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From the Editor

Welcome to yet another and also the last edition of the PSSA newsletter for 2007. As you can well imagine, it has been difficult keeping abreast of all the new and exciting things occurring around us. South Africa has been through an overhaul of its environmental laws in recent years, and more recently the Portfolio Committee on Environmental Affairs and Tourism has conducted numerous public hearings on the new *Integrated Coastal Management Bill* of 2007. In this edition of the newsletter you are provided with some insight into the content of the new bill. Moving northward, we have contributions from both western and eastern Africa in the form of a *phycological exploration in Angola*, to a new technique for *combating Kappaphycus die-offs in Tanzania*. In addition to these interest-specific articles, included are the regular, general *World Science* articles, and a rather interesting account of a new teaching resource that *puts Lowland treasures in more hands*. While this latter article may not appear relevant, you will find its contents particularly interesting and appealing to even your distant phycological interests.

No doubt many, if not all of you, have been busy with your various administrative, teaching and research endeavors. None-the-less, I hope this year has been fruitful for all of you. With this in mind, I wish you all peace, happiness, lots of well-deserved rest and a safe return to work in the new year. For those of you celebrating *Christmas*, here's wishing you all a blessed and safe festive season.

See you all next year!

Best wishes
Sincerely
Gavin

Synarthrophyton patena
epiphytic on *Gelidium capense*

News and Reviews

1. Combating *Kappaphycus* die-offs in Tanzania

The problem of *Kappaphycus alvarezii* (cottonii) die-off has been experienced in a number of places in Tanzania when the off-bottom method is used. To try and solve the problem, a new technique (the deep-water floating lines technique) was introduced under the Sustainable Coastal Communities and Ecosystems (SUCCESS) Programme run by the Western Indian Ocean Marine Science Association (WIOMSA) and funded by USAID. The technique adapted from SE Asia is used in deep waters as opposed to the peg and line (off-bottom) method commonly used for farming seaweed. It has been shown that most of the seaweed die offs are generally related to rainfall, temperature and fouling (Mmochi et al. 2005). Deeper waters have more stable salinity and temperature regimes and less fouling macroalgae. Currently, the solving of the problem of die-off is being conducted under the Zanzibar Seaweed Cluster Initiative (Seaweed CI) which is under the Innovation Systems and Innovative Clusters Programme in Tanzania (ISICP-Tz) funded by Sida.

The process and areas where the die-off problem is being combated

One of the areas where the efforts to combat die-offs are being made is Bagamoyo on the coast of mainland Tanzania, located in the Western Indian Ocean region. In this area (e.g. Mlingotini village), seaweed farmers have been facing problems of seaweed die-off and stunted growth, and had not harvested since November 2003. The work started in Bagamoyo where two 20 x 12 m floating lines systems made of nylon ropes (Fig. 1) were constructed on the 28th May 2005. The seaweed was planted on the 7th and 8th June. The frame of the system was made of thick 12 mm rope, anchors were held with a 10 mm rope and seaweed lines were of 4 mm rope. Anchors were made of plastic bags filled with sand.

Other areas are located in the Menai Bay, Zanzibar, South West Coast (in Bweleo and Kisakasaka) and North Coast (in Kidoti).

In Bweleo, two small (5 x 5 m) rafts were constructed using the same type of materials and deployed at sea in April 2006. Small rafts were used to test if the rafts can be kept at sea for at least six weeks (the harvesting time of farms in ordinary off-bottom method) before putting in bigger rafts. They were also aimed at testing the occurrence of conflicts between farmers and fishermen as experienced in Bagamoyo. Following the success of the small rafts, two larger rafts (as in fig. 1) were constructed and the seaweed planted.

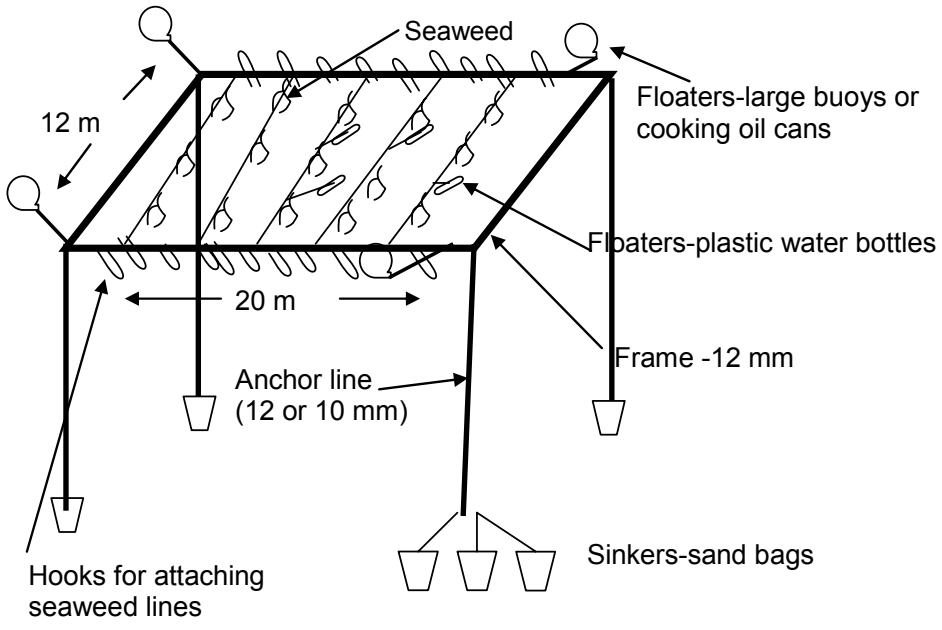

Figure 3. A diagrammatic representation of the floating lines system for farming seaweed in deep waters.

Seaweed farmers from Kisakasaka then visited Bweleo and observed the deep-water floating technique, requesting their neighbours from Bweleo to teach them how to use the new technique. The farmers were trained for two days on the 3rd and 4th April 2007 when one floating system was constructed and deployed with funds from SUCCESS and Seaweed CI. Trainers included 2 representatives of Bweleo farmers, Seaweed CI task force, and SUCCESS scientists. Two more systems were constructed on later dates.

The technique has recently been introduced in Kidoti village in the North West Coast of Zanzibar. The training was done on the 28th August 2007, followed by the construction of two floating line systems, anchorage at sea and planting of the seaweed on the 27th and 28th September. Representatives of farmers from Bagamoyo, Bweleo, and Kisakasaka were used as trainers together with the Seaweed CI task force. The training workshops were conducted under the Seaweed CI using a grant from the SMEs Competitiveness Facility.

The systems are usually placed in water depth of 2 – 6 m depending on the tide. In each area farmers contributed by providing floaters and anchors for the systems. For the farmers to be able to work in the floating systems, they need boats, one of the main requirements of the technique. SUCCESS has provided boats to 2 of the 4 villages while other organisations are coming to their aid with the transport requirements and farming materials.

Results

In Bagamoyo, cumulative weight of the seaweed in the floating lines system was growing at a specific growth rate (SGR) of 6.1 – 7.6 $\%d^{-1}$. Similarly in Bweleo, the seaweed was growing at an average of 6 – 15 % d^{-1}. In Kisakasaka the growth rate was 3.2 - 4.9 % d^{-1}. The off bottom method showed growth rates varying from 2.4 – 5.4 % d^{-1} at the three sites (see Fig. 2).

The technique is also being used to increase seaweed production, something that has been emphasized by many stakeholders (e.g. MNRT 2005, Brogaard et al. 2005) in the country. The current production is about 6000 to 7,000 MT of dry seaweed while the buyers/exporters are able to buy up to 20,000 MT (Buyers, personal communication). Due to higher growths in the

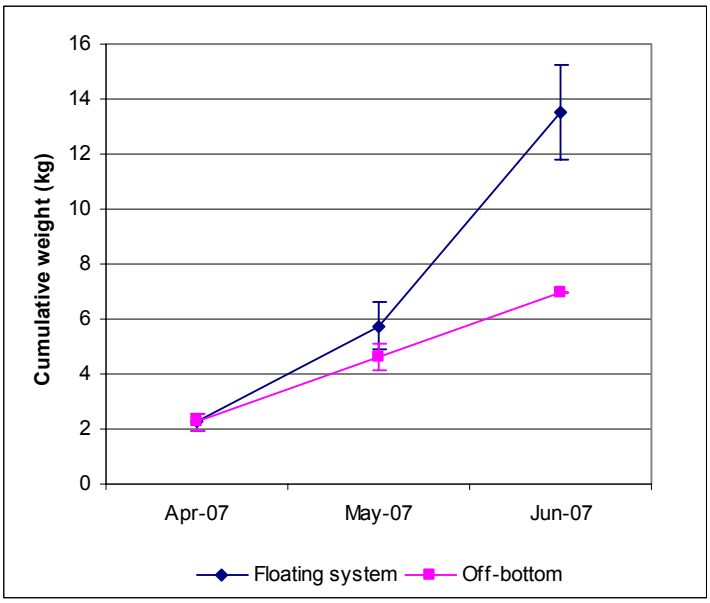

Figure 2. Variation in cumulative weight of the seaweeds (fw, kg±stdev) in floating lines and off-bottom farming techniques.

floating lines technique, seaweed production is higher than in the off-bottom method and thus production per farmer and country-wide will be increased.

The floating line system is a fish aggregating device attracting fish after 2-3 weeks of cultivation when the seaweed forms a shade under the systems. Farmers have been harvesting fish using basket ("*dema*") traps under the floating systems and have vowed to continue the seaweed farming if for the fishery alone. However, the new system has also attracted fishermen with fishing nets, who repeatedly destroyed the systems in Bagamoyo. This necessitated the formation of village by-laws and zoning to protect the fisher folks. No such problems were, however, experienced in Zanzibar.

In conclusion, the new technique has been used to solve the problem of seaweed die-offs in the costal waters of the Western Indian Ocean, enabling farmers to harvest seaweed throughout the year. This increased seaweed production has increased farmers' income and supplemented their income and food with the fish caught under the floating lines systems. The increase in production could, however, result in the increase of seaweed prices within the country as the business running costs would be lowered.

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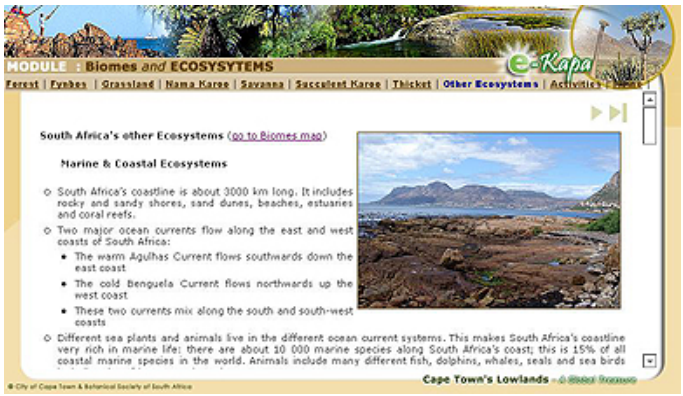
2. New teaching resource puts Lowland treasures in more hands

Bright, beautiful, inspiring, and accessible – this describes not only the Lowlands treasures of Cape Town, but also the newest resource aimed at teaching learners (and anyone else) about the spectacular biodiversity in the city. "e-Kapa: Cape Town's Lowlands - a global treasure" is the first example of electronic environmental education learning and teaching resource materials produced for schools by the City of Cape Town and the Botanical Society of South Africa in collaboration with the Khanya Project of the Western Cape Education Department (WCED).

Through an interactive, activity-based website (also available on CD), learners and educators are introduced to "the natural diversity of one small part of South Africa – Cape Town's Lowlands. Like hidden treasures, plants and animals survive in small natural areas between houses, schools and businesses in this city. This web-based interactive

resource provides information to help us care for this diversity on our doorsteps."

Environmental educator Ally Ashwell, who wrote the learning resource, is delighted by the "magic" created by designer Martin Cocks from her text, along with the pictures, activities, maps and other visuals. "The beauty of the Lowlands treasures is clear on the screen – it gives us a chance to see what is so special about this precious heritage, and to experience why nature can make us feel good about life."



A screen capture of the "*Biomes and Ecosystems*" of South Africa page that provides information on the marine and coastal ecosystems.

In 2001 Ashwell wrote "Cape Flats Floral Treasures: A teacher's guide to active learning in Cape Town schools" (also published by the Botanical Society of South Africa and the City of Cape Town). The original guide is now out of print, and in 2006, in response to requests from educators, the Botanical Society and City of Cape Town decided to revise and republish this guide as an updated, expanded electronic resource. What makes e-Kapa special is that, unlike the original printed guide, it is more widely accessible, notes Ashwell. This new web technology means that there are few constraints when it comes to use of colour, number of pictures, and the number 'printed'. "It's really putting information in people's hands!" says Ashwell. "Teachers' guides used to be so rare, perhaps only one to a class, or black and white to keep down costs. Now, with the Khanya Project well on its way to installing computer labs in all schools in the province, learners will have direct access to the information and activities."

e-Kapa consists of 10 interactive modules, each covering a particular aspect of biodiversity in Cape Town – such as "Nature on your doorstep", "Rare, endangered and extinct", "Nature and culture", and "Planting indigenous". Each module comes complete with fun interactive activities, both electronic and paper-based. The resource also includes an educators' guide with a number of lesson plans for different learning areas and learning outcomes. It is not only aligned to the national curriculum, but also links to fieldwork programmes at environmental education centres in Cape Town.

e-Kapa was produced by the City in collaboration with the Botanical Society of South Africa, Cape Flats Nature, the World Bank, the University of the Western Cape's Department of Biodiversity and Conservation Biology and the Khanya Project of the Western Cape Education Department. The resource will be distributed to schools in the Western Cape through the Khanya programme, a project that uses technology to augment teaching capacity.

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A screen capture of the "*Four Unique Ecosystems*" page that includes wetlands as one of the four ecosystems.

While this resource is largely devoted to the lowland flora and fauna of the Cape Flats region, there are a number of sections that will be of interest to the general phycologist. These include general segments on marine and coastal ecosystems, river and wetland ecosystems, Cape Town's entire wetland ecosystem (with an

interactive map of the present distribution of wetlands), adapting to living in wetlands, and many more scattered tidbits throughout the resource. The interactive CD version of the resource is being released sometime early in the new year.

A screen capture of the "*Adaptations to the Environment*" page in which the many ways by which freshwater organisms have adapted to living in wetlands is demonstrated

3. Theses abstracts from students who recently completed their studies

3.1 Biological and ecological feasibility studies of using seaweeds *Ulva Lactuca* (Chlorophyta) in recirculation systems in abalone farming

Deborah Robertson-Andersson (PhD thesis, Department of Botany, University of Cape Town)

Supervisors: John Bolton (UCT), Max Troell (Stockholm University, Sweden), Trevor Probyn (MCM)

Graduation date: 10th December 2007

Abstract

Significant effort has been put into the development of cost-effective abalone (*Haliotis midae*; Gastropoda) cultivation systems in South Africa, but the limited availability of suitable seaweed for abalone food is an obstacle to future development. The aim of this study was to investigate whether a land-based recirculating seaweed-abalone integrated aquaculture system using *Ulva lactuca* was feasible as well as to test the differences between a commercial gravel bed recirculation system to an existing flow through system. These studies were carried out at two abalone farms: Danger Point (I & J) (140 km east of Cape Town) and at Jacobs Bay (JSP) (120 km north of Cape Town, South Africa). In both studies no significant difference in terms of water quality, abalone growth rates and abalone health were found. It was found that a seaweed/abalone recirculating system at the designed water exchange rates (25 %) was nitrogen limited and that the system as designed could be run at 75 % recirculation rate and remove a significant proportion of the dissolved nutrients (ammonium, phosphorus, nitrate and nitrite). It was concluded that seaweed functions well, as a biofilter. The system, both at 25 % and at 75% recirculation, was capable of reducing the effluent concentrations and maintain, or sometimes even improve, water quality as compared to control. Total particle loading did not increase with higher re-circulation, nor does the load of fractions smaller than 35 µm or the carbon content of the particle load. Since sabellids prefer organic particles smaller than 35 µm as feed, these results indicate that, at least from a feed perspective, kelp fed re-circulating systems did not favor sabellids or other mobile macro fauna, this was echoed in the health examinations of the animals. In addition, mobile macrofauna diversity and density were similar in a recirculating system compared to a flow through system. Although dissolved oxygen production in the seaweed part of the system was 33 % higher than the flow through system, the oxygen was not being transferred to the abalone tanks. This meant that over the experimental period dissolved oxygen in the integrated system was 5 % lower than the flow through system. Temperature in the flow through system was 1 % lower than the recirculation system. Seaweed production was positively or negatively affected by external environmental effects (e.g. warm water intrusions over the western Agulhas bank result in a 7 kg per tank decrease in seaweed production). The risk of spreading disease or rising bacterial levels in the grow-out through integrated seaweed/abalone aquaculture, was considered low.

Abalone farms want to supplement the abalone feed with cultivated *Ulva* and investigate the potential of integrated abalone seaweed systems. The *Ulva* used in this study was simple to cultivate as it grows vegetatively and was

collected from free floating populations in Simons Town Harbor. It has a further benefit in its capacity to absorb nutrients and improve water quality of the aquaculture effluent.

However, macroalgae, as feeds for aquacultured abalone produce dimethylsulfonio-propionate (DMSP). DMSP levels are high in *Ulva lactuca* up to 6977 ± 1161 $\mu g.g^{-1}$ w.wt. DMSP, while *Gracilaria gracilis* and the kelp *Ecklonia maxima* contain between 0.8 ± 0.3 and 26.8 ± 20.6 $\mu g.g^{-1}$ w.wt. DMSP. DMSP levels increase in abalone tissue after they feed on these algae. A volatile breakdown product of DMSP, dimethylsulfide (DMS), is formed in abalone during canning, causing repellent tastes and odours in some batches of canned meat. The abalone adductor muscle (the part which is more commonly eaten) displays high DMSP concentrations compared to other tissues. Further, the feeding regime determines to what extent DMSP accumulates. When *U. lactuca* is fed to cultivated abalone in isolation, DMSP accumulates in the abalone to a concentration of up to 23×10^3 $\mu g.g^{-1}$w.wt. DMSP, a value of about 1.4 % of the fresh mass of the animal. A depuration phase of 3 – 6 months (depending on water temperature) prior to processing allows for the reduction of tissue DMSP levels to those seen in wild abalone, thereby ameliorating the negative effect on taste and odor. Taste tests showed that Asian people preferred abalone in its raw state with high DMSP contents while this preference changed when the abalone was cooked. Knowing the DMSP levels in feeds and its behavior in abalone tissue will lead to the development of new strategies for controlling abalone taste characteristics.

Feed not only affects taste but also affects the cultivation environment. Abalone are wasteful feeders with more than 60 % of their feed intake being converted to waste. This waste is in the form of particulates and dissolved organic nutrients. The sediments have different particle sizes and nutrient values depending on the primary feed source. The higher the nutritional value of the sediments (e.g. a compound pellet feed), the greater mobile fauna, sabellids, *vivo* bacteria, nitrogen and carbon content the sediments will have. A mixed seaweed diet produced significantly higher phosphate concentrations of the three diets tested, while and Abfeed® diet produced significantly higher total ammonium nitrogen. The abalone farms have had a significant socio-economic impact in the coastal communities in which they are situated. They employ 840 people countrywide but if the feed, canning and seaweed industry figures are included this increases to 1200. Of this 61 % are unskilled workers, which is the highest percentage of people in these communities. The industry has expanded by 500 % in the last 10 years and is predicted to expand by another 100 % in the next 5 years. This should see South Africa retain its position as the leading aquaculture abalone country outside of Asia at least until 2010.

3.2 Seasonal variation in nutritional content of the kelp *Ecklonia maxima* on the West and South coasts of South Africa, with reference to its use as abalone feed

Melanie Jayne Smith (Dissertation as part of MSc in Applied Marine Science, Department of Oceanography, University of Cape Town)

Supervisor: John Bolton (UCT)

Graduation date: December 10th 2007

Abstract

Knowledge of the chemical composition of marine macroalgae is important to understand their nutritional value for abalone as well as their potential as a source of protein, carbohydrate and lipid for commercial use. This study investigates the seasonal variations in chemical composition and nutritive value of *Ecklonia maxima* collected from various kelp beds near commercial abalone farms on both the west and south west coasts of South Africa. It has been suggested by numerous abalone farmers that west coast kelp is not as good as the south west coast for abalone feed.

Measurements of tissue moisture in the kelp samples did not reveal differences between location but showed a seasonal pattern in which concentrations increased during spring and summer (82 – 91%) and decreased during autumn and winter (75 – 79%). Similarly seasonal variation in averaged carbon content reflected the seasonal growth pattern of storage carbohydrates,

with a higher content in summer and autumn (33 – 37%) and decreasing contents after growth started in winter (31 – 33%). Carbon content was higher (33.82 ± 0.17) for all the months on the south west compared to the west coast (31.17 ± 0.22). Concentrations of fibre were also significantly higher on the south west coast (41.34 ± 1.21%) compared to the west coast (28.64 ± 1.22%) but these values did not show a seasonal pattern. On the contrary, ash, phosphorus, sodium and potassium had higher values on the west coast and showed a slight increase in concentration during the late-winter spring months. Protein concentrations were not significantly different between the two locations and did not reveal a seasonal pattern. Similarly, fat content was low and constant throughout the year.

Results show nutrient composition alone is insufficient for predicting the superiority of *Ecklonia maxima* growing in one location over the other. Kelp growth rate trials as well as abalone feeding trials need to be added to this study to provide conclusive answers to the main question posed.

3.3 The effects of differences in feeding regime and of export simulations on the growth of the abalone *Haliotis midae* Linnaeus

Tamson L. Francis (MSc thesis, Department of Biodiversity and Conservation Biology, University of the Western Cape)

Supervisor: Gavin W. Maneveldt (UWC), Jonathan Venter (Jacobsbaai Sea Products)

Graduation date: March 2008

Abstract

Beach-cast kelp (the most widely used feed for commercially grown South African abalone) is plentiful during winter months when periodic storms cause kelp to wash ashore. During summer, however, this resource is not always readily available and farmed abalone are often starved for short periods. The aim of this research was to assess how periodic kelp starvation influences growth of the commercially grown abalone, *Haliotis midae* Linnaeus. Growth of grow-out abalone was monitored on a commercial abalone farm over a period of six months and consisted of 3 treatments with 2 replicates (n = ±250 abalone per replicate). The treatments were: Control (abalone always given more kelp than what they typically needed); Treatment 1 (abalone fed their weekly ration only once a week); Treatment 2 (abalone fed half their weekly ration every 3 and then 4 days respectively). While the data at first suggest that the control animals outperform the treatment animals, after undergoing an initial adjustment period to the new feeding regime, the treatment animals perform better. Weight gain and feed conversion efficiencies show that the treatment animals perform better overall. The control animals generally required much more feed to produce comparable increases in both length and weight compared to the treatment animals. This study has shown that periodic bouts of starvation is beneficial to *Haliotis midae*, allowing variable growth spurts when returned to full feed rations.

Kelp (*Ecklonia maxima*) constitutes the major feed for farmed abalone, *Haliotis midae* Linnaeus, on the West and western South coast of South Africa. However, kelp is relatively low in protein content and is approaching limits of sustainable harvesting in kelp concession areas with high abalone farm concentrations. This has largely been the motivation for the development of a nutritionally complete, high protein feed, Abfeed®-S34 which contains 34% protein. Two of the negative effects of using Abfeed®-S34 is the higher incidence of sabellid infestation as the worms feed on the nutrient-rich faeces produced by the abalone, and the potentially poor water quality resulting. This is particularly prevalent in culture environments with abalone of shell lengths >50mm and at relatively high water temperatures, and has prompted the development of a new low protein Abfeed®-K26 (26% protein) which does not have these effects. The aim of our research was to compare the growth of grow-out abalone (abalone with a shell length >20mm) fed kelp against those fed the new Abfeed®-K26 in both a flow-through and a recirculation system, research that has not been attempted on a commercial farm before. Results show that both feeds generally produce similar growth in abalone. No significant differences were found in shell length growth for

either the recirculation or the flow-through systems for either feeds. While growth in body weight showed no significant differences in the recirculation system (P = 0.522), Abfeed®-K26 outperformed kelp in the flow-through system (P = 0.014). Abfeed®-K26 is doing exactly what it was designed to do and will no doubt prove to be of tremendous benefit to the abalone aquaculture industry as a kelp and Abfeed®-S34 substitute because it has most of the benefits of the high protein Abfeed®-S34, and none of its apparent disadvantages.

Live abalone are usually exported in polystyrene containers on ice in plastic bags containing 100% oxygen humidified with seawater for 30 to 42 hrs. Through this process, they tend to lose 4-15% of their body mass due to evaporation and pedal mucous production. Little information exists regarding live export protocols to decrease transport mortalities and weight loss during the exportation of live abalone. The aim of this research was to run an export simulation and then to determine the best growth environment to allow rapid weight gain in the abalone, *Haliotis midae* Linnaeus returned from the export simulation. Grow-out abalone were cultured in both a flow-through and a recirculation system. Abalone were fed one of two feeds (the formulated feed Abfeed®-K26 and kelp) and subdivided into replicate baskets of ±250 abalone per replicate. Abalone were grown in a series of different culture histories to determine the effects that systems history may have on the responses to the export simulation. Prior to the export simulation, abalone were purged of their gut contents. An export simulation was then run for 36 hours. Our data show that prior culture history (system and feed) affects the recovery response in exported abalone. Firstly, prior systems history appears to determine how abalone respond to the purging process. Thereafter, the type of feed that had been provided, determines their recovery response. The data also suggests that over-handling affects the recovery response in abalone returned from an export simulation. Four of the eight treatments in which abalone were fed Abfeed®-K26 regained their post-purging weights after the export simulation, while none of those fed kelp, regained their post-purging weights.

4. A little phycological exploration in Angola

A coastline that stretches about 1500 km from the cool, windy desert at the Cunene River to the sweltering, tropical lowlands at the mouth of the Congo River; “long sandy beaches interspersed with sometimes extensive stretches of rock”; new sights and experiences; perhaps a few massive fish on rod and line; and of course a whole new suite of seaweeds - who could resist? In 2006 the BCLME (Benguela Large Marine Ecosystem) Project commissioned a survey of the coastal biodiversity of Angola, and I was very happy to go along as the seaweed scientist, armed with a few papers and a list of species gleaned off that marvelous website, *AlgaeBase.*

Phycologically, the coast remains largely unexplored. Before a 1974 British Museum expedition added some 100 species to the list for Angola, only about 50 species of seaweed had been recorded, in about 30 papers, some dating from the 1800s. The 1974 BM expedition, led by George Lawson, Dave John and Jim Price, visited Angola during the last stages of Portuguese colonial occupation. They were hospitably treated by the authorities, but military conflict prevented them from entering the far northern part of the coast. They were, however, able to collect (intertidally and using SCUBA) at more than 20 sites from just north of Luanda to well down in the south, where there was little conflict. Their collections brought the total number of seaweeds for Angola to about 140 and resulted in a series of useful publications. However, when civil war broke out in Angola in 1975 no further phycological exploration took place.

In the north of Angola many rivers drain the high interior, but none can match the Congo River, which drains an area three times the size of South Africa and is second only to the Amazon River in size. These rivers, particularly the Congo, have a strong influence on the coast, bringing fresh water and large quantities of fine sediments that often make the sea turbid. In the south a few rivers enter the sea from the central highlands, but their influence on the coast is localized, and the water is generally clear.

The warm Guinea Current flows southwards down the coast, reaching about 400 km from the Namibian border in summer and retreating northwards in winter. The cold Benguela Current travels parallel to the coast of Namibia and turns westwards into the Atlantic near the Cunene River, its position moving up the coast in winter. The inshore waters of Angola are thus warm, with tropical temperatures in the north, grading to warm temperate waters in the south.

Cabo Ledo artisanal fishers in northern Angola (Rob Anderson).

Three trips were planned to cover the northern, central and southern coasts, but in the end, financial and time constraints limited us to two. Our task was to meet with Angolan biologists, and together sample the shallow inshore environment for fish, larger invertebrates and seaweeds.

The October 2006 trip saw our small group flying into the sprawling capital city of Luanda, which lying about a quarter of the way down from the Congo River, was hot and humid. After two days of planning meetings with Angolan colleagues, we finally set off in 4x4's loaded with gear, and arrived that afternoon at Cuanza fishing camp. Established a few years ago by Dr Bruce Bennett, a UCT fish biologist turned entrepreneur, the camp is a neat collection of wooden bungalows surrounded by lush lawns on the bank of a large estuary. Across the water, a tropical sunset silhouetted a massive mangrove forest, and it seemed like we were in the Africa of Joseph Conrad, except with cold beer.

We started our sampling the next day at a site about 100 km south of Luanda, and returned to Cuanza camp that night. Subsequently, we traveled north and the luxury ended. We soon settled into a daily routine of leaving our accommodation (rudimentary "hotels"), sampling at a suitable site, quickly sorting samples and packing up, driving all afternoon, finding new accommodation, sorting the rest of the samples, eating whatever supper could be found, and sleeping until daylight meant it was time to start again. The accommodation we found certainly explained the absence of tourists in Angola.

The highlights of this trip were the Slave Museum at Mussulo Bay and in the north, the town of Ambriz. Mussulo Bay, one of several very sheltered sites on the Angolan coast formed by long, offshore sand-spits, was used by slave-ships as a safe anchorage, and the slave-holding fort is now a museum. It was unforgettably moving to sit on the steps leading to the water's edge, and to imagine the uncounted numbers of men, women and children who were loaded onto ships, the more fortunate among them surviving to work the plantations of Sao Tome or the Caribbean. So many slaves came from Angola (and through there from other central African countries) that it was called the "Black Mother" of the New World.

Ambriz, our final site some 170 km north of Luanda, was reached after a full day of driving at about 20 km/hour. This arterial road appears not to have been repaired since before the Portuguese left in 1975: the few remaining patches of tar serve only to give the potholes sharp edges, and we saw shattered hulks of armoured vehicles next to the road. The town of Ambriz stands on a hill between a vast bay and an exposed rocky shore. Wide boulevards are lined with *Ficus* and other tall trees, and the faded, old colonial villas have pretty gardens and long verandas. It took me a while to put my finger on the other quality that makes Ambriz unique – it is clean. I saw one patient old man sweeping the broad streets and wondered if he alone was responsible for this unusual state of affairs. Ambriz bears the scars of battles between FNLA and MPLA forces during the Angolan civil war. The clock on the ruined town hall still marks

the hour when the building was shattered by cannon fire, and now trees grow out of the walls.

Trees sprouting from the shelled clocktower of Ambriz town hall (Rob Anderson).

The Ambriz Hotel is freshly painted, but has only half a roof, and because there is no mains electricity, the barman must rush out to tend a small generator. Here we ate an excellent dinner that was cooked on fires made in the kitchen corridor. Lobsters, fish, vegetables, rice, manioc and goat stew were served on long, immaculate tables set with spotless cutlery and green cloths. To me, this place was a remarkable testimony to the ability of ordinary Angolans to survive and make the best of difficulties that would crush most of us.

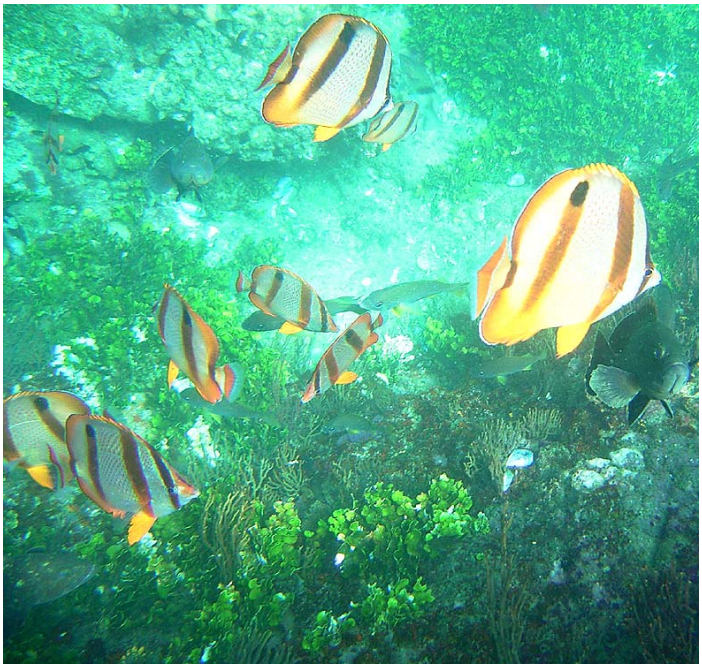
On the shores we sampled, intertidal life was generally a little disappointing. Typically, the northern sites we visited comprised cliffs with rocks at their bases. Often the rocks were of recent, sedimentary nature, and relatively soft: sometimes so soft they could be cut with a knife. From the BM reports, we expected a low diversity, but the algae tended to be small, and often in short turfs. There was seldom time to try and identify anything, and I had to be content with getting the material in formalin and correctly labeled. I had hoped to collect by snorkeling, but except for the sheltered site at the Slave Museum, the water was far too dirty.

Our second visit, in December 2006, was organized differently. The remoteness of most of the southern coast meant that we had to camp out. We flew by (very) light plane from Windhoek, and in Lobito met the Angolan scientists and three Namibian ecotourism operators who came up from Swakopmund in 4x4's with all the necessary food and equipment.

This southern Angolan trip was marvellous! The desert coast, clean seas (and still warm – usually about 20^{o}C), good catering by Neels, Ingo and Walther, the absence of dirty, crowded seaside encampments and villages, and mostly the great snorkeling, made it all memorable. I was also pretty sure that I was finding species that had not been recorded from this coast before, although everything just went into formalin and there was seldom time to press or even sort material for drying in silica gel. The marine life seemed to be a mixture of tropical and temperate species. Butterfly-fish swarmed alongside blacktails, and the shallow reefs were covered by mussels that looked like *Perna perna*. Once again most of the algal life was turfs, which was no surprise given the numerous grazing fish. However, some of the underwater crevices and intertidal pools and overhangs produced large seaweeds I had seen nowhere else on the coast.

One section of the road that we travelled provided 4x4 tales that should stand me in good stead for some time, wherever "manne" gather around the braai fire. This "short cut" between two small towns crosses a series of low mountains covered with dry thorn scrub. It is spectacularly rough, with sections of bare, jagged bedrock, sandy valleys and alarming slopes in all directions. Somewhere on our second day of slow, grinding travel, the heavy trailer that carried most of our equipment ripped the massive steel towing plate on the Land-Cruiser in half. The trailer was transferred to a Land-Rover and we crept on.

Our last site was Bahia dos Tigres, in the south. This can only be reached by traveling along the base of high dunes during a few hours at low tide,. The Namibians were extremely anxious, because a breakdown would have meant disaster, but we were rewarded by a spectacular vista of this vast bay, surrounded by desert, and yet more fish samples.



Under the water in southern Angola among *Halimeda* and butterfly-fish (Rob Anderson).

A few months of lab work followed, during which John Bolton and I established that among the 100-odd seaweeds I collected were more than 50 new records for Angola, bringing the total for that country to about 200 species. Although this total is low by comparison with other tropical and temperate algal floras, it is high by west African standards, and places Angola second only to Ghana in terms of seaweed diversity. This total can only rise when more collecting is done, particularly in the far north of Angola, which neither we, nor the 1974 BM expedition, were able to reach. We were also unable to collect in most of central Angola because the three trips that were initially planned had to be cut to two on account of time and money.

Multivariate analysis of the seaweeds and rocky-shore invertebrate distributions shows a bio-geographical change along the Angolan coast. Sites in the north (essentially those from our first trip) have a truly tropical inshore biota while in the south there are many taxa with temperate affinities, giving the southern biota a "transitional" nature. These findings accord with the hydrological regime on this coast. The south-flowing, warm Angola Current (essentially an offshoot of the tropical Guinea Current) dominates the northern and central coasts, but in the south, the influence of the cool Benguela current is felt as far north as Lobito – the sites we visited on our second trip. Endemism is extremely low in seaweeds, invertebrates and fish.

Much work remains to be done on our seaweed samples. Some identifications must be checked, and a large collection of pressed and slide-mounted specimens must be properly labeled and sent to the National Herbarium in Luanda. Eventually, we hope to provide a good account of the biogeography of the seaweeds of that country, based on our collections and all those of our predecessors. Meanwhile, a comprehensive report on the trip has been compiled for BCLME, and the findings should greatly increase our understanding of biodiversity and biogeography in the region.

Acknowledgements

Thanks to Anchor Environnmental Consultants for inviting me along, MCM for supporting my participation, and my SA and Angolan colleagues for good company and assistance (especially Dr Domingos Neto and Dr Nina Steffani for help with sampling). Special thanks to Neville Sweijd (BENEFIT) for management and backup.

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Sampling the southern Angolan shore at Babas (Rob Anderson).

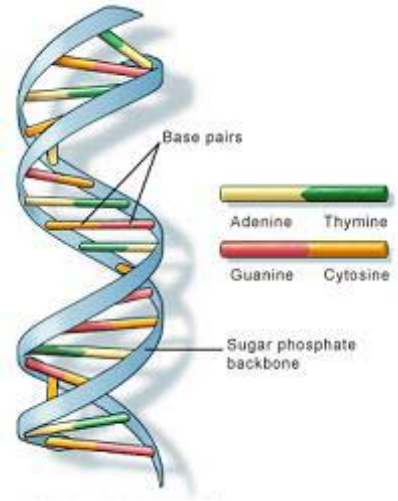
World Science

1. Study suggests how DNA building block might have formed

November 2, 2007
Courtesy: University of Georgia and World Science

Many experiments have shown it: simple molecules can combine chemically – outside of living things – to form the building blocks of DNA, the key component of life. But just how this combination occurs is unknown. Scientists want to find out, since that might explain how DNA originated.

Now, chemists have proposed what they call the first detailed, feasible account of how one of DNA's major building blocks could have arisen on an early, lifeless Earth. The necessary ingredients: five cyanide molecules, they said. Where "biomolecules," such as DNA's components, originated isn't known, said University of Georgia chemist Paul von Ragué Schleyer, one of the researchers. "One can only speculate. They could have formed from smaller molecules present on primitive Earth, either very slowly over millions of years or rapidly before the Earth cooled down. Asteroids may have brought them from outer space," he added, thought this doesn't explain how they would have formed there.



The basic structure of DNA (Courtesy U.S. National Library of Medicine).

DNA is life's molecular blueprint, passed from generation to generation. First isolated in 1869 by a Swiss doctor from pus in discarded bandages, DNA's structure was discovered in 1953. It's shaped somewhat like a twisted ladder with rungs anchored by interlocking pairs of two out of four molecules, known as nucleic acid bases (adenine, guanine, cytosine and thymine).

Schleyer's team focused on adenine because of its prevalence and ability to form from simple components in the dark. Along with other building blocks of life, adenine has even been detected in outer space, though there, the great distances among its smaller molecular ingredients make its emergence trickier to explain. But many experiments have shown that simulated primitive Earth conditions can lead to the formation of essential compounds of life including amino acids, nucleotides and carbohydrates, the researchers wrote in their study. The work was published Oct. 30 in the scientific journal *Proceedings of the National Academies of Science*.

Remarkably, they said, adenine has been found to arise from highly poisonous cyanide dissolved in ammonia and frozen in a refrigerator for 25 years. A high-temperature experiment designed to simulate early volcano-like environments, also produced adenine. But the question is how. Schleyer's team devised an answer by solving a series of key riddles. They worked out processes in which five cyanide molecules might combine to make adenine under terrestrial conditions. The proposal was based on computer-assisted studies that involved quantum mechanics, the sometimes illogical-seeming rules that govern atomic interactions.

The researchers said the report provides a more detailed understanding of some of the processes of "chemical evolution," and a partial answer to the basic question of how life's chemistry emerged. The investigation should trigger similar probes into the origins of the three remaining bases and of other biologically relevant molecules, they added.

2. New Antarctic image map to "revolutionize" research

November 27, 2007
Courtesy: NASA and World Science

Researchers have unveiled a new, highly detailed map of Antarctica, built from satellite images, that they say will revolutionize research of the continent's frozen landscape. Freely available at

http://lima.usgs.gov, the map was created using the NASA-built Landsat 7 satellite. It gives a nearly cloudless view of the continent at 10 times greater resolution than any previous map, scientists said.

With an unprecedented ability to see features half the size of a basketball court, the map offers the most geographically accurate, true-color, high-resolution views of Antarctica, they added. "It will open new windows of opportunity for scientific research as well as enable the public to become much more familiar with Antarctica and how scientists use imagery in their research," said Robert Bindschadler of NASA's Goddard Space Flight Center in Greenbelt, Md. "This innovation is like watching high-definition TV in living color versus watching the picture on a grainy black-and-white television. These scenes don't just give us a snap-shot, they provide a time-lapse historical record of how Antarctica has changed," Bindschadler said. They "will enable us to continue to watch changes unfold."

Researchers can use the map to plan scientific expeditions and map rock formations and types, among other uses, he added. To make the map, scientists stitched together more than a thousand images from three years of Landsat observations. Eight different versions of the resulting "mosaic" are available to download. Bindschadler, who conceived the project, initiated NASA's collection of images of Antarctica for the project in 1999. He and colleagues chose the images to be used and developed new techniques to interpret the data. The collage contains almost no gaps in the landscape, other than a doughnut hole-shaped area at the South Pole, researchers said.

"The mosaic represents an important US-UK collaboration," said Andrew Fleming of British Antarctic Survey in Cambridge, U.K. "I have no doubt that polar researchers will find this mosaic, one of the first outcomes of that initiative, invaluable for planning science campaigns."

The same Antarctic scene imaged by different satellite instruments: from the Landsat 7 above, used in the new map; and the MODIS instrument on the Terra and Aqua satellites in lower resolution at the bottom (Courtesy NASA [below], USGS [above]).

Featured Article

National Environmental Management: Integrated Coastal Management Bill – 2007

South Africa has been through an overhaul of its environmental laws in the last three years, relating back to an original white paper on the subject in the early nineties and the proclamation of the principal act, the National Environmental Management Act (NEMA) in 1998. The bill also introduces a number of high priority concerns of more recent years such as the effects of global warming and the invasion of coastal areas; the need to define coastal protection zones; estuarine management protection protocols; new boundaries in view of the dissolution of apartheid land definitions; and the setting up of control committees across all three tiers of government.

The main objective of the bill it to establish a system of integrated coastal and estuarine management in the Republic, including norms,

standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligations in relation to coastal matters; and to provide for matters connected therewith.

PREAMBLE

Whereas everyone has the constitutional right to have the environment, including the coastal environment, protected for the benefit of present and future generations;
and whereas integrated management of the coastal zone as a system is essential to achieve the constitutional commitment to improving the quality of life of all citizens, while protecting the natural environment for the benefit of present and future generations;
and whereas the coastal zone is a unique part of the environment in which biophysical, economic, social and institutional considerations interconnect in a manner that requires a dedicated and integrated management approach;
and whereas much of the rich natural heritage of our coastal zone is being squandered by overuse, degradation and inappropriate management;
and whereas the economic, social and environmental benefits of the coastal zone have been distributed unfairly in the past;
and whereas the conservation and sustainable use of the coastal zone requires the establishment of an innovative legal and institutional framework that clearly defines the status of coastal land and waters and the respective roles of the public, the State and other users of the coastal zone and that facilitates a new co-operative and participatory approach to managing the coast;
and whereas integrated coastal management should be an evolving process that learns from past experiences, that takes account of the functioning of the coastal zone as a whole and that seeks to co-ordinate and regulate the various human activities that take place in the coastal zone in order to achieve its conservation and sustainable use.

The bill (copies can be downloaded from DEAT's website) has been tabled. The Portfolio Committee on Environmental Affairs and Tourism has conducted numerous public hearings on the new bill, the most recent one taking place on the 23 November 2007.

Sources: http://www.environment.gov.za/; http://www.participation.org.za/; http://www.sabinet.co.za/sabinetlaw/index.php

For any further queries regarding the bill or aspects of the participatory process, please feel free to contact **Ms. Albertina Kakaza**
(Email akakaza@parliament.gov.za)

Conference Countdown

The 23rd Congress of the Phycological Society of Southern Africa (15-18 January) is just a few weeks away. The venue, Ellingham Resorts is situated within walking distance of the beach and accommodation is in log cabins. The conference venue is air-conditioned. All meals will be provided by the on site restaurant, the Bell and Anchor.

The conference will take the form of 20-minute oral presentations, a poster session and a field trip organized by Dr A.J. Smit. The invited speaker is Dr. N.S. Yokoya from the Institute of Botany, São Paulo, Brazil. If you would still like to register, please contact Wendy Stirk at *stirk@ukzn.ac.za*. Details are still available of the society's website.

Calendar of Events

Upcoming Conferences

1. Spring meeting of the Society for General Microbiology (UK) *"Cyanobacteria: who they are and what they do?"*, Edinburgh, Scotland, 2-3 April 2008. http://www.sgm.ac.uk/meetings/MTGPAGES/Edi08Se.cfm
2. *Ectocarpus* 2008. Dunstaffnage Marine Laboratory, Oban, Scotland, 4-8 June 2008. http://www.ccap.ac.uk/Conferences2008.htm
3. 11th Congress of the International Society for Applied Phycology (ISAP). Galway, Ireland, 21-27 June 2008. Email: stefan.kraan@nuigalway.ie
4. South African Marine Science Symposium (SAMSS) 2008. Cape Town, RSA, 30 June - 3 July 2008. Email: annette@nrf.ac.za
5. 20th International Diatom Symposium, Dubrovnik, Croatia, 7-13 September 2008. http://www.imp-du.com/ids2008
6. 5th Asian Pacific Phycological Forum (APPF). Wellington, New Zealand, 10-14 November 2008. http://www.appf2008.com
7. International Phycological Congress (IPC) 2009. Tokyo, Japan, 2-8 August 2009.

Potash from African Seaweed.

Investigations of the possibilities of producing potash from sea bamboo and other seaweed off the coast of South Africa, carried on by Gilbert F. Britten, have shown that while South African sea bamboo is lower in potash contents than the American weed, it is better in composition. According to The Cape Argus, which is quoted by Consul General George H. Murphy of Cape Town, Mr. Britten believes it possible for large quantities of potash to be obtained from the seaweed available off the South African coasts, and he recommends that a marine survey be made to ascertain its distribution.

The New York Times
Published: March 31, 1918

23rd Congress of the Phycological Society of Southern Africa

15th – 18th January 2008

Ellingham Resorts
Rocky Bay, KwaZulu-Natal

Sponsored by:
Taurus Products (Pty) Ltd and
National Research Foundation, Pretoria

Organized by:
Research Centre for Plant Growth and Development,
University of KwaZulu-Natal, Pietermaritzburg

Programme

▲denotes student speaker

TUESDAY 15th JANUARY 2008

15.00 – 17.30 REGISTRATION

17.30 BRAAI: outside conference venue

WEDNESDAY 16th JANUARY 2008

7.00 – 7.45 BREAKFAST: Bell and Anchor

7.45 – 8.00 **WELCOME ADDRESS**
John Bolton

8.00 – 8.50 **PLENARY**
Chairperson: *Wendy Stirk*

Nair Yokoya
Effects of plant hormones on growth and morphogenesis in Rhodophyta

SESSION 1 **PHYSIOLOGY AND ULTRASTRUCTURE**
Chairperson: *John Bolton*

8.50 – 9.10 ▲ *Steve Dlaza*
The effects of environmental conditions on the life history of South African *Porphyra capensis* (Bangiales, Rhodophyta) in culture

9.10 – 9.30 ▲ *Diina Shuuluka*
The influence of irradiance, temperature and salinity on the growth of the green alga *Ulva rigida* C. Agardh (Ulvales, Chlorophyta) in culture

9.30 – 9.50 *Wendy Stirk*
Effect of exogenous cytokinins on the growth rate of the microalgae *Chlorella minutissima* (Chlorophyta) in culture

9.50 – 10.10 ▲ *Mark Cyrus*
Use of stable isotope signatures in the kelp *Ecklonia maxima* and the filter-feeder *Mytilus galloprovincialis* to determine the extent of sewage dispersal from Green Point Outfall, Cape Peninsula, South Africa

10.10 – 10.30 ▲ *Bernadette Hubbart*
The uptake and clearance of a suite of phycotoxins from the mussel *Chromytilus meridionalis* in the Southern Benguela

10.30 – 10.50 ▲ *Philippa Wing*
Coccolith production in *Pleurochrysis carterae* (Prymnesiophyceae)

10.50 – 11.00 GROUP PHOTOGRAPH

11.00 – 11.30 TEA BREAK: outside conference venue

SESSION 2 **BIODIVERSITY AND MICROALGAL COMMUNITIES**
Chairperson: *Eileen Campbell*

11.30 – 11.50 *Rob Anderson*
The marine macroaglae of Angola

11.50 – 12.10 *Claudio Marangoni*
Pseudo-nitzschia species from Southern Africa

12.10 – 12.30 ▲ *Gavin Snow*
Phytoplankton recovery following a flood in the Knysna Estuary

12.30 – 12.50 ▲ *Nuette Gordon*
A comparison of the limnology of three lacustrine wetlands in the Agulhas Plain, with special reference to the microalgal community

12.50 – 13.10 ▲ *Micole Moses*
Primary productivity across intertidal sandy beaches, KwaZulu-Natal

13.10 – 13.30 *Tommy Bornman*
The influence of a large flood event on the phytoplankton assemblages of three blackwater dominated estuaries

13.30 – 14.30 LUNCH: Bell and Anchor

14.30 FIELD TRIP: *AJ Smit and Johan van der Molen*
Testing the accuracy of a FluoroProbe to measure chlorophyll

15.45 -16.15 TEA BREAK: outside conference venue

16.15 FIELD TRIP continued

19.30 DINNER: Bell and Anchor

THURSDAY 17th JANUARY 2008

7.00 – 8.00 BREAKFAST: Bell and Anchor

Session 3 **MARICULTURE**
Chairperson: *Gavin Maneveldt*

8.00 – 8.20 *AJ Smit*
The effect of diet on the sensory quality of cultivated abalone

8.20 – 8.40 *Flower Msuya*
Deep water floating lines technique could solve the problem of seaweed die-off in Tanzania

8.40 – 9.00 ▲ *Kishan Sankar*
Feed trial growing abalone (*Haliotis midae*) using different ratios of artificial feed (Abfeed®) and kelp (*Ecklonia maxima*)

9.00 – 9.20 ▲ *Tamson Francis*
Comparing the growth of market-size abalone fed kelp versus the new low protein, commercially available Abfeed®-K26

9.20 – 9.40 ▲ *Dorette du Plessis*
Response of phytoplankton to enrichment from cage aquaculture in enclosed farm dams of the Western Cape

9.40 – 10.00 ▲ *Elizabeth van der Merwe*
The effects of hand vs machine grading on the growth and survivorship of grow-out abalone

10.00 – 10.20 *Mark Rothman*
Gracilaria collection in South Africa: Long-term monitoring of a declining resource

10.20 – 10.40 *John Bolton*
Analysis of kelp (*Ecklonia maxima*) as abalone feed in South Africa

10.40 – 11.00 TEA BREAK: outside conference venue

Session 4 **DIATOMS**
Chairperson: *Johan van der Molen*

11.00 – 11.20 *Bill Harding*
The value of diatoms in South African aquatic biomonitoring: *Quo vadis*?

11.20 – 11.40 *Colin Archibald*
The use of historic herbarium material and contemporary diatom-based community composition data as an added-value measure of river health in rivers of KwaZulu-Natal

11.40 – 12.00 *Jonathon Taylor*
The freshwater African Surrirellaceae types of B.J. Cholnoky and M. Giffen: A pilot project for the typification of South African diatom species

Session 5 **POSTERS**

Chairperson: *Derek du Preez*

12.00 – 13.20

Johan van der Molen
The South African Diatom Collection: Making headway

Jonathon Taylor
Documentation and survey of South African diatom species

Anatoly Levenets
Diversity of algae in saline soils of Eastern Transvaal, South Africa

▲ *Nolusindiso Jafta*
Diatoms as water quality indicators for Soetendalsvlei, Western Cape

▲ *Sabine Hoppe-Speer*
Diatom community structure within the temporarily open-closed estuary within the Tsitsikamma Estuary

Anatoly Levenets
Conjugatophyceae in the soils of the Republic of South Africa: Historical and new data

Eileen Campbell
A biotic classification of Eastern Cape sandy shores

▲ *Tamson Francis*
Determining the most appropriate feeding regime for the South African abalone *Haliotis midae* Linnaeus grown on kelp

▲ *Tinus Sonnekus*
Culturing of *Hypnea rosea* as a food source for commercially grown abalone, *Haliotis midae*, on the Eastern Cape coast

▲ *Elizabeth van der Merwe*
The effects of grading vs. splitting on the growth of <30-month old abalone

Flower Msuya
The influence of environmental parameters on the growth rate of cultivated seaweeds *Kappaphycus alvarezii* and *Eucheuma denticulatum* in Zanzibar, Tanzania

13.15 – 14.00 LUNCH: Bell and Anchor

SESSION 6 **MARICULTURE**
Chairperson: *Rob Anderson*

14.00 – 14.20 *Klaus Rotmann*
The economic value of *Ecklonia maxima*

14.20 – 14.40 *AJ Smit*
Algal DMSP as potential antioxidative agents in abalone

14.40 – 15.00 ▲ *Debbie Robertson-Andersson*
A pilot scale intergrated seaweed (*Ulva lactuca*) and abalone (*Haliotis midae*) recirculation system

15.00 – 15.20 ▲ *Dotto Salum*
Do different planting densities have an effect on carrageenan yield and quality from *Kappaphycus alvarezii* and *Eucheuma denticulatum* cultivated in Zanzibar, Tanzania

15.20 – 15.50 TEA: outside conference venue

SESSION 7 **TAXONOMY**
Chairperson: *Claudio Marangoni*

15.50 – 16.10 *Gavin Maneveldt*
Keys to the non-geniculate coralline algae (Corallinales, Rhodophyta) of South Africa

16.10 – 16.30 ▲ *Lineekela Kandjengo*
Are *Ulva capensis* Areschoung and *Ulva rigida* C. Agardh distinct entities, and what are the implications for aquaculture?

16.30 – 16.50 ▲ *Trevor Bell*
A cladistic study of *Nephroselmis* Stein

17.00 AGM

19.30 DINNER AND PRIZE-GIVING: Bell and Anchor

FRIDAY 18th JANUARY 2008

7.00 – 8.00 BREAKFAST: Bell and Anchor

DEPARTURE
