NEWS FROM:

Communication and Marketing Department
Isebe loThungelwano neNtengiso
Kommunikasie en Bemarkingsdepartement

Private Bag X3, Rondebosch 7701, South Africa
La Grotto House, Glendarrach Rd, Rondebosch, Cape Town
Tel: +27 (0) 21 650-3733/2, Fax: +27 (0) 21 650-5682
Internet: www.uct.ac.za

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UCT PhD research assists local abalone farmers

Abalone farming is a growing export industry in South Africa. The stock feeds on seaweed, whose health and cultivation are examined by three UCT graduands who received their PhDs on Friday, 10 June 2011.

Diina Shuuluka's PhD thesis, *Ecophysiological studies of three South African* Ulva *species from integrated seaweed/abalone aquaculture and natural populations,* examines species of the green seaweed *Ulva* ("sea lettuce"). Recommendations from the thesis have already assisted in the management of seaweed production on local abalone farms, and her study has made a significant scientific contribution to the sustainable aquaculture of seaweeds in land-based integrated multi-trophic aquaculture systems.

Over a thousand tons are grown annually on South African abalone farms as feed for the animals and to carry out bioremediation (nutrient removal) of aquaculture effluent. Two species grown in commercial aquaculture are compared with similar species growing in natural populations. The study encompasses a wide range of topics, including commercial production and its optimisation, effects of a variety of environmental conditions on photosynthesis and growth in the laboratory, factors controlling seasonal patterns of commercially important components (protein and amino acids, nutrients, carotenes, minerals, heavy metals), and disease.

Shuuluka is Namibian and studied at the University of Namibia in Windhoek. She obtained an MSc in 2005 in microalgal biotechnology in the Department of Chemistry (UNAM), co-supervised by scientists from Ben Gurion University of the Negev in Israel. She came to UCT seconded from a post at the Sam Nujoma Coastal Resources Centre of UNAM in Henties Bay, where she works as an aquaculture scientist. Her supervisor is Professor John Bolton in the Department of Botany at UCT, and her PhD is in Botany.

Thembinkosi Dlaza's PhD thesis, *Development in culture, ecophysiology and nutritional content of three South African Porphyra (Rhodophyta, Bangiales) species,* examines the biology of three common South African *Porphyra* species with respect to their possible cultivation. All three species have potential for cultivation, and this study provides the

information for selecting species and conditions in order to take such cultivation to pilot commercial level.

The genus *Porphyra* is commercially valuable for production of *nori* and potentially valuable in South Africa as feed for farmed abalone. From studies of natural populations Dlaza shows that gametophytes are present year-round in two of the species, but absent in winter in the third. Spore release is affected quantitatively by temperature, salinity and irradiance. Culture studies of the conchocelis phases (described for the first time in two of the species) illustrate quantitative effects of irradiance, photoperiod and temperature, with some differences between species. Gametophytes are analysed seasonally for macro-elements, micro-elements and crude and soluble protein. All three species show relatively high nutritional values and nutritionally safe levels of potentially toxic elements such as heavy metals. Four apparently undescribed *Porphyra* species were found in the course of the study and are provisionally described.

Dlaza studied at the University of the Western Cape from 1998 to 2005, obtaining BSc, BSc (Hons) and MSc degrees. He has been studying at UCT in the Department of Botany since 2006. During this time he co-authored several publications and conference presentations. His supervisor is Professor John Bolton in the Department of Botany at UCT. Dlaza's PhD is in Botany.

Christopher Ealand's PhD thesis, *Identification and characterization of the activated defence response in the commercially important agarophyte, gracilaria gracilis, following exposure to disease elicitors,* examines the defence response mounted by *G. gracilis* following exposure to oligoagar polymers that resemble degraded cell wall. The commercially important red seaweed, *Gracilaria gracilis*, occurs naturally in Langebaan Lagoon and Saldanha Bay, South Africa. However, the yield of beach-cast seaweed has diminished substantially due to oligotrophic conditions and the consequent action of opportunistic microbial pathogens which degrade the cell wall of the seaweed.

A DNA microarray was used to identify differentially expressed genes in seaweed exposed to disease elicitors. Differential expression of a few of these genes, chosen on the basis of their putative function following bioinformatic analysis, was confirmed. Two genes, encoding proteins thought to play a role in the defence response of the seaweed, were cloned into an expression vector and expressed in *E. coli* to produce sufficient protein for generation of polyclonal antibodies. Western hybridisation was used to investigate expression of the two putative defence response genes at the translational level in seaweed exposed to disease elicitors.

Ealand obtained a BSc degree in Microbiology and Physiology and a BSc (Hons) degree in Microbiology from the University of the Witwatersrand. His PhD supervisor is Associate Professor Vernon Coyne of the Molecular and Cell Biology Department at UCT. Ealand's PhD is in Molecular and Cell Biology.

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Issued by: UCT Communication and Marketing Department

Patricia Lucas
Tel: (021) 650 5428 Fax (021) 650 5628
Cell: 076 292 8047
E-mail: pat.lucas@uct.ac.za
La Grotto House, Glendarrach Road
University of Cape Town
Rondebosch
Website: www.uct.ac.za