

## THE EUPHORIAS AND DISADVENTURES OF YOUNG RESEARCHERS IN MARINE SCIENCE

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This invited contribution to the Young Marine Scientists Contact Day (Jongerencontactdag) from the Flanders Marine Institute (Vlaams Instituut voor de Zee – VLIZ) shows how scientific research in marine sciences may constitute a complex puzzle in which life experiences and personal attitude play a considerable role. It deals with basic concepts such as communication, integration and flexibility both *sensu scientiae* and *sensu personae* that may be of importance to young marine scientists that are preparing an MSc or PhD thesis, and illustrates these concepts with both positive and negative experiences during the course of fundamental and applied scientific research. This includes a construction of a wider research framework as well as specific statistical problems marine scientists may be confronted with. The biocomplexity of mangrove forests – the linkages and regulation of the ecosystem functions and biodiversity of these intertidal ecosystems – is used as an exemplary model to discuss the above, and the research presented originates thanks to collaborative research between the Università degli Studi di Firenze (IT), the Kenya Marine Fisheries Research Institute (KE), the University of Ruhuna (LK), the Small Fishers Federation of Lanka (LK), the University of Stockholm (SE) and several Belgian and Dutch academic institutions.

Whereas motivation must be the primary incentive to perform scientific research (*do what you like to do and do that well*), one important tool that must be used at all times is communication on different levels of scientific research (e.g. counselling, data sharing, assessment) and in society (e.g. university, local people, wide public). This will shed new light on the scientific approach and the types of analysis that must be used. It is evident that in fundamental research one must focus on a specified subject and that the researcher gains experience in well established techniques in data collection and data analysis. However, he must also face what is not known with the aim of acquiring it as new information or as a familiar technique, such as in the quest for a cause or in the availability of new analysis techniques.

Important factors to be considered in collaborative scientific research in developing countries are ethical constraints and obligations. When collecting data from people for instance, one should consider whose property the data are, who should be local institutional and field partners, who should receive feedback, and so forth. The same applies in part to the publication of scientific results where one should carefully assess who should be a co-author, apart from selecting an intermediate way amongst the journals' impact factors, the immediacy indices, the cited half-lives and the scientific public aimed at.

The search for the unknown is illustrated by the research on the orientation capabilities of Kenyan mangrove crabs. Starting from dietary analysis of a selected number of species, this research turns towards the ethology of three species that display a particular foraging and/or migratory behaviour. While in search of the various 'WH'-questions, a distinction must be made between 'ruling out certain causes' and 'finding proof for a particular cause'. Various experimental designs must be made *de novo* and often *ad hoc*, in our case depending on

certain aspects of the crabs' behaviour, and even involved the training of crabs to use certain burrows and landmarks for homing in a horizontal plane. The research proved that the crabs use visual cues and have a route-based memory. The vertical homing behaviour (migration from the mangrove root complex towards the canopy) of another species was followed using permanent personal observations from a tree platform and by video, and appeared to be completely different causally, but to a large extent comparable to the horizontal homing memory. The third crab species displayed a feeding-based foraging behaviour that appeared to significantly inhibit the regeneration of mangroves and their vegetation structure.

From here, the research takes another turn towards the types of mangrove vegetation structure in Kenya, Sri Lanka and Mauritania, the decadal evolution of mangroves forests and the role played by propagule predators in the shaping of the vegetation structure (e.g. zonation). The importance of understanding the wider research framework and the integration of one's theme in the entire puzzle is emphasised, as well as the biocomplexity (incl. human impacts) within one theme. The sustainable use and management of the ecologic, social and economic very important mangrove ecosystem cannot be done without understanding the direct and indirect impact of man on the mangrove and on the ecological functional activity of this forest, without foreseeing their consequences, the forest's lag-time, resilience and recovery capacity or without considering mitigating measures, all of which requires fundamental and applied research. A research framework on mangrove vegetation science, biocomplexity and some elements of ethnobiology is therefore discussed.

Remote sensing and geographical information systems (GIS) are excellent tools to monitor, integrate and manipulate the biological data collected, even data that on first sight have no spatial structure. It may lead to clear environmental management guidelines with respect to for example land use patterns and ecological footprint analysis, vegetation structure and vegetation structure dynamics. It is highlighted how retrospective remote sensing, GIS-technology and ordination analysis can be combined to reduce and explore the data and to produce an added value. Specifically it is shown how predictions for the future can be done based on vegetation history and current regeneration status in the field. Attention is drawn to flexibility of scientists in this type of study. Research fields that are rapidly developing such as computer science or space-technology may require continuous schooling in order not to be surpassed, but require at the same time calibration with formerly used data and techniques. For instance, new digital remote sensing technology must be integrated in long-term studies using sequential aerial photography, which on one hand often forms the only set of data available for long-term retrospective research of spatial nature, and on the other hand images with an unbeaten resolution. Also the use of GIS may require repeated change of GIS-software due to software development and evolution to 'stand-alone' systems. Finally, common statistical analysis tools in science are being equalled and even beaten by more appropriate ones, particularly for ecology and environmental sciences.

Expensive acquisition and analysis techniques such as in remote sensing and geographic information systems may however be a barrier for some research units, particularly in developing countries. In fact, together with motivation, communication and flexibility, also potential, capacity and/or expertise are important resources without which scientific research cannot function optimally. All of these can be used in dealing with stochastic factors as well as human interactions, which often steer scientific research much more than one wishes to acknowledge.