globally. They serve as habitat and nursery to numerous other species and play key roles in nutrient recycling. However, their diversity patterns and habitat status are poorly documented. This project will form part of SponBIODIV Work Package 3 "Connectivity and resilience of sponge ecosystems" (<https://sponbiodiv.org/>) and will contribute to improving our understanding of sponge connectivity along South Africa's coastline. Much remains unknown on the distribution, species composition and biogeographical relationship of the sponge fauna along the South African coast. The environmental factors driving their dispersal and their aggregation on the seabed remains largely speculative. Understanding these drivers however is critical for effective conservation and restoration measures to protect marine sponges and their ecosystems.

The research will 1st focus on characterising the benthic physical environment using a number of indicators such as water temperature, salinity, ocean currents and when available, bio-geochemical



properties along the seabed. While the surface ocean environment has received significant attention from the scientific community, little is known on the nature of the physical oceanic environment near the seabed in South Africa. Increasing our understanding of the oceanographic conditions along South Africa's seabed is important for conservation of all benthic communities but also for the industry sectors such as mineral extraction and telecommunications. The research will then aim to identify the drivers influencing sponge settlement and virtual particle tracking

using ocean model outputs experiments. The knowledge derived from this research will be used to inform the management and expansion of Marine Protected Area networks in South Africa.

Data and Methodology:

Ocean model outputs from the South West Indian Subtropical Gyre (SWAG) simulations will be used. Building upon prior research, the SWAG simulations utilize recent datasets and incorporate the latest advancements in CROCO to execute high-resolution, long-term oceanic simulations spanning from 1993 to 2018. The simulation will be used to characterise the circulation along the South African

continental shelf bed. The analysis will be limited to water depth less than 200m. Any in-situ information available will be exploited to validate the SWAG simulation and further characterise the bottom environment along South Africa's shores. The connectivity of the sponge network will be investigated by undertaking back-tracked Lagrangian experiments using ICHTHYOP (a Lagrangian tool for simulating ichthyoplankton dynamics: <https://ichthyop.org/>). These experiments will serve to investigate both connectivity as well as source regions for sponges.

Funding and opportunities:

Annual allocation: R180 000 per annum

Funding for the first two year of the project will be provided through the SponBioDiv project. An amount of R 180 000 per year has been secured. Additional funding will be sourced from the National Research Foundation over the 3-year duration of the PhD project and any other funding opportunities will be investigated. The selected student will form part of the Nansen-Tutu Centre for Marine Environmental Research. The student will be required to spend some of their study period in France with their French supervisor in Brest. Specific funding will be sourced to finance study periods in France.

Application Requirements:

- M.Sc in Physical Oceanography, Ocean and Atmospheric Science or Environmental Science
- Strong data processing and data analytics skills
- Advanced Python programming
- Independent and self-motivated individual
- Good communication skills
- At least one published Peer-reviewed publication
- Good knowledge of the South African marine environment
- Send CV and letter of motivation to mkrug@dffe.gov.za and mn.ragoasha@uct.ac.za

References:

Samaai, T., Sink, K., Kirkman, S., Atkinson, L., Florence, W., Kerwath, S., ... & Yemane, D. (2020). The marine animal forests of South Africa: Importance for bioregionalization and marine spatial planning. *Perspectives on the marine animal forests of the world*, 17-61.

Samaai, T., & Gibbons, M. J. (2005). Demospongiae taxonomy and biodiversity of the Benguela region on the west coast of South Africa. *African Natural History*, 1(1), 1-96.

Wang, S., Kenchington, E., Murillo, F. J., Lirette, C., Wang, Z., Koen-Alonso, M., ... & Pepin, P. (2024). Quantifying the effects of fragmentation of connectivity networks of deep-sea vulnerable marine ecosystems. *Diversity and Distributions*, 30(5), e13824.