



Kunduchi: An ideal setting to begin a career in marine sciences

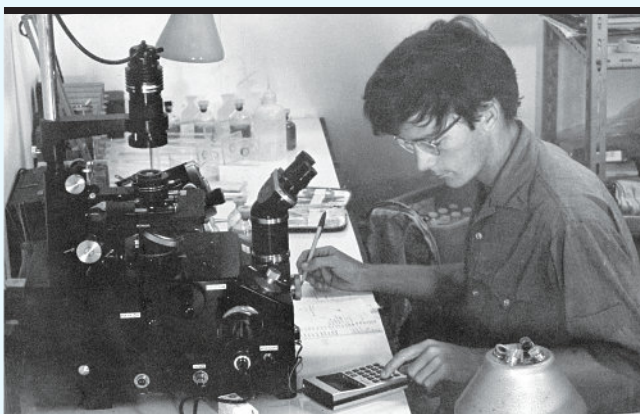
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Since the 1960s, Kunduchi was the location for the University of Dar es Salaam's Marine Biology Station and the adjacent Kunduchi Marine Fisheries Research and Training Institute, whose facilities are now combined to form the university's School of Aquatic Sciences and Fisheries Technology (SoAF).

An ideal place for multidisciplinary research

The location of Kunduchi's facilities is ideal for marine science research and training. The buildings are situated a few metres from a beautiful long white siliceous sandy beach, below which there are sandy intertidal flats, and seawards from these lie extensive seagrass beds with clear depth-related zonation. Just 450 metres southwards, flows a tidal creek, which fills and drains a mangrove forest with the rising and falling tides. The mangrove forest contains a diverse flora and fauna typical of mangroves. Seaward to the east, just three kilometres offshore, is Mbudya Island, which is now part of the Dar es Salaam Marine Reserve System, encircled by a magnificent coral reef, rocky intertidal platform, white coralline sandy beaches, and limestone cliffs. Further to the south lies Msasani Bay, which contains multiple coral reefs and seagrass beds. The continental shelf offshore from Kunduchi is quite narrow, so that truly oceanic waters of the Western Indian Ocean flow nearby.



Ian using an inverted microscope in one of the laboratories at Kunduchi (1973). ©Ian Bryceson

From a social science perspective for marine and coastal research, Kunduchi is ideally located to Kunduchi fishing village, with a community of small-scale fishers who have extensive and profound traditional knowledge of marine ecosystems and traditional coastal and fisheries management systems. Adjacent to Kunduchi is also a large tourist hotel, where one can observe both the positive benefits and the negative impacts of the tourism industry on the coastal environment and neighbouring communities.

The close proximity to Kunduchi of these social and ecological processes makes it a perfect site for multidisciplinary and transdisciplinary studies. Kunduchi is also an attractive setting for regional and international scientific collaborations.

Personal story: where it all began

My own personal passion for marine ecology started at the young age of eleven in 1961, when my family moved to Dar es Salaam from Kilimanjaro. Our home was quite close to Kunduchi, located adjacent to Msasani and Kawe fishing villages, where the fishers were enormously kind to me, and invited me to accompany them on fishing trips in their *ngalawa* (outrigger canoes) across the bay and out to nearby islands, all close to Kunduchi too. The fishers' profound knowledge of marine species, ecosystems and oceanographic processes inspired me to wish to study marine sciences. After completing school, I was fortunate to be awarded a Fulbright scholarship to study marine sciences at the University of Washington in Seattle.

As a staff of the Kunduchi Marine Fisheries Research and Training Institute

I completed my studies quickly, and in 1971, aged twenty-one, immediately returned to Tanzania and applied for a position at the Kunduchi Marine Fisheries Research and Training Institute from January 1972. I was appointed Head of Training, but I was surprised to find that the fisheries syllabus was simply a copy of a Canadian syllabus, and I promptly requested to introduce changes in the syllabus to make it more relevant to Tanzania's coastal resources, fishing

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Aerial photograph of Kunduchi. ©Ian Bryceson

technologies, and fisherfolks' livelihoods, but the Principal and Canadian and Dutch 'experts' considered my suggestions to be irrelevant, and my wish to invite knowledgeable fishers to give lectures about small-scale fisheries to be contravening civil service regulations. I therefore chose to seek employment at the University of Dar es Salaam, and was fortunate to start work as a Tutorial Assistant from January 1973, with access to the wonderful facilities of the Kunduchi Marine Biology Station in its ideal setting for marine research and field visits for university students.

As a PhD student at Kunduchi

In 1973, I submitted a research proposal to study phytoplankton ecology in the coastal waters of Dar es Salaam, and commenced my PhD research.

My choice to focus my PhD research on phytoplankton ecology was because I considered this to be the largest gap in marine science knowledge in Tanzanian and East African coastal waters. Phytoplankton are the main primary producers of the world's oceans, and very little was known about them for the Western Indian Ocean, apart from a few sporadic short-term international observations.

The textbooks that I had studied at the University of Washington asserted that there was no clear seasonality in tropical marine systems, but the lessons that I had learned from small-scale fishers and coastal villagers did not agree with this, and there were names for the seasons (*Kaskazi*, *Masika*, *Kusi*, and *Vuli*). I set about measuring seawater temperature, salinity, dissolved oxygen, phosphate, nitrate and chlorophyll levels regularly throughout the year, and took samples of phytoplankton.

Kunduchi Marine Biology Station had fairly modest but good-quality facilities, including wet labs, large aquaria, and an inverted microscope (ideal for phytoplankton studies). The technical staff of the station, including Kacholima (a boat driver, who was also chairperson of Kunduchi village), Mshamu (a cleaner, who was also renowned traditional doctor), Nguzo, Evans, Mkombachepa, Mulyutu and Biringi, all of whom were immensely kind and helpful. Academic staff included Rudman (New Zealand), Rosen (USA), Sankarankutty (India) and Menon (India). At this time, Boniface Mwaiseje and Philip Bwathondi were studying for their PhDs in Britain, and they subsequently returned to join the Kunduchi Marine Biology Station staff.

We did not have a spectrophotometer at Kunduchi, or even at the main campus, at that time, so I requested Prof. Nhonoli of the Central Pathology Laboratory at Muhimbili Hospital to allow me to use their spectrophotometer once a week, and he kindly agreed. Later, I was also kindly assisted by Prof. Fay of the University of London for access to gas chromatograph and mass spectrometer.

My research confirmed the clear seasonality of physical and chemical oceanographic conditions, which verified the traditional knowledge of the fishers and villagers, while disproving the text books and conventional science. The seasonality of Tanzanian coastal waters is influenced by the monsoon winds, whereby the northern monsoon (*Kaskazi*) is characterised by lower wind speeds, less waves and vertical mixing, clearer water visibility, and higher temperatures, whereas the southern monsoon (*Kusi*) exhibits stronger winds, bigger waves, deeper mixing, greater turbidity, and lower temperatures. The inter-monsoonal periods of *Masika* and *Vuli* coincide with

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the longer and shorter rainy seasons, which are characterised by lower inshore salinities. Phytoplankton ecology is accordingly heavily influenced by this seasonality, and in particular, I found that the phytoplanktonic cyanobacterium *Trichodesmium erythraeum* is dominant in the water column throughout the northern monsoon, but absent during the southern monsoon, due to strong mixing of the water column in the latter period, causing it to be inhibited by low light intensities. This seasonality of phytoplankton productivity strongly affects the seasonality of zooplankton (confirmed by Okera's thesis), and then small fishes and finally larger fishes at all trophic levels of the pelagic food chain, including migrations of tuna and other large species. This seasonality also influences benthic ecosystems to a considerable extent. I defended my PhD in 1977, and then continued to work in more detail on nitrogen fixation by planktonic cyanophytes, which constitutes crucial enrichment of Indian Ocean waters with biologically assimilable nitrogen, the principle limiting factor for productivity.

While studying phytoplankton from a base at Kunduchi Marine Biology Station, I also observed other marine ecosystem processes, and was able to bring University of Dar es Salaam students to Kunduchi to experience beaches, seagrasses, mangroves and coral reefs. Students cannot comprehend marine science without spending considerable time in these ecosystems, and they cannot appreciate the myriad of underwater life with incredible biodiversity without swimming and



Tubastrea aurea at Mbudya island.
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snorkelling to watch them for themselves. Similarly, students cannot learn about fisheries technology from books alone, so it is crucial to spend adequate time sailing and fishing with local fisherfolk in their traditional vessels using traditional gears. The combination of traditional knowledge together with modern science and technology is what all aspiring marine scientists should strive to learn from.

From Kunduchi, I was fortunate to experience many positive lessons, but there were also some negative issues. One of the issues was the destruction of coral reefs by dynamite fishing, which was the subject of my first scientific publication. Contrary to other claims, I realised that the small-scale fishers were not to blame, but that corrupt bureaucrats were the real organisers and perpetrators of dynamite-fishing.

After Kunduchi

The late Boniface Mwaieseje and I both sought postdoc fellowship elsewhere in 1980, and he moved to France and I to Norway. From Norway, I have continued my research in marine sciences, now as Professor Emeritus at the Norwegian University of Life Sciences, and all along I have strived to promote a series of marine science collaboration projects with the University of Dar es Salaam. Currently, I feel privileged to be part of two major six-year NORHED-funded projects, including the School of Aquatic Science and Fisheries Technology at Kunduchi as a key actor ■



Rhizophora mucronata prop-roots, Kunduchi mangroves.
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