

Forum Phycologicum



Newsletter of the
**Phycological Society
of Southern Africa**

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From the Editor

At the end of yet another year and the usual end-of-year tiredness has already long been upon most of us. It is re-assuring knowing that the year has had its moments and from the number of publications for 2011, it is clear that many of us have been quite productive.

First let me start by apologizing for the delay in sending out the December issue of the newsletter. The year had come to an end far too quickly and with my many administrative responsibilities, it was hard keeping abreast of what I really love doing i.e. keeping everyone informed! Getting on with matters at hand, this issue has an assortment of news and reviews, two of which are worth highlighting at this point. In honour of deceased PSSA member Klaus Rotmann, Taurus Chemicals have established a Memorial Award to foster research on the commercial applications of seaweeds. We are also proud to announce that Colin Archibald will be awarded his PhD from UCT in just a few days and will (we presume) continue to highlight the importance of diatom research in SA. I've kept the featured article more light-hearted this time round and have chosen instead to use Rob Anderson's wonderfully informative submission as the centre-piece for the December issue. It is nice knowing that SA phycologists are impacting well beyond our borders.

Not to labour my comments any further, but I do hope that you have all started planning for the 2012 annual meeting in the Eastern Cape. It has been a very long while since I've missed a PSSA (2011) and so I am really looking forward to our meeting in June of 2012. Here's wishing you all a blessed, restful and safe festive season. Till we meet again.

Sincerely
Gavin

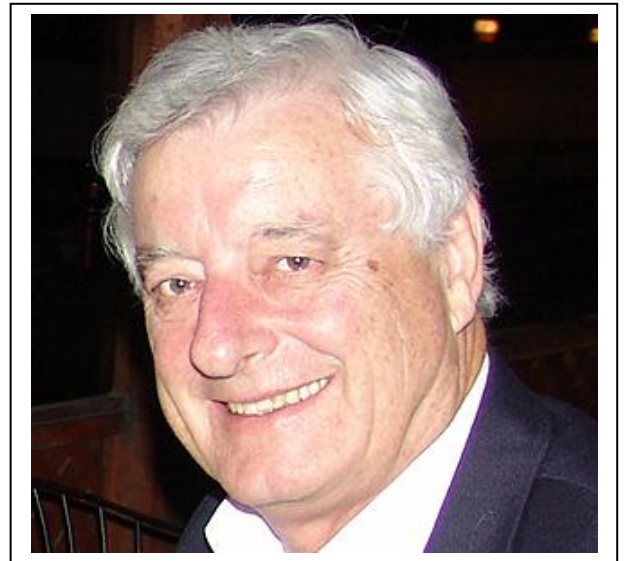
Synarthrophytonpatena
epiphytic on *Gelidiumcapense*



News and Reviews

1. Klaus Rotmann Memorial Award

As most of you are now well aware, Klaus Rotmann died peacefully on 15 April 2011 in St Gallen, Switzerland, with his family at his bedside, after succumbing to cancer (see *Forum Phycologicum* Vol. 76). Klaus was a staunch friend of phycology in southern Africa and supported, and regularly attended the annual congresses of the Phycological Society of Southern Africa (PSSA). Professionally or socially, Klaus was always good company: helpful, modest, witty and ready for a good laugh. He was a big man with an even larger personality.



In recognition of Klaus' memory, Taurus has very kindly offered to sponsor an annual award at PSSA Congresses. The award is being offered in the hope that it will encourage research on the commercial applications of seaweeds. Klaus felt strongly that there were many facets to research on seaweeds and always wanted to further this approach among students in southern Africa.

An award of R2000 will be made annually for the best applied presentation(s), decided on by the panel of PSSA. Should there be no such presentation, the funds will roll over to the next year.

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2. SA Diatom Research Forges Ahead

In the July 2010 (Volume 73) issue of *Forum Phycologicum*, Bill Harding reported on the challenges facing diatom research in South Africa. Despite the proven value of diatom research (for aquatic biomonitoring, as indicators of eutrophication and acidification, for the formulation of ecological inferences and providing an evidence base on which water resource management decisions can be made), regrettably the programme was prematurely terminated in January 2010. For the second time in recent South African history, the most exciting development in aquatic biomonitoring was shut down.

A year after the report by Bill (*Forum Phycologicum* Vol 76), recognition was given to South African diatom research with a recent paper establishing a new diatom genus (*Archibaldia*) dedicated to the brothers R.E.M. (late) and Colin G.M. Archibald, recognizing their tremendous impacts on the study of diatoms. The gist of all of this was that it demonstrated that the small band of diatom folk in South Africa are at the forefront of diatom research, despite the difficulty in securing local funds to continue all their important work.

In continuing with this tradition, Colin Archibald will be graduating with a PhD in Botany from the University of Cape Town (under the supervision of John Bolton) later this month (16 December) after successfully defending his doctoral thesis entitled:

"The use of contemporary and historic diatom assemblages in the derivation of reference state communities for rivers in KwaZulu-Natal. South Africa"

In contrast to the lack of support for diatoms in biomonitoring in South Africa, Colin's external examiners (No 1 in UK and also No 1 in Australia in river biomonitoring) had this to say ... *"it is an impressive piece of work ... it tackles an important question relevant in South Africa and beyond using an impressive dataset"* and *"the topic selected is unique but relevant to the use of diatoms as biomonitors in the modern world threatened by water pollution and water crisis"* ... *"It is not surprising that finding a benchmark state for water*

bodies is a challenging task ... allowing the biomonitors to tell the story themselves - is enunciated very clearly"

These comments are provided, not to sing Colin's praises, but to demonstrate that international scientists recognise the value of diatoms in biomonitoring of rivers, which seemingly is not the case in South Africa. The 'battle' therefore goes on to have the SA Diatom Protocol truly accepted in the 'toolkit' of the SA River Health Programme and it is comforting knowing that our diatom specialists are not being dissuaded by such actions. Well done Colin!

3. New logo for the International Seaweed Association

As the Secretary of the International Seaweed Association (ISA), it is my pleasure to announce the launching of a contest to find a new logo for our association. The rules of the contest are attached (see Appendix II).

To be considered, designs must include the acronym "ISA" and a figurative representation of at least one brown seaweed, one red seaweed and one green seaweed, hopefully of commercial interest. So, during the next three months, get your creative juices, and those of your students or friends, flowing. Provide me with your proposal no later than Friday, March 2, 2012.

The members of the ISA Logo Committee will then decide which proposal will become the official logo of the ISA for the years to come. The winner of the contest will have her/his registration fees to the next International Seaweed Symposium in Bali, in April 2013, waived as the Prize for this contest. Get your mouse or pen working and surprise us with an imaginative logo about our favorite organisms: seaweeds!

Thank you very much in advance and all the best,

Thierry Chopin

Secretary of the International Seaweed Association

Email: tchopin@unbsj.ca



4. Report on the 5th European Phycological Congress

I was lucky to be able to attend the 5th European Phycological Congress held on the island of Rhodes, Greece from the 4-9 September 2011. The conference was held in the Rhodos Palace Hotel overlooking the calm, blue Mediterranean Sea. A walk along the pebble beach in the evenings was an ideal way to relax after the days talks.

The conference consisted of four days of interesting talks and posters covering a broad spectrum of topics ranging from *Environmental Stresses on Coastal Marine Algae*, *Molecular and Cellular Responses in Algae Induced by Changes in the Environment*, *Diversity and Taxonomy of Seaweeds*, *DNA Taxonomy*, *Genetics of Speciation*, *Cell Biology and Molecular Physiology* and *Algal Biotechnology*. I presented a talk on “Endogenous cytokinins in synchronized *Chlorella* cultures in relation to light and the cell cycle” and was a co-author on an invited paper on “Plant hormones in algae – potential use in agriculture” presented by our long-standing collaborator Mirek Strnad (Czech Republic) who used many examples based on our experiments with Kelpak.

For the mid-week excursion, I went to another old Greek town Lindos that is on the same island. Having just helped my son with a project on Ancient Greece, it was nice to see real examples of an ancient Greek Acropolis with doric columns, an amphitheatre and mosaic floors, etc.

The 6th European Phycological Congress is to be held in London, United Kingdom in 2015.

Wendy Stirk

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5. 2011 Members' Publications

On the following pages are just some of the PSSA Members' Publications over the past year.

Images from Rhodes Island, Greece



View from my hotel bedroom



The Acropolis in Lindos



The only Greek taxi drivers who were not striking during the conference (I caught a bus to the airport as it is hard to load a suitcase onto a donkey)



Identification and in vitro anti-esophageal cancer activity of a series of halogenated monoterpenes isolated from the South African seaweeds *Plocamium suhrii* and *Plocamium cornutum*

Antunes EM, Afolayan AF, Chiwakata MT, Fakee J, Knott MG, Whibley CE, Hendricks DT, Bolton JJ, Beukes DR

Five known (1, 2, 4, 6 and 7) halogenated monoterpenes together with 1Z,3R*,4S*,5E,7Z)-1-bromo-3,4,8-trichloro-7-(dichloromethyl)-3-methylocta-1,5,7-triene (3) and (3R*,4S*)-3,4,6,7-tetrachloro-3,7-dimethylocten-1-ene (5) were isolated from the red macroalga *Plocamium suhrii* and their structures deduced from their spectroscopic data. The seven compounds from *P. suhrii* together with five related compounds from *Plocamium cornutum* have been evaluated for their cytotoxic effects on an esophageal cancer cell line (WHCO1). Compounds 1-6 showed greater cytotoxicity in this assay as compared to the known anticancer drug cisplatin

Phytochemistry (2011) 72: 769-772

First report of *Sporolithon ptychoides* (Sporolithales, Corallinophycidae, Rhodophyta) for the Atlantic Ocean

Bahia RG, Riosmena-Rodriguez R, Maneveldt GW, Amado Filho GM

Samples corresponding to *Sporolithon ptychoides* Heydrich were collected in the mesophotic zone (50 m depth) south of Espírito Santo State, Brazil. The collected material presented features characteristic of the species, namely: tetrasporangia of 75–105 x 40–55 µm grouped into sori that are raised above the surrounding vegetative thallus surface; presence of a basal layer of elongate cells in areas where the tetrasporangia develop; presence of buried tetrasporangial compartments deep in the thallus; and 3–5 cells in the tetrasporangial paraphyses. These same features said to collectively characterize *S. ptychoides*, were all observed in a representative specimen and the type specimen of *Sporolithon dimotum* (Foslie & Howe) Yamaguishi-Tomita ex

M.J Wynne. This latter species is thus conspecific with *S. ptychoides* and is therefore considered a heterotypic synonym thereof, as *S. ptychoides* has nomenclatural priority. This study expands the known geographical distribution of the species and may give insight into the origin of the species into other geographical regions.

Phycological Research (2011) 59: 64–69

Evolutionary history of the Corallinales (Corallinophycidae, Rhodophyta) inferred from nuclear, plastidial and mitochondrial genomes

Bittner L, Payri CE, Maneveldt GW, Couloux A, Cruaud C, de Reviers B, Le Gall L

Systematics of the red algal order Corallinales has a long and convoluted history. In the present study, molecular approaches were used to assess the phylogenetic relationships based on the analyses of two datasets: a large dataset of SSU sequences including mainly sequences from GenBank; and a combined dataset including four molecular markers (two nuclear: SSU, LSU; one plastidial: psbA; and one mitochondrial: COI). Phylogenetic analyses of both datasets re-affirmed the monophyly of the Corallinales as well as the two families (Corallinaceae and Hapalidiaceae) currently recognized within the order. Three of the four subfamilies of the Corallinaceae (Corallinoideae, Lithophylloideae, Metagoniolithoideae) were also resolved as a monophyletic lineage whereas members of the Mastophoroideae were resolved as four distinct lineages. We therefore propose to restrict the Mastophoroideae to the genera Mastophora, Metamastophora, and possibly Lithoporella in the aim of rendering this subfamily monophyletic. In addition, our phylogenies resolved the genus *Hydrolithon* in two unrelated lineages, one containing the genotype *Hydrolithon reinboldii* and the second containing *Hydrolithon onkodes*, which used to be the genotype of the now defunct genus *Porolithon*. We therefore propose to resurrect the genus *Porolithon* for the second lineage encompassing those species with primarily monomerous thalli, and trichocyte arrangements in



large pustulate horizontal rows. Moreover, our phylogenetic analyses revealed the presence of cryptic diversity in several taxa, shedding light on the need for further studies to better circumscribe species frontiers within the diverse order Corallinales, especially in the genera *Mesophyllum* and *Neogoniolithon*.

Molecular Phylogenetics and Evolution (2011) 61: 697–713

Molecular evidence for three separate cryptic introductions of the red seaweed *Asparagopsis* (Bonnemaisoniales, Rhodophyta) in South Africa

Bolton JJ, Andreakis N, Anderson RJ

The red seaweed genus *Asparagopsis* Montagne (Bonnemaisoniales) contains two widely introduced species that are considered notorious seaweed invaders worldwide, *Asparagopsis armata* and *A. taxiformis*, both characterised by heteromorphic, diplo-haplontic life histories. To uncover cryptic introductions of *Asparagopsis* along the South African coastline and identify ‘*Falkenbergia*’ isolates (i.e. tetrasporophytic life-history phase morphologically identical between species), the mitochondrial *cox2–3* spacer was sequenced from gametophytes of *Asparagopsis taxiformis* from Scottburgh, KwaZulu-Natal, on the East Coast, Knysna Lagoon on the South Coast and from tetrasporophytes, otherwise unidentifiable to species level, collected from False Bay near Cape Town on the South-West Coast and Tsitsikamma on the South Coast. Only tetrasporophytes of the temperate *Asparagopsis armata* were encountered from the Cape Peninsula (Cape Town) probably as far east as to Port St Johns, Eastern Cape province. This is considered an introduced species, and was first collected at Kommetjie (Cape Peninsula) in 1935. Gametophytes of the warm-temperate to tropical *A. taxiformis* were first collected at Reunion Rocks near Durban in 1984; the KwaZulu-Natal material studied here belongs to an Atlantic Mediterranean cryptic lineage. This taxon is an ecological dominant in some intertidal and shallow subtidal areas in northern KwaZulu-Natal, and is thus considered ‘introduced’ and ‘invasive’. In contrast, *A. taxiformis* gametophytes, collected in Knysna

Lagoon in 2008, clustered with individuals of Indo-Pacific lineage 2. The latter is considered a major invasive lineage in the western Mediterranean, but at present is categorised as introduced in South Africa. This study provides molecular evidence of three independent, cryptic introductions in South Africa, one of them probably very recent, and this is discussed with respect to potential vectors responsible for transport.

African Journal of Marine Science (2011) 33(2): 263–271

Impact of AMPEP on the growth and occurrence of epiphytic *Neosiphonia* infestation on two varieties of commercially cultivated *Kappaphycus alvarezii* grown at different depths in the Philippines

Borlongan IAG, Tibubos KR, Yunque DAT, Hurtado AQ, Critchley AT

Two varieties of the carrageenophyte *Kappaphycus alvarezii* (Tungawan, TUNG; and Giant tambalang, GTAM) from Zamboanga Sibugay, Philippines were used to test the efficacy of Acadian Marine Plant Extract Powder (AMPEP) as source of nutrients for growth, and to determine if applications had any effect on the percent occurrence of an epiphytic infestation of the red alga *Neosiphonia* sp. at four different depths in the sea. Results showed that the use of AMPEP significantly ($P < 0.05$) increased the growth rate of both *Kappaphycus* varieties tested but decreased the percent occurrence of *Neosiphonia* sp. The percent occurrence of *Neosiphonia* sp. infection (6–50% at all depths) of both *Kappaphycus* varieties with AMPEP treatment was significantly lower than the controls (i.e., 10–75% at all depths). Both the growth rate of the cultivated seaweed and the percent occurrence of the epiphytes decreased as the cultivation depth increased. Plants dipped in AMPEP and suspended at the surface had the highest growth rates (i.e., 4.1%, TUNG; 3.1%, GTAM) after 45 days; those without AMPEP dipping had the highest percent



occurrence of *Neosiphonia* infection (viz. 70–75%). The occurrence of *Neosiphonia* infestation was found to be correlated with changes in irradiance and salinity at the depths observed. The results suggested that both varieties of *K. alvarezii* used in this study have the fastest growth rate when grown immediately at the water surface. However, in order to minimize damage caused by the occurrence of epiphytic *Neosiphonia*, *K. alvarezii* should be grown within a depth range of 50–100 cm. These observations are important for the improved management of *Kappaphycus* for commercial farming. Furthermore, the use of AMPEP treatments for enhancement of growth and reduction deleterious *Neosiphonia* sp. infections is encouraging.

Journal of Applied Phycology (2011) 23: 615–621

Commercial extract of the brown seaweed *Ascophyllum nodosum* enhances phenolic antioxidant content of spinach (*Spinacia oleracea* L.) which protects *Caenorhabditis elegans* against oxidative and thermal stress

Fan D, Hodges DM, Zhang J, Kirby CW, Ji X, Locke SJ, Critchley At, Prithiviraj B

There is considerable interest to enhance the nutritional quality of fresh produce especially vegetables. The effects of root treatment of spinach with commercial extracts of the brown macro alga, *Ascophyllum nodosum* (ANE) on antioxidant level of spinach were studied. At the concentration of 1.0 g/L, ANE treatment significantly increased the total phenolics and flavonoids content, total antioxidant activity (as measured by DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging capacity) and Fe²⁺ chelating ability in spinach leaves. The 1H NMR and LC-MS analyses of spinach extract suggests that the increased antioxidant activity is largely associated with flavonoids. The biological effect of ANE-enhanced polyphenols was tested using the *Caenorhabditis elegans* nematode model. The extracts from ANE-treated spinach significantly improved the survival of the animals under oxidative stress by 50% and high temperature stress by 61% as compared to the extracts from

untreated plants (0% and 38%, respectively). Taken together, the results suggest that ANE stimulate flavonoid synthesis in spinach leaf thus enhancing its nutritional quality. Furthermore, the increased flavonoid content exerts beneficial effects in *C. elegans* against oxidative and heat stress.

Food Chemistry (2011) 124: 195–202

On-land cultivation of functional seaweed products for human usage

Hafting JT, Critchley AT, Cornish ML, Hubley SA, Archibald AF

Worldwide, there has been much interest in the development and commercialization of human functional products from seaweeds. Novel seaweed compounds with potential applications as bioactive ingredients in natural health products are being isolated in a number of active research programs on this topic. The majority of these research programs do not include cultivation as a critically important component in scaling the discoveries up to commercialization (i.e., economies of scale realized). Many of these seaweeds of interest with potential as functional human products are diminutive in size, sparse in density, and seasonal in occurrence and bioactive efficacy, making commercialization by resource management and harvesting economically challenging and the application of traditional ocean-based production methods risky. Human functional products will require sustainable production coupled with quality assurance and standardized, consistent efficacy. Since humans are the consumers of these types of functional seaweed products, traceability and security of supply are of the utmost importance to successful commercialization. On-land cultivation is essential for commercial success in the development of human functional products from seaweeds at industrial scales. On-land cultivation allows the highest levels of control over quality, efficacy, traceability, and security. On-land cultivation represents the most environmentally acceptable method for the production of biomass from natural



resources that could not be economically or sustainably developed any other way. However, on-land cultivation has many associated barriers to development, including high costs associated with capital, operations, maintenance, and cultivar development, and these demands limit industrial scale development of seaweed functional products for human consumption.

Journal of Applied Phycology (2011):
DOI 10.1007/s10811-011-9720-1

Tasco®, a Product of *Ascophyllum nodosum*, Imparts Thermal Stress Tolerance in *Caenorhabditis elegans*

Kandasamy S, Fan D, Sangha JS, Khan W, Evans F, Critchley AT, Prithiviraj B

Tasco®, a commercial product manufactured from the brown alga *Ascophyllum nodosum*, has been shown to impart thermal stress tolerance in animals. We investigated the physiological, biochemical and molecular bases of this induced thermal stress tolerance using the invertebrate animal model, *Caenorhabditis elegans*. Tasco® water extract (TWE) at 300 µg/mL significantly enhanced thermal stress tolerance as well as extended the life span of *C. elegans*. The mean survival rate of the model animals under thermal stress (35 °C) treated with 300 µg/mL and 600 µg/mL TWE, respectively, was 68% and 71% higher than the control animals. However, the TWE treatments did not affect the nematode body length, fertility or the cellular localization of *daf-16*. On the contrary, TWE under thermal stress significantly increased the pharyngeal pumping rate in treated animals compared to the control. Treatment with TWE also showed differential protein expression profiles over control following 2D gel-electrophoresis analysis. Furthermore, TWE significantly altered the expression of at least 40 proteins under thermal stress; among these proteins 34 were up-regulated while six were down-regulated. Mass spectroscopy analysis of the proteins altered by TWE treatment revealed that these proteins were related to heat stress tolerance, energy metabolism and a muscle structure related protein. Among them heat shock

proteins, superoxide dismutase, glutathione peroxidase, aldehyde dehydrogenase, saposin-like proteins 20, myosin regulatory light chain 1, cytochrome c oxidase RAS-like, GTP-binding protein RHO A, OS were significantly up-regulated, while eukaryotic translation initiation factor 5A-1 OS, 60S ribosomal protein L18 OS, peroxiredoxin protein 2 were down regulated by TWE treatment. These results were further validated by gene expression and reporter gene expression analyses. Overall results indicate that the water soluble components of Tasco® imparted thermal stress tolerance in the *C. elegans* by altering stress related biochemical pathways.

Marine Drugs (2011) 9: 2256-2282

Bioassay to detect *Ascophyllum nodosum* extract-induced cytokinin-like activity in *Arabidopsis thaliana*

Khan W, Hiltz D, Critchley AT, Prithiviraj B

Ascophyllum nodosum, a brown macroalga, is the most widely used seaweed in agriculture. We report a rapid method for the detection of cytokinin-like activity in plants treated with a commercial *A. nodosum* liquid concentrate (Stimplex®) using a transgenic line of *Arabidopsis* carrying the ARR5 promoter fused to β-glucuronidase (GUS) reporter gene. Based on GUS activity assay, an increase in cytokinin-like activity was detected in plants grown in vitro treated with 3 mL L⁻¹ Stimplex®, whereas foliar spray treatments showed similar cytokinin-like activity at a concentration of 5 mL L⁻¹. Histochemical staining showed Stimplex®-induced GUS activity in leaf as well as in the root tissues. Taken together, our results suggest that Stimplex® contains compounds that may elicit endogenous cytokinin-like activity. Furthermore, it is shown that this bioassay can be used for rapid screening of extracts that can stimulate cytokinin-like activities using *Arabidopsis* AAR5::GUS reporter transgenic plants.

Journal of Applied Phycology (2011) 23: 409–414



***Heydrichia cerasina* sp. nov. (Sporolithales, Corallinophycidae, Rhodophyta) from the southernmost tip of Africa**

Maneveldt GW, van der Merwe E

A new species of *Heydrichia* (Sporolithales), *Heydrichia cerasina* sp. nov., is described, found only on pebbles in the low intertidal zone along a 10 km stretch of the South African south coast from Cape Agulhas to Struisbaai. The species is characterized by the following suite of features that distinguish it from the other two species of *Heydrichia* found in South Africa: (1) unusual cherry-red colour when freshly collected; (2) uniformly warty growth form; (3) relatively thin crust (up to 1400 μm thick); (4) tetra/bisporangial sori comprised of mostly single sporangial chambers; and (5) unbranched spermatangial structures distributed on the floor, walls, and roof of the mature male conceptacle. The species appears to be most closely related to *Heydrichia homalopasta* from Australia. This study has affirmed that the distribution of spermatangial structures within male chambers is a feature that cannot be used to separate *Heydrichia* from *Sporolithon*, the only other genus in Sporolithales, although features of thallus construction and tetra/bisporangial continue to distinguish the genera. A key to the southern African species from the order Sporolithales is provided.

Phycologia (2012) 51 (1): in press

Effects of wild and farm-grown macroalgae on the growth of juvenile South African abalone *Haliotis midae* Linnaeus

Robertson-Andersson DV, Maneveldt GW, Naidoo K

The effect of various macroalgal diets on the growth of grow-out (> 20 mm shell length) South African abalone *Haliotis midae* was investigated on a commercial abalone farm. The experiment consisted of four treatments: fresh kelp blades (*Ecklonia maxima* [Osbeck] Papenfuss) (c. 10% protein); farmed, protein-enriched *Ulva lactuca* Linnaeus (c.

26% protein) grown in aquaculture effluent; wild *U. lactuca* (c. 20% protein); and a combination diet of kelp blades + farmed *U. lactuca*. Abalone grew best on the combination diet ($0.423 \pm 0.02\%$ weight d⁻¹ SGR [specific growth rate]; $59.593 \pm 0.02 \mu\text{m d}^{-1}$ DISL [daily increment in shell length]; 1.093 final CF [condition factor]) followed by the kelp only diet ($0.367 \pm 0.02\%$ weight d⁻¹ SGR; $53.148 \pm 0.02 \mu\text{m d}^{-1}$ DISL; 1.047 final CF), then the farmed, protein-enriched *U. lactuca* only diet ($0.290 \pm 0.02\%$ weight d⁻¹ SGR; $42.988 \pm 0.03 \mu\text{m d}^{-1}$ DISL; 1.013 final CF) that in turn outperformed the wild *U. lactuca* only diet ($-0.079 \pm 0.01\%$ weight d⁻¹ SGR; $3.745 \pm 0.02 \mu\text{m d}^{-1}$ DISL; 0.812 final CF). The results suggest that protein alone could not have accounted for the differences produced by the varieties of *U. lactuca* and that the gross energy content is probably important.

African Journal of Aquatic Science (2011) 36(3): in press

Microalgal fatty acid composition: implications for biodiesel quality

Stansell GR, Gray VM, Sym SD

The fuel properties of microalgal biodiesel are predicted using published microalgal fatty acid (FA) compositions and predictive fuel models. Biodiesels produced from the microalgae investigated are predicted to have extremely poor oxidative stabilities and the majority also have poor coldflow properties. The cetane number in most cases is out of specification, but less so than the oxidative stability and cold flow. These findings support the idea that feedstocks rich in monounsaturated fatty acids (MUFAs) are desirable for biodiesel but the composition of the saturated fatty acids (SFAs) is also shown to be of great importance. There is an apparent relationship between algal class and the percentage of FAs represented by MUFA. This potentially allows for the identification of high-MUFA algal classes, or at least provides some basis for researchers to make initial selections of target classes for bioprospecting. Comparisons of FA groups



between algal classes also show that the SFAs of Mediophyceae contain significantly higher proportions of C14:0, which is in contrast to the normally abundant C16:0 and the Mediophyceae therefore have better cold-flow characteristics than other classes with similar total SFA contents. Certain particularly promising cases for biodiesel production are presented as species level examples of feedstocks that are close to satisfying the biodiesel standards and to further illustrate the challenges that remain. Variation in FA composition as a response to changes in certain environmental variables forms another important facet to feedstock selection and is briefly considered, with suggestions for further research.

Journal of Applied Phycology (2011):
DOI 10.1007/s10811-011-9696-x

Daily changes in endogenous cytokinin concentrations in two *Chlorella* (Chlorophyta) strains

Stirk WA, van Staden J, Novák O, Doležal K, Strnad M, Dobrev PI, Ördög V, Bálint P

Changes in endogenous cytokinins were monitored in two synchronized *Chlorella* strains – *Chlorella minutissima* Fottet Novákova (MACC 361) and *Chlorella* sp. (MACC 458) over 24 h starting with a 10 h dark period and followed by a 14 h light period. These cultures followed the typical cell division pattern for synchronized cultures with cell division occurring at the start of the dark period and cells increasing in size during the light period. Similar isoprenoid cytokinins were detected in both strains, consisting of five *cis*-zeatin and three *N*⁶-(2-isopentenyl)adenine derivatives. No *trans*-zeatin, dihydrozeatin and aromatic derivatives were detected. All cytokinin levels were low during the dark period and increased during the light period. Free bases, riboside and O-glucoside forms occurred at low concentrations, with concentrations peaking at 24 h. Ribotides (*N*⁶-(2-isopentenyl)adenosine-5'-monophosphate and *cis*-zeatin riboside-5'-monophosphate) occurred in the highest concentrations and peaked earlier at 18-21 h, suggesting *de novo* cytokinin biosynthesis with

the ribotides being the first cytokinins formed. *In vitro* deuterium-labelling technology was used to measure biosynthetic rates of various endogenous cytokinins during the dark and light periods of growth in *C. minutissima* (MACC 361). Highest rates were measured in samples harvested during the light period (except for *cis*-zeatinriboside), with *N*⁶-(2-isopentenyl)adenosine having the highest tracer/trace ratio.

Journal of Phycology (2011) 47: 291-301

Extracts of the marine brown macroalga, *Ascophyllum nodosum*, induce jasmonic acid dependent systemic resistance in *Arabidopsis thaliana* against *Pseudomonas syringae* pv. *tomato* DC3000 and *Sclerotinia sclerotiorum*

Subramanian S, Sangha JS, Gray BA, Singh RP, Hiltz D, Critchley AT, Prithiviraj B

We studied the mechanism of *Ascophyllum nodosum* (a brown macroalga) induced resistance in *Arabidopsis thaliana* against *Pseudomonas syringae* pv. *tomato* DC3000. Root treatment of *A. thaliana* Col-0 plants with extracts of *A. nodosum* [aqueous (ANE), chloroform (C-ANE) and ethylacetate fractions, (E-ANE)] reduced the development of disease symptoms on the leaves. These extracts also induced resistance in salicylic acid deficient NahG and *ics1* plants. However, the extracts did not elicit an effect on *jar1* (jasmonic acid resistance 1) mutant. *A. nodosum* extract induced resistance to Pst DC3000 correlated with increased expression of jasmonic acid related gene transcripts PDF1.2 while PR1 and ICS1 expression were less affected. Additionally, pretreatment of *Arabidopsis* plants with ANE, protected the plants from a necrotroph, *Sclerotinia sclerotiorum*. The results suggest that the *A. nodosum* extracts can induce resistance in *Arabidopsis* to different pathogens which is largely jasmonic acid dependent.

European Journal of Plant Pathology (2011):
DOI 10.1007/s10658-011-9802-6



Chromista

Sym SD, Maneveldt GW

The concept of chromists, at its most expansive, includes the heterokonts (stramenopiles), alveolates, rhizarians, heliozoans, telonemians, haptophytes and cryptophytes. There is mounting evidence that this grouping is not valid. Even in the narrowest sense (the heterokonts), chromists include very diverse forms, exhibiting a great variety of trophic mechanisms. This great diversity in form and feeding make it difficult to identify any unifying features, but molecular phylogenetic studies have shown that this group of organisms is indeed monophyletic. The distribution of morphological characters over reconstructed trees allows for the identification of potential synapomorphic characters that have been secondarily lost or modified across the group. These include a combination of mitochondria with tubular cristae; the biflagellate heterokont condition; and, if photosynthetic, then with chlorophyll *c*, girdle lamellae and four membranes around the chloroplast, the outer continuous with the nuclear envelope. Heterotrophy appears to be ancestral but is also occasionally a derived state from autotrophic forms.

Encyclopedia of Life Science (2011):
DOI: 10.1002/9780470015902.a0001960.pub2

Fine structure and systematics of *Prymnesium radiatum* sp. nov. (Prymnesiophyceae) from False Bay and Franskraal, South Africa

Sym SD, Pienaar RN, Edvardsen B, Egge ES

A novel colonial prymnesiophyte from the inshore waters of South Africa, which is reminiscent of the genus *Corymbellus*, is described at light and electron microscope levels. It differs from the only species of this genus, *Corymbellus aureus*, in scale structure, cell shape and colony morphology and has a complement of unusual morphological features that link it most with members of the Prymnesiales. Phylogenetic analyses of the nuclear-encoded SSU and LSU ribosomal DNA sequences indicate that this organism is closely related to members of the genus *Prymnesium sensu lato* and it

is thus considered as a novel species, here named *P. radiatum*. The closest relative to *P. radiatum* in the SSU rDNA phylogenetic tree was *Prymnesium neolepis* (formerly *Hyalolithus neolepis*). The reconfiguration of the cytoskeleton during cell division in this organism is also novel, with a progressive elaboration of existing elements, rather than the massive reorganization expected in the prymnesiophytes.

European Journal of Phycology (2011) 46(3):
229–248

Optimization of culture conditions for tissue culture production of young plantlets of carrageenophyte *Kappaphycus*

Yunque DAT, Tibubos KR, Hurtado AQ,
Critchley AT

To improve the production of *Kappaphycus* plantlets in tissue culture, optimum media concentrations of an *Ascophyllum nodosum* extract (Acadian Marine Plant Extract Powder, AMPEP), plant growth regulators (PGR), pH–temperature combinations, and explant density were determined. *Kappaphycus alvarezii* var. *tambalang* purple (PUR), kapilaran brown (KAP), vanguard brown (VAN), adik-adik (AA), tungawan green (TGR), and *K. striatum* var. *sacol* green (GS) were used as explants. Based on the shortest period for shoot emergence and the economical use of AMPEP, the optimum enriched media was 3.0 mg L⁻¹ AMPEP and 0.1 mg L⁻¹ AMPEP+PGR 1 mg L⁻¹ each phenylacetic acid (PAA) and zeatin for PUR, 1.0 mg L⁻¹ AMPEP+PGR for KAP and GS, 0.1 mg L⁻¹ AMPEP+PGR for VAN, and 3.0 mg L⁻¹ AMPEP and 0.001 mg L⁻¹ AMPEP+PGR for AA and TGR. Results showed that the addition of PGR to low concentrations of AMPEP hastened shoot formation. pH–temperature combinations for the most rapid shoot formation were determined for the brown (KAP) and purple (PUR) color morphotypes of *K. alvarezii* var. *tambalang* and the green morphotype of *K. striatum* var. *sacol* (GS) cultured in 1.0 mg L⁻¹ AMPEP+PGR. The brown morphotype produced the most number of shoots at pH 7.7 at 20°C after as little as 20 days.



Purple *K. alvarezii* showed an increased shoot formation at pH 6.7 at 25°C and the green *K. striatum* morphotype at pH 8.7 at 25°C. The optimum number of explants added to the culture media was also determined for tungawan green (TGR), brown (KAP), and tambalang purple (PUR) varieties of *K. alvarezii* in 1.0 mg L⁻¹ AMPEP+PGR. The number of explants and the volume of the culture media combination were also tested. The highest average number of shoots formed occurred in two explants: 1 mL culture media (2:1) for KAP and PUR (35.00% and 16.67%, respectively) and 1 explant: 2 mL culture media for the TGR (100.00%) with a range of 0.5–3.0 mm shoot length after 40 days in culture. The earliest shoot formation was observed after 21 days for the brown and 9 days for both the green and purple color morphotypes of *Kappaphycus*, in all densities investigated. This indicated that within the range tested, the density of explants did not have a significant effect on the rate of shoot formation but did influence the average number generated from the culture. The rate of production of new and improved *Kappaphycus* explants for a commercial nursery stock was improved through the use of AMPEP with optimized culture media pH, temperature, and density conditions.

Journal of Applied Phycology (2011) 23: 433–438

Featured Article

Talking it and snorkeling in it! Four days of kelp on Rottneest Island, Western Australia.

In early November 2011, Mark Rothman, John Bolton and Rob Anderson joined Kjersti Sjøtun (from Norway) and four Australian researchers in a kelp workshop organized and run by Dr Thomas Wernberg of the University of Western Australia. The morning before going to Rottneest, we all gave brief talks summarizing the current state of knowledge on kelps in our various regions of the world, to students and staff at the Oceans Institute of the University of Western Australia (in Perth). The workshop group then sailed to Rottneest, a half-hour ferry ride from Perth.

Rottneest Island (or “Rotto” in local slang) is a very popular holiday and tourist destination that very successfully combines “nature reserve” with “resort”. The first European to find the island was a Dutch sea-captain, who named it Rottenest (Rat’s Nest) on account of the many quokkas – small marsupials with a passing resemblance to rats. Quokkas are a lot bigger than any rat I’ve seen – they look more like rock hyraxes (klip dassies) with kangaroo-type back legs and long



The workshop group (L to R): Kjersti Sjøtun (Norway), Thibaut de Bettignies (France/Australia), Mark Rothman (SA), Scott Bennett (Aus), Thomas Wernberg (Aus), Gary Kendrick (Aus), Rob Anderson (SA) and John Bolton (SA).



tails – and there certainly are lots of them on the island.

We stayed in two of the hundreds of holiday bungalows that are clustered on the northern end of the island (most of the island has been kept undeveloped), and spent the first three days in workshop sessions in a conference room in the island's small hotel. Discussions centred on the similarities and differences between kelp bed systems around the world, and the kelps in them, but mostly those in Australia, Norway and South Africa. The Australian group is well up on the ecology of their kelps and the various theoretical ecological approaches, and there were many lively discussions before some consensus was reached on getting most of it down on paper (digitally speaking, that is).



A quokka, one of the small marsupials that gave the island its name.

grazing strongly influence subtidal community structure. The shallow subtidal zone was fascinatingly different to anything I've ever seen, and I wish I could have spent a lot more time in the water.

The project under which the workshop was run is funded by WUN (the World Universities Network). We hope to keep the momentum with a visit of an Australian group to South Africa next year. It is envisaged to include some collaborative experiments to test some of the ideas that emerged during the Rotto excursion.

Rob Anderson

Seaweed Unit

Department of Agriculture,

Forestry and Fisheries

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We spent the last morning on Rotto snorkeling in some of the beautiful shallow bays around the island. The water was clear and (at about 18 °C) warmer than it is in Cape Town. Kelps (*Ecklonia radiata*) and a mixture of *Sargassum* species dominate the shallow subtidal zone, with patches of large *Caulerpas* and a variety of other algae creating an interesting and unusual mixture of temperate and tropical seaweeds. Sandy patches are covered by extensive beds of various seagrasses, including two *Posidonia* species and one species of *Amphibolus*. Fish are abundant, especially Kyphosids (rabbit fish) that reach a fair size. These aggregate in shoals and by their



An underwater seaweed scene showing tufts of the green alga *Caulerpa obscura*, the kelp *Ecklonia radiata* and one of the numerous species of *Sargassum*.



Conference Countdown

Conference 2012 is being hosted by the Seaweed Unit (Department of Agriculture, Forestry and Fisheries), under the chair of Robert Anderson. The conference is planned for 17-22 June and will be held at the Seagulls Hotel Conference Centre in Qolorha, Eastern Cape.

The Seagulls Hotel and Conference Centre lies less than 100 km NE of East London by road, on the “Wild Coast” of the former Transkei. The hotel is about 7 km east of the Kei River mouth, and is perfectly situated right on the edge of the sea. It offers a perfect venue for the phycologically inclined, with rocky shores, sandy beaches and many nearby estuaries and rivers, all within the warm temperate Agulhas Marine Biogeographic Province.

Important dates to remember

- 31 January 2012 - “Intention to attend PSSA 27”. Please submit Form A of the emailed first announcement to help with planning. For those who might wish to book immediately, the full registration form (Form B) was also sent.
- 31 March 2012 - Registration and Payment. *Note: a late registration penalty of R 300 will be charged after 31 March.*
- 31 April 2012 – Submission of abstracts.

Calendar of Events

Upcoming Conferences

1. Algae 2012 – IV International Conference: Advances in Modern Phycology. Kyiv, Ukraine, 23-25 May.
www.botany-center.kiev.ua/algae2012_eng.htm
2. 2nd International Conference on Algal Biomass Biofuels and Bioproducts. San Diego, USA, 10-13 June 2012.
www.algalbbb.com
3. 4th Congress of the International Society for Applied Phycology. Halifax, Canada, 19-24 June.
www.appliedphycologysoc.org/congresses.lass_o
4. 2nd International Phytoplankton Identification Course. Plymouth, UK, 2-13 July 2012.
www.mba.ac.uk/phytoplankton-workshop
5. 12th International Coral Reef Symposium (ICRS 2012). Cairns, Australia, 9-13 July 2012. www.coralcoe.org.au/icrs2012
6. 8th Asia-Pacific Conference on Algal Biotechnology and 1st International Conference on Coastal Biotechnology. Adelaide, Australia, 9-12 July 2012.
sapmea.asn.au/conventions/apcab2012/index.html
7. 7th Southern Connection Conference. Dunedin, New Zealand, 21-25 January 2013.
www.otago.ac.nz/V11-southern-connection/
8. XXIst International Seaweed Symposium. Nusa Dua, Bali, Indonesia, 21-23 April 2013.
xxiseaweedsymposium.org



An aerial view of Qolorha. The Seagulls Hotel and Conference Centre is at the middle top of the image.





Objectives

- Promote training and capacity building
- Advance sustained global ocean observations and their applications

**Deadline:
15 January
2012**

What does the fellowship offer?

- 1-3 month visit to another oceanographic institute anywhere in the world
- Training on any aspect of oceanographic observations, analyses, and interpretation

It is NOT meant:

- For an academic course of study
- For pure research

Priority Areas

- Fixed-point time-series observations (e.g. contributing to OceanSITES, ChloroGIN, Antares)
- Large-scale, operational biological observations including biodiversity (e.g. Continuous Plankton Recorder)
- Emerging technologies for ocean observations
- Coastal observations/ Coastal zone management
- Ocean and coastal modelling
- Data management
- Argo floats

What is covered?

- International airfare
- Transport from airport to host institution
- Contribution towards living expenses

What is NOT covered?

- Domestic travel in host country
 - Visa costs and insurance
 - Salary/bursary
 - Training costs



What is needed to apply?

- Application form
 - Letter of recommendation
- Letter of acceptance from prospective host

Who can apply?

- Scientists
 - Technicians
 - Graduate students (PhD)
 - Post-doctoral fellows
- ...from developing countries and countries with economies in transition.

Priority is given to early-career scientists



Website: <http://ocean-partners.org/training-and-education/pogo-scor-fellowship>

E-mail: pogoadmin@pml.ac.uk

INTERNATIONAL SEAWEED ASSOCIATION

CONTEST FOR A NEW LOGO FOR THE ASSOCIATION

RULES

1) The contest objective is the creation of a logo for the visual identification of the International Seaweed Association (ISA).

The ISA is an international organization dedicated to the encouragement of research and development of seaweed and seaweed products. The mission of the ISA is to promote applied phycology on a global basis, and to stimulate interactions among researchers and industrialists in all relevant institutions and industries in all countries. Within this mission, the objectives of the ISA are primarily directed towards seaweeds, but also include other algae including cyanobacteria, as well as algal constituents. Included are studies on basic biology and chemistry of utilized or potentially utilizable algae; algal biotechnologies; responsible resource management and conservation programs; improved harvesting, cultivation, and processing of algae; and utilization of algal products and their derivatives.

2) This call is open to anyone who wishes to participate (no need to have attended the last International Seaweed Symposium (ISS) in Ensenada, Mexico, in February 2010 and, hence be a member of the ISA).

3) Proposals will be accepted until Friday, March 2, 2012.

4) Each person is allowed to enter up to two logo design proposals.

5) The design of the logo must include the acronym "ISA" and a figurative representation of at least one brown seaweed, one red seaweed and one green seaweed, hopefully of commercial interest.

6) The designer must have in mind the fact that the logo may be used with different electronic media, different types of reproduction systems and at different scales. An easily reproducible design, without extreme minutia, is, therefore, strongly recommended.

7) The design proposal must be submitted in its final representation (no sketch accepted). The design should contain a maximum of three ink colours, without degradation, relief or shadow effects.

8) The proposal should contain:

- An original version fitting on a letter-size white board (11 x 8.5 inches or 28 x 22 cm),
- A version reduced to 10 %.
- A high quality digital version compatible with PC systems and in a GIF and a print ready PDF formats.
- A conceptual description and rationale for the logo (limited to one page).

9) Each proponent will be responsible to ensure that no violation of copyrighted material is incurred. Plagiarism, intentional or not, will be disqualified from the contest.

10) Any proposal not respecting the above rules will be rejected at the discretion of the ISA Logo Committee.

11) Each proposal should be sent to the Chair of the ISA Logo Committee:

Dr. Thierry Chopin
Canadian Integrated Multi-Trophic Aquaculture Network
University of New Brunswick
P.O. Box 5050
Saint John, N. B., E2L 4L5 Canada
Email: tchopin@unbsj.ca

12) The membership of the ISA Logo Committee reflects an impressive experience and knowledge of seaweed research, development and commercialization around the world, both at the academic and industrial levels, and of scientific arts. Its composition is as followed:

Dr. Thierry Chopin (Chair), University of New Brunswick, Canada
Dr. Pete Bixler, Ingredient Solutions, USA
Dr. Eurico Cabral de Oliveira, Universidade de São Paulo, Brazil
Dr. Michael Guiry, National University of Ireland Galway, Ireland
Dr. Iain Neish, Seaplant.net Foundation, Indonesia
Dr. Tierney Thys, Science Media Producer, National Geographic Emerging Explorer, USA

13) The winner of the contest will be selected by the ISA Logo Committee. The decision of the Committee will be final. If deemed appropriate, the Committee could forfeit the contest in case it judges no proposal entry as satisfactory.

14) The winner of the contest will have her/his registration fees to the next ISS in Bali, in April 2013, waived as the Prize for this contest.

15) The winner of the contest will have to provide the logo in the TIFF/PSD and EPS/AI formats. The logo will become the property of the ISA, which will be free to use it to support any of its activities.

16) The results of the contest will be announced in the spring of 2012. Proposal materials will not be returned to their authors.