

A practical approach to marine biology



Professor Patrick J. Schembri elucidating the basic principles of the use of a plankton net aboard the research vessel

With a 272 km-long coastline, a sea area 20 times that of the land surface area, and a benign climate, the Maltese Islands' environment is tailor-made for the teaching of practical marine biology.

Although the need for such training is there, because of financial constraints the last such course was held way back in the 1970s, when the islands had their own marine station at Fort St Lucian, Marsaxlokk.

In October 2002, an opportunity to fill this academic lacuna presented itself - in the form of the UNESCO Participation Programme administered locally by the Malta National Commission for UNESCO.

Professor Patrick J. Schembri, of the Department of Biology of the University of Malta, applied to UNESCO for funds to set up of a marine biology course within the Bachelor of Science academic curriculum. UNESCO thought this to be sufficiently important for developing the country's human resource base that in June 2003 they awarded a grant for this purpose.

Course contents

After a year's preparatory work, the course was announced as an option for third year B.Sc. students. It received a heartening response - of the 43 eligible, 35 students opted to follow the course. These students had to end their summer recess slightly earlier than usual since the marine biology course, which was co-ordinated by Dr Joseph A. Borg, was held between September 10 and 17 this year due to both weather and timetabling considerations.

A detailed handbook was compiled for the occasion and was uploaded on the Department's Website, from where students could access and print it. Another good omen was the good weather which prevailed throughout the course's duration, which paved the way for some rewarding fieldwork by students.

The course week was a hectic one, to make an understatement, since each day included a fieldwork session in the morning, a lecture on the theoretical background to the fieldwork of the following afternoon, followed by laboratory work.

Students were also tempted to try their hand at Scuba diving at the beginning of the course, an offer taken up by some of the more adventurous. During the opening lecture, the head of the Department of Biology, Professor Victor Axiak, stressed the importance of such a course and thanked UNESCO and the Maltese National Commission for making it all happen.

Besides Professor Axiak, Dr Borg (the course co-ordinator) and Professor Schembri, other course lecturers included Edwin Lanfranco and this writer. Support was provided by demonstrators and of course the technical and clerical staff of the Department of Biology.

The kaleidoscopic view of marine biology that the course offered was designed around sampling of the major marine habitats of the islands from the adlittoral (the maritime fringe) to

the upper reaches of the infralittoral (the submerged seabed), and involved the identification of the major floral and faunal species, training in the techniques of studying such species and in characterising the physical environment of the sites sampled.

The rocky coast stretch chosen was the one at Ghallis, where students were briefed on the use of sighting frames and quadrats along a line transect extending from mean sea level ('Biological Zero') to the supralittoral (the splash zone) part of the shore to estimate percentage cover, individual abundance and species richness for floral and faunal species.

Students encountered a whole plethora of species during their sampling, such as the Black periwinkle *Melarhaphe neritoides* (zibget il-bahar), the three different species of barnacles (*Chthamalus* spp. - koccli) on our islands, the three species of limpets (*Patella* spp. - mhar) and the isopod *Ligia italica* (dud tas-sajd).

They were provided with visual aids to bolster their chances of positive identification and lecturers stressed that all forms were to be respected and released whenever possible. Some students were intrigued to realise that the characteristic black colour of rocks in the mediolittoral is due to the presence of millions of microscopic organisms known as cyanobacteria (more commonly known as blue-green bacteria).

Students were also taught that for shore organisms, characteristics of the physical environment such as slope, roughness and exposure were very important in determining what occurred and where. To estimate the index of roughness of the rocky coast at the scale of the animals on it, a plastic profiler, adapted from a device used by carpet layers was employed, while the shore profile was mapped using the rulers and spirit level method and the Thomas Index of Exposure was estimated.

The latter quantifies the degree of exposure to wave action that a particular site is subjected to by considering the exposure to prevailing winds, the depth of adjoining water and the distance from any adjacent headlands. The students applied their field observations to study the effect of exposure to wave action on the zonation and presence of different biotic assemblages on different shores.

Similar methodology was employed on the sandy beach sampled - Ghajn Tuffieha - where line transect on the beach were again employed. However, here two different sampling techniques were used: coring and sieving of the sand, and using handnets in shallow water.

The former technique targets infauna (i.e. animals living in the sediment) while the collecting with handnets targets fauna, such as mysids (opossum shrimps) and amphipods (sideswimmers), emerging in the water column to feed. Sand samples were systematically collected for grain-size analysis (granulometry) which is an analysis used to scientifically describe the sediment at hand (for e.g. fine sand, medium sand, coarse sand, etc).

Students encountered a number of psammophilic species (i.e. species restricted to the sand environment), such as the beetles *Phaleria acuminata* and *Trachyselis aphodioidis*, while being briefed on the importance of not clearing beached seagrass debris (banquettes) since they harbour a unique suite of organisms themselves - the psammatophiles - while aiding beach nourishment. In the afternoon laboratory session, students were briefed on the various hypotheses as to why Maltese beaches are relatively poor in fauna compared to other Mediterranean beaches.

Shallow sublittoral hard and soft bottom habitats were sampled using snorkelling and Scuba diving. In the case of *Posidonia oceanica* (Neptune grass - alka) shoot density counts were taken in situ by the divers. Neptune grass is an important keystone species of the Mediterranean photic zone (i.e. where light intensity is sufficiently high to permit photosynthesis - normally taken to be up to a depth of 40-50 m) due to its productivity and capacity for oxygenation, by serving as a nursery for many fish species, by being a feeding ground for many animals, due to its rhizomes stabilising the bottom sediment, etc. From *Posidonia* shoot densities one can glean information regarding water transparency and condition of the environment.

Back in the laboratory, students even measured the length, width and number of leaves in a small sample of shoots to discern any differences between different sites and different depths. Interestingly enough, *Posidonia* is not the only seagrass in our waters, which are also embellished by other species such as the Lesser Neptune grass, *Cymodocea nodosa*, and the Red Sea grass, *Halophila stipulacea*, which is introduced from the Red Sea via the Suez Canal.

During the practical on sublittoral rocky bottoms, the students mapped their transect area by classifying the benthos (bottom dwelling plants and animals) into different types, such as those of bare sand, pebbles, rock, etc. The various distinct algal zones which merged into each other were also observed, with the most common algae being the Peacock's tail, *Padina pavonica* (denb il-pagun), the coralline red alga, *Phymatolithon lenormandii*, brown algae known as sea-

firs, *Cytoseira* spp., which form extensive beds in shallow water, and the green algae *Ulva* (hass il-bahar) and *Enteromorpha*, which are normally associated with sheltered, nutrient-rich areas. Some ubiquitous faunal species, such as sea urchins, sea stars, brittle stars and sponges (including rock-boring sponges which are not characteristically 'soft') were also encountered.

On the final day of sampling, the focus was on offshore marine biology, with the students spending the morning on a boat sampling studying both offshore water and the deeper seabed. There being no tailor-made research vessel on the island, a fishing vessel was used for this trip and the 40-odd persons on board with their bright orange life jackets made a colourful sight entering and leaving Marsaxlokk harbour.

At sea, water samples being taken for subsequent chemical analysis in the laboratory using a device known as a Van Dohm bottle. Other water quality parameters were measured in situ using various instruments such as a turbidity meter and a Secchi disk for measuring water transparency, an oxygen meter for measuring dissolved oxygen, and a spectrofluorimeter used for estimating chlorophyll a concentrations which is a measure of productivity.

Subsequent chemical analysis in the laboratory revealed the seawater's content of nitrates and phosphates, two nutrients of fundamental importance to marine productivity but large concentrations of which (such as close to sewage outfalls) may lead to seawater pollution.

Such water quality parameters are today considered as cornerstones in most seawater monitoring protocols. The biota were sampled using a Van Veen grab and a benthic dredge, employed to collect samples of plants and animals living on the seabed beyond the reach of divers, and a plankton net to collect the microscopic animals that float in seawater. Thus the entire spectrum of marine offshore habitats were sampled.

The curtain fell on the gruelling week with an interactive forum organised on the last day when students were able to discuss their experiences. The prevailing theme of the students' feedback was one of satisfaction that they had finally come close to being even with their counterparts abroad who make numerous field studies during their courses, and that the organisation of such a course was long overdue.

Students finally started appreciating the labour which must be invested by researchers to gather the data on which biological knowledge (and their textbooks) are based. Some expressed the hope that the course would be held again next year, a hope I share, especially since, despite the absence of foreign financial help, no exorbitant sum on equipment needs to be forked out by the University of Malta since all the basic equipment has now been acquired through the generosity of UNESCO. The ball is now in the University's court - the Biology Department has shown the way forward.

Some afterthoughts

Shoddy criticism has been levelled in the recent past at the Department of Biology from specific sectors that it is not inculcating students with aspects of applied biology. A particularly disparaging source seeks to give the impression that branches of biology, such as marine biology and systematic biology, are out of sync with the country's needs in branding them as 'classical' aspects of biology and that not all academic members of staff are abreast with modern developments in biology. The same source suggests a greater emphasis on 'modern' biology as a possible panacea.

The marine biology course I have reviewed amply deflates such minimalist, fringe opinions. With resources at a premium, our islands' academic acumen should be directed towards the study of marine-related issues, a sector in which the Department of Biology has gained an international reputation, rather than pinning hopes on sectors already firmly established in well-funded laboratories abroad.

The impact of yacht marinas, fish-farming, coastal tourism, overfishing, untreated sewage discharge, etc, have become household terms in an insular country like ours. The only way to address such issues is through the rational management and sustainable exploitation of marine resources by bolstering marine research.

The government should follow up on its claims that it was releasing €800,000 for research purposes by improving the University's dismal financial situation. One way to do this is to revise the stipend system, often abused by students in their student card-related purchases. The bottom is being scraped in that the Department of Biology is just making ends meet to hold student final year elective projects, without resorting to departmental funds which are meagre, to say the least. Finances are even lacking when it comes to holding normal course practical sessions.

The disparity between the research opportunities offered by the University of Malta and those offered abroad should convince all those opposing the much needed stipend system revamp. In addition, the recipients of the promised financial tonic should not necessarily be industry or

economy-related departments - is it not worth investing in testing the impact of sewage on our bathing water quality or testing the impact of a yacht marina on seagrasses which in turn affects fish stocks, even though few direct commercial benefits are too be gleaned? Do we always need to justify research in monetary terms?

The author, on behalf of those who benefited from the course, wishes to thank UNESCO for making this venture possible.

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