

Forum Phycologicum



**Newsletter of the
Phycological Society of
Southern Africa
Vol. 84
September 2018**

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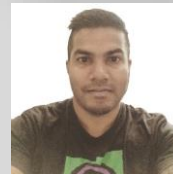
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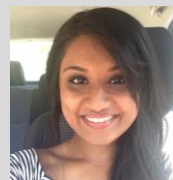
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From the editor >>>

Welcome to Volume 84 of our PSSA newsletter series. This is your new newsletter editor elected at the past PSSA congress. As you may have noticed the newsletter has a new look, but keeping with tradition this volume serves as a record of events for the past PSSA congress. These newsletters serve as a platform for you to keep the psychology community up-to-date with news about exciting field trips, regional or international research visits, or to share a sneak peek of your research outcomes. We are happy to hear about all things Phycology.

Maggie Reddy
Newsletter Editor

Kelpak turns 40! >>>

In 1978, Kelpak was started when they registered their patents for their Cold Cell-burst technology which they used to extract active ingredients from *Ecklonia maxima*. Their partnership with the University of KwaZulu Natal which resulted in the first PhD thesis on Kelpak, confirmed the beneficial properties of Kelpak on agricultural crops. This was the impetus to establish Kelpak in the local market which they expanded internationally in 1985. This is a real testament to the value of the partnership between industry and scientific research. Today Kelpak exports kelp products to over 70 countries. Since the establishment of the PSSA in 1988, there have been many presentations at PSSA on the benefits of Kelpak on different agricultural crops. Over the years, Kelpak has played a significant role in the society through their generous sponsorships. The PSSA values their relationship with Kelpak and hopes it will continue long into the future.

From our society, we would like to wish Kelpak a happy 40th birthday!



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New PSSA committee



Social media handles

The PSSA is now available on social media. Follow us on:



Phycological Society
of Southern Africa



@_PSSA



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31st PSSA Congress >>>

The 31st congress of the Phycological Society of Southern African was held at the Amazingwe Lodge in Gauteng from the 14th to the 17th of July 2018. More details can be found in the President's report. The conference fieldtrips in the scenic Highveld included a game-drive coupled with an elephant walking tour, as well as a bushveld zip-lining adventure.

AMANZINGWE

Where service is a right, not a privilege



Congress excursions >>>

Game drive and elephant walking tours



At the neighbouring Glen Afric lodge some delegates enjoyed a bush game drive and elephant walking tour. The elephant walking tour offered a unique opportunity to interact with these magnificent creatures in their natural habitat.

Ndlovu (Zulu for elephant) affectionately recognizes a fellow Ndhlovu



Zip-lining, for the brave and adventurous

Zip-line tour!

The Ama Zwing Zwing Zipline tour was situated at the conference venue and offered 7 slides and 10 platforms that ranged in size from 2-14 m.

This year's PSSA was hosted by Dr. Pierre Durand of the Evolutionary Studies Institute, Wits University, at the Amanzingwe Lodge in Gauteng. It was our Congress' 31st meeting and was attended by approximately 40 delegates from 10 institutions. The group was represented by a core of 15 regulars, and a mixture of new students and industry representatives. The ratio of permanent staff to students seems to have increased this year.

What I find interesting is the fact that over recent years the industry and other areas of applied phycology have become more widely represented at our PSSA meetings. The core of our Society has always been academic phycologists, but clearly there are more phycologists amongst us, particularly outside of academia. Perhaps these 'cryptophycologists' do not self-identify as phycologists, even though the work they do is clearly inherently phycological. Or perhaps our campaigns to attract new members into our society need to be widened and we need to be more active in seeking out practicing phycologists in all the sectors where they might be employed. This means that as a Society we need to locate—either by word of mouth or through active research—all these 'microniches' that offer fertile ground for phycological endeavors in South Africa. I would also like to call that we once again extend our reach to elsewhere in southern Africa, as we have done in previous years. We are called the Phycological Society of *Southern Africa* for a reason. Let us live up to that name.



Delegates at the 31st PSSA congress

About 40 delegates is the average number of delegates we have come to expect at any one meeting. However, the fact that we have had almost double the number present at the milestone 30th meeting at De Hoop testifies that we need to work hard at attracting more people, more frequently, and more consistently. They are out there. Let us identify the phycologists amongst us, and bring them all in to our meetings. Let us reduce the number of 'phycologists anonymous'.

Phycological topics:

Macroalgal ecology (9 talks), various aspects of microalgae (14), molecular systematics (2), applied phycology (10), coastal ocean temperature (2), and genetic engineering involving microalgae (1). Of course, there are many ways to classify the talks, but whichever way we do it, at the broadest level one might be tempted to make a distinction between the micro- and macroalgal topics. At this level it seems another trend emerges: that is, there is a tendency for microalgae to become better represented at our meetings. This trend is again linked to the increased representation of the industry.

New at our most recent meeting was the concept of 'Parallel sessions,' which are group discussions on issues the organisers deemed topical. Topics included 'Seaweed ecology' and 'Microalgae in bioenergy'. I thought that these sessions were a welcome addition to our programme, and I look forward to seeing how future organisers will bring innovative changes to the PSSA programme in future meetings.

President of the PSSA
AJ Smit

Secretary-Treasurer's report >>>

The society has a 'Money On Call Account' that is held at First National Bank. This account has a basic monthly charge, a small cash handling fee and a higher interest rate than conventional current accounts. There is a cheque book linked to the account but most transactions are done via internet banking because it is convenient. There are two signatories for the cheque book (currently John Bolton and Mark Rothman), although withdrawals or cheques only require one of the two signatures. Currently all our transactions are done electronically.

We thank the industry for their continued support of Phycology, it is always such a pleasure to have representatives from Taurus Chemicals (Cape Kelp) Pty. Ltd. here. Taurus Chemicals (Cape Kelp) Pty. Ltd. has sponsored the Klaus Rotmann Memorial award for best applied talk/poster for commercial use of seaweed. Taurus Chemicals (Cape Kelp) Pty, Kelpak, and for the first time— The Durand Foundation and Inqaba Biotec, made generous financial contributions to the congress, for which we are extremely grateful. The Durand Foundation sponsored an additional R1000 for an oral presentation. The Royal Society of SA has also offered a R 3000 poster prize subjected to conditional criteria and reserve the right not to award prizes if criteria are not met.

It has been a pleasure serving the society in the capacity of Secretary/Treasurer, for the past 10 years, however, I will not make myself available for re-election because I would like to give someone else the opportunity to serve in this capacity.

Thank you very much.

Secretary-Treasurer
Mark Rothman

The financial report is as follows >>>

PSSA BALANCE SHEET, Amanzingwe Lodge, Gauteng
March 2017 - 03 August 2018
Money Market Account (First National Bank)

	Credit	Debit	Balance	
Brought forward August 2012			67 387.69	
Bank fees		R 1 364.72	R 66 022.97	see Note1
Payment received	R 185 343.24		R 251 366.21	
Interest	R 1 533.60		R 252 899.81	
Sponsorship and donations	R 40 000.00		R 292 899.81	see Note 2
Outstanding Payments	R -		R 292 899.81	
Petty Cash	R 1 100.00		R 293 999.81	
Payments Made		R 199 144.00	R 94 855.81	see Note3
Total Assets			R 94 855.81	

Capital gain for Period 01 March 2017 till 15 July 2018 R 27 468.12

Note 1

i) Monthly account fees	R 760.00
ii) Service Fees	R 540.00
iii) Cash deposit fees	R 64.72

Note 2

Taurus Chemicals	5 000.00
Kelp Products	20 000.00
Durant Foundation	15 000.00

Note 3

prizes	R 3 000.00
Amanzingwe Lodge	R 157 814.00
Excursions	R 13 330.00
Printing	R 10 000.00
Organising	R 15 000.00

Membership report >>>

There are 101 members at present. PSSA delegates automatically become members of the society for two years. The table shows a breakdown of members from the 30th and 31st PSSA Congresses.

	LOCAL	INTERNATIONAL
Life	10	1
Corporate	6	
Ordinary	30	5
Student	55	5
Total	101	11

Membership Secretary
Chris J.T. Boothroyd

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Student representative's report >>>

Our student representative Rob Schlegel organised yet another successful student meet and greet (party night!) at the conference. Unfortunately he reported that no students submitted articles for the prior newsletter for which there was a cash prize for the best student article. Results from his survey : "Do we all agree on how long just now is?" found no significant difference in "now now" and "just now", with "now" being significantly longer than both.

This year's student's student prize was awarded to Lulama Matshamba who took home a box of Maggi 2 minute noodle, a staple dietary item in every student's culinary arsenal.

Prize winners from the 31st congress >>>

This year there was fierce competition amongst students for prizes. The talks and poster were of exceptional quality and prizes were awarded to candidates for the best presentation in each of four categories.

Well done to all prize winners!



The Klaus Rotmann Memorial Prize is awarded to the best applied talk/poster for commercial use of seaweeds. This year's winner was Michael Fleishman from the University of Cape Town who won a cash prize for his talk on "Using *Macrocystis pyrifera* (Laminariales) as an alternative abalone feed, within the South African abalone industry".



The cash prize for the best student talk about macroalgae was presented to David Dyer, from the University of Cape Town, for his talk titled "Characterising kelp forest POM during upwelling and downwelling conditions: differentiating between detritus and phytoplankton".

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The cash prize for the best student talk about microalgae was presented to Andrew Ndhlovu from the University of Witswatersrand for his talk titled “The thecal structure of the red tide forming dinoflagellate *Prorocentrum triestinum*”.



This year, an additional prize was given for the best talk about evolutionary biology. This was awarded to Dr Roksana Majewska, from North West University, for her research on “Charismatic microflora: recent discoveries of unique sea turtle-associated diatom communities” awarded by A/Prof AJ Smit

Looking ahead to the 32nd PSSA >>>

Dr. Tommy Bornman of SAEON’s Elwandle Node and Dr. Paul-Pierre Steyn (NMU) have kindly agreed to host the next PSSA, (including many new members!) there.

The venue he proposed is at the Wavecrest Hotel and Spa along the Wildcoast (<http://wavecrest.co.za/facilities/>), and the suggested time will be January 2020. We look forward to welcome the society’s members.



President of the PSSA
AJ Smit

ORDER OF EVENTS:

DAY 1 (14 July 2018)

Plenary 1: Paul Oberholzer “The environmental feasibility of low cost algae-based sewage treatment as a climate change adaptation measure in rural areas of SADC countries”

DAY 2 (15 July 2018)

Plenary 2: Jonathan Featherston “The evolution of multicellularity in the volvocine lineage”

Dlaza, T. Network analysis of seaweeds in different habitats along the East Coast of South Africa.

Dunga, V. Mapping and assessing ecosystem conditions of South African Kelp Forests

Schlegel, R. Projected impacts of climate change on the distribution of South African algae

Mahamba, Y. Epibiotic seaweed diversity on the brown mussel *Perna perna* along the East Coast of South Africa

Majewska, R. Charismatic microflora: recent discoveries of unique sea turtle-associated diatom communities

Ndhlovu, A. The thecal structure of the red tide forming dinoflagellate *Prorocentrum triestinum*

Pitcher, G. Devastating farmed abalone mortalities attributed to yessotoxin-producing dinoflagellates

Van Niekerk, K. The molecular evolution of the dinoflagellate *Prorocentrum triestinum*

Marcus, L. Enigmatic Human Parasite Finds Taxonomic and Pathogenic Home: Or Has It?

Durand, P. The SA National Phycology Culture Collection

Sym, S. New insights into the subgenus *Trichocystis* of *Pyramimonas*

Mokoena, K. Cryopreservation of four species of *Pyramimonas*: effects of varying concentrations of Dimethyl Sulphoxide (DMSO) and the slow cooling method

Reddy, M. Three decades of molecular systematics of seaweeds in South Africa, what have we learned?

Parallel Session 1A: Seaweed ecology (discussion leaders T Dlaza and R. Schlegel)

Parallel Session 1B: Microalgae in bioenergy (discussion leaders M. Smit and C. Davison)

Etwarising, L. Feed stimulants from green alga *Ulva* for sea urchin *Tripneustes gratilla*

Fleischman, M. Using *Macrocystis pyrifera* (Laminariales) as an alternative abalone feed, within the South African abalone industry

DAY 3 (16 July 2018)

- Smit, AJ:** Malleable macroalgae: The effect of environmental drivers on kelp morphology
- Stirk, W.** Role of brassinosteroids and gibberellins in microalgae growth and metabolite production
- Mansfield, L.** South Africa's participation in HAEDAT and OBIS
- Cwecwe, Y.** How substrate type influences metal accumulation in *Gelidium pristoides* along the East Coast of South Africa
- Williamson, R.** Drivers of short-term sea water temperature variability and uncertainty of long-term trends in nearshore in situ observations
- Rothman, M.** Geographical variation of the two dominant kelp species, *Ecklonia maxima* and *Laminaria* (Phaeophyceae, Laminariales), on the west coast of Southern Africa
- Dyer, D.** Characterising kelp forest POM during upwelling and downwelling conditions: differentiating between detritus and phytoplankton
- Parallel Session 2A:** Aquaculture and bioremediation (Discussion leaders Mahamba, Etwarising and Cwecwe)
- Parallel Session 2B:** Taxonomy and ecology (Discussion leaders Bolton, Sym, Majewska and Reddy)
- Matshamba, L.** Habitat and site effects on the morphology of *Ecklonia radiata* along the Eastern Cape coastline
- Mayombo, S.** Epi- and endophytic diatoms associated with two South African kelp species: *Ecklonia maxima* (Osbeck) Papenfuss and *Laminaria pallida* Greville ex. J. Agardh
- Conference Activities**
- After-Dinner Speakers:** M. Rothman and G. Pitcher

DAY 4 (17 July 2018)

- PLENARY 3: J. Bolton** "The seaweed revolution, and the problem of naming seaweed species"
- Smit, M.** Fatty Acid Profile of Indigenous Microalgae Cultivated on Mine Impacted Water
- Mtambanengwe, K.** The important and justified control of rotifers in open raceway microalgae cultivation systems
- Grobler, J.** Biofuel production potential of South African indigenous microalgae
- Davison, C.** The Nelson Mandela University Institute for Chemical Technology, InnoVenton, Microalgae to Energy Project- Novel Methods in Microalgae Cultivation and Algae Biomass Processing.

PLENARY SPEAKER 1**Paul Oberholster**

Seminar: The feasibility of low cost algae-based sewage treatment as a climate change adaptation measure in rural areas of SADC countries

Employing specific algae treatment to treat municipal domestic waste water effluent presents an alternative practice to improving water quality effluent of existing rural pond systems in Southern Africa. In the present study domestic waste water was treated using inoculated algae strains in two rural waste water pond system treatment plants. The novelty of the technology is (1) the consortium of specific algae that were selected on the bases of robustness, maximum abortion of nutrients. (2) Other algae and conventional technologies on the market currently required high cost investment, requires electricity for mixing of algae and need skill labours to maintain the system. The objective of the current study was to determine through field pilot studies, if algae nutrient treatment efficiencies in prevailing traditional waste stabilization ponds can be optimize through the manipulation of the existing natural consortium of alga by the mass inoculation of specific algae strains. One of the mean concerns using specific strains of algae in SADC countries, are temperature requirements of the selected strains. Temperature variations due to climate change can affect biochemical reactions and subsequently biochemical composition of algae. The current study did show that inoculations of specific algal strain can potentially enhancing the treatment efficiencies of existing rural domestic sewage pond systems.

PLENARY SPEAKER 2

Jonathan Featherston

Seminar: The Evolution of Multicellularity in the Volvocine Lineage
 The volvocine lineage of chlorophytes is a model lineage for investigating the evolution of multicellularity, sexual dimorphism and other biological processes. Extant members of the lineage include unicellular to many celled multicellular taxa with germ-soma division of labour. Investigating the genome sequences of modern volvocines furthers our understanding of the molecular basis of multicellularity. Amongst the simplest of multicellular organisms in the lineage is the homothallic 4-celled *Tetrabaena socialis*, which makes it ideal for investigating the genomic basis for the initial transition to simple multicellularity. With the aim of exploring the molecular basis for the evolution of multicellularity de novo nuclear and organelle genome assemblies as well as a de novo transcriptome assembly of *T. socialis* NIES-571 were generated. The organelle genomes of *T. socialis* were found to be highly inflated with non-coding DNA and the mitochondrial genome is circular indicating that a circular mitochondrial genome was present near the evolution of multicellularity. Inflated organelle genomes are presumably due to population genetic effects and neutral evolution. As per previous analyses of volvocine genomes comparative genomic analyses demonstrated that the evolution of multicellularity was not associated with extensive gains in genome or proteome complexity.

Various analyses identified modifications to the ubiquitin proteasomal pathway (UPP) that were associated with the origin of multicellularity. Targeted ubiquitin-mediated degradation of cell cycle effector molecules is a potential mechanism for regulation of cell division number in the volvocine lineage. Gene families gained at the origin of multicellularity were identified and found to be enriched in developmental genes and lineage specific genes. Few genes gained are known only from multicellular organisms and, therefore, the analysis of gene family gain and loss does not support shared genetic mechanisms for multicellularity but instead that the evolution of multicellularity involved lineage specific genetic mechanisms. Mating-locus genes that in heterothallic volvocines are limited to either gender, were identified in the genome of the homothallic *T. socialis* (the first homothallic taxon in the lineage to be sequenced). The presence of gender-limited mating-locus genes in the genome of *T. socialis* demonstrates how a single strain can produce both plus and minus mating-types. The genome sequence of *T. socialis* adds to a growing collection of volvocine genomes for analysis and as one of the simplest in the lineage it is of unique significance.

PLENARY SPEAKER 3

John Bolton

Seminar: The seaweed revolution, and the problem of naming seaweed species
 The production and use of seaweeds is one of the fastest growing global food sectors. This is a revolution in both meanings of the word, as indigenous coastal peoples throughout the world have always used seaweeds. There is, though, a major problem with naming seaweeds, with confusion between common names, names used in industry, older scientific names, and new scientific findings. Seaweeds are notoriously difficult to identify, and it is often not possible without detailed study. In addition, the move to DNA sequencing for identifying seaweeds and studying their evolutionary relationships has thus far not resolved, but further confused, these problems. There has even been a suggestion that traditional algal taxonomy itself might be “a road to nowhere?”. Global studies of widespread genera are revealing large complexes of cryptic ‘molecular species’, with important taxa containing dozens of such hidden species, and it is not clear how far the chemistry may differ among these molecularly distinct entities. Widely used species names, such as *Plocamium cartilagineum*, *Gracilaria verrucosa*, *Portieria hornemannii*, *Dictyota dichotoma*, *Ulva lactuca* etc., are currently all but meaningless in this context. Legally specified genus and species names for import and export are often different from recently changed, scientifically accepted nomenclature. Examples of worldwide genera with these problems will be discussed. It is likely that, fairly soon, DNA barcoding will be considered essential for identification of material, but there is a great initial need for the taxonomy of seaweed groups which are of potential use to be clarified on a global scale.

DELEGATES, PRESENTERS AND ABSTRACTS

(in alphabetical order; posters indicated by *)

Pg. 15-30

Bolton, J.

See plenary speaker 3.

Boothroyd, C.

Not presenting.

Cwecwe, Y.

Title: How substrate type influences metal accumulation in *Gelidium pristoides* along the East Coast of South Africa

Abstract: Conventionally, the substrate composition was believed to not influence the nutrient composition of seaweeds. The current study thus investigated the effects of growing epilithic and epizoic on the accumulation of metals in *Gelidium pristoides*. *Gelidium* growing epizoic on barnacles had more lead ($0.09 \pm 0.01 \mu\text{g/g}$), copper ($1.34 \pm 1.21 \mu\text{g/g}$) and iron ($20.19 \pm 4.26 \mu\text{g/g}$) compared to *Gelidium* growing on rocks. Zinc and chromium were higher in *Gelidium* growing epilithic while minor differences were detected in cadmium content of *Gelidium* on barnacles ($0.07 \pm 0.01 \mu\text{g/g}$) and on rocks ($0.08 \pm 0.01 \mu\text{g/g}$). Barnacles without epizoic *Gelidium* had more iron, chromium, manganese and lead compared to those colonized by *Gelidium*. However, cadmium, zinc and copper were higher in barnacles colonized by *Gelidium*. Colonisation of barnacles by the *Gelidium* was therefore regarded as beneficial to the metal accumulation in barnacles.

Davison, C.

Title: The Nelson Mandela University Institute for Chemical Technology, InnoVenton, Microalgae to Energy Project- Novel Methods in Microalgae Cultivation and Algae Biomass Processing

Abstract: The NMU Institute for Chemical Technology, InnoVenton, has been conducting the Microalgae to Energy (MA2E) project, funded by the DST and TIA, for several years. The project has achieved significant breakthroughs and world-firsts in microalgae cultivation and processing, which have generated a number of patents. Currently the MA2E research focuses on three main microalgae research themes, namely cultivation systems, renewable energy, and biomass processing. The MA2E cultivation system theme is multi-faceted and focuses on the development and optimisation of both system designs and methods in the cultivation of different microalgae species and subsequent harvesting of the biomass. The renewable energy theme focus on the use of microalgae composites as a sustainable energy alternative via the pyrolysis and gasification of InnoVenton patented Coalgae®, a composite of coal fine and microalgae. Lastly, InnoVenton is constantly developing new products from the microalgae biomass, either in the form of whole microalgae (soil remediation and bio-fertiliser) or the fractionated and processing of the microalgae into its primary constituents (protein, carbohydrates, lipids) for downstream products such as aquafeed and bioethanol.

Dlaza, T.

Title: Network analysis of seaweeds in different habitats along the East Coast of South Africa

Abstract: This study was conducted in order to perform network analysis so as to quantify and visualize interactions among various seaweeds in two habitats across different sites. Silaka had 16 vertices and 19 edges while Dwesa network had 44 vertices and 60 edges with Hluleka having 39 edges and 26 vertices. Closeness was highest in rock pools (0.04) than on outcrops (0.03) in Silaka while Dwesa outcrops (0.02) had a higher closeness than rock pools (0.01). Hluleka outcrops (0.04) had a higher closeness than rock pools (0.02). *Lethesia difformis*, *Gelidium pristoides*, *Hypnea spicifera* and *Cladophora rogulosa* were unique to outcrops while *Ralfsia epansa*, *R. verrucosa*, *Bryopsis myosuroides* were indicators species for rock pools in Silaka. A total of 20 species defined outcrops while 8 species were characteristic of rock pools and 14 species connected the two habitats in Dwesa. Only 7% of the common species had rock pool affinities in Dwesa, 40% had rock pool affinities in Silaka. Overall, there were 1138 edges and 50 vertices with more closeness recorded on the outcrops (0.02) compared to rock pools (0.01). Habitat and sites influence the interaction of seaweeds along the Wild Coast.

Dunga, V.

Title: Mapping and assessing ecosystem conditions of South African Kelp Forests

Abstract: Kelps dominate ca. 25% of the world's coastline, forming one of the most productive habitats and delivering key ecosystem services, including providing nurseries for many marine species, supporting commercially important fished species, feed for aquaculture and human health products. Kelp forests are vulnerable to anthropogenic and natural threats. Their mapping, and monitoring is significant for proper management. This study focuses on mapping two commercially valuable kelps (*Ecklonia maxima* and *Laminaria pallida*) occurring between the Orange River and De Hoop Nature Reserve using Sentinel-2A satellite imagery at 10m resolution. The high spatial and spectral resolution of this platform detects higher canopy kelps consistently and at low cost for large areas and therefore fills crucial data gaps occurring in previous mapping exercises. Reference information for classification and validation was derived from mid-2000s dated field-observation and low spectral and spatial resolution satellite imagery derived kelp maps. Results showed that a substantial amount of kelp beds i.e. Cape Point, Groen and Spoeg rivers and Saldanha-Langebaan Bay system, had not been mapped in previous approaches. Further, this mapping approach is relevant for monitoring and mapping other marine biomes.

Durand, P.

Not presenting

Dyer, D.

Title: Characterising kelp forest POM during upwelling and downwelling conditions:

differentiating between detritus and phytoplankton

Abstract: Particulate organic matter (POM) is the primary carbon source for filter-feeding organisms in kelp forest ecosystems. It comprises a mixture of kelp-derived detritus (KDD) and phytoplankton. However, determining the exact composition of POM and thus the drivers of kelp forest food webs remains problematic. Several parameters and metrics, from existing literature, were used to characterize POM along two transects (off-shore and along-shore) originating within a west coast kelp forest. Additionally, we used the natural variability in POM composition created by upwelling and downwelling conditions to obtain stable isotope end member identities. Stable isotope analysis was subsequently used to determine the composition of the POM samples collected. The results of this study show clear differences in POM composition between upwelling and downwelling conditions. Phytoplankton dominated the POM under downwelling conditions however KDD was more prevalent under upwelling conditions. Detritus, from both *Ecklonia maxima* and *Laminaria pallida*, was evident within the POM collected under upwelling conditions, with KDD accounting for up to 89% of total POM. Understanding whether KDD or phytoplankton is the prominent driver of kelp forest food webs is critical to our understanding of the energy transfer in these systems.

Etwarising, L.

Title: Feed stimulants from green alga *Ulva* for sea urchin *Tripneustes gratilla*

Abstract: Secondary metabolites play a fundamental role in mediating ecological interactions for marine plants. Much evidence of this chemical mediation comes from plant/herbivore interactions, where it is clear that some metabolites act as allelochemicals. However, other ecological interactions such as feed stimulants or attractants are less well known. Local aquacultured sea lettuce (*U. armoricana*) is known to elicit phagostimulatory responses in the sea urchin *T. gratilla*, with several studies showing a feeding preference for this alga. The present study investigated the feeding preference of *T. gratilla* for several *Ulva* fractions with the prospect to identify chemical compounds that may act as a feed stimulant or attractant. The touch and feed preferences of *T. gratilla* were investigated for nine *Ulva* fractions (F1, F2, F3, F4, F5, F6, F7, F8 and F9) using a modified version of the 'Avice' plating technique from Sakata et al. (1984). F9 and F8 were mostly preferred in the feeding preference tests followed by F6, F5 and F4. Digalactosyl diacylglycerol (DGDG) and monogalactosyl diacylglycerol (MGDG) were isolated from F9 and F8 respectively. Results show clear evidence of the presence of compounds in *Ulva* that may act as a feed stimulant or attractant for the sea urchin *T. gratilla*.

Featherston, J.

See plenary speaker 2.

Fleischman, M.

Title: Using *Macrocystis pyrifera* (Laminariales) as an alternative abalone feed, within the South African abalone industry

Abstract: South African abalone aquaculture is a fast-growing industry, which relies heavily on available kelp biomass for abalone feed. Many abalone farms along the West-coast feed the local abalone species, *Haliotis midae*, on fresh *Ecklonia maxima*. However, within some kelp concession areas this kelp resource has reached its limits of sustainable harvesting. *Macrocystis pyrifera* is a large brown alga, widespread in temperate oceans, including the South African coastline. It is used as the dominant source of feed within the Chilean abalone industry. The purpose of this study was to determine (1) if *H. midae* will feed on *M. pyrifera* and (2) how the growth of abalone fed with *M. pyrifera*, compares with those fed with *E. maxima*. *Haliotis midae*, grown in a land-based grow-out operation, were fed according to two diets (fresh *M. pyrifera* and *E. maxima*), for a six-month period. Abalone were sampled monthly to assess growth and development. Preliminary data suggest that *H. midae* does feed on *M. pyrifera*, and that *M. pyrifera* may be a suitable alternative feed within this industry. These findings may stimulate research into future cultivation, and utilisation of *M. pyrifera* within the South African abalone aquaculture industry.

Gallimore, W.

Not presenting

Geldenhuys, A.

Not presenting

Grobler, J.

Title: Biofuel production potential of South African indigenous microalgae

Abstract: South Africa is facing a possible energy crisis where the cost of electricity is continuously increasing and there is a need for renewable energy alternatives. Bio-energy has been widely studied as a renewable energy source. One of the main challenges of traditional bioenergy is that it competes with local food and agriculture industries for feedstock and arable land. Bio-energy derived from a microalgal biomass feedstock has the potential to be used without competing with agriculture and food industries. Biodiesel and bioethanol can be generated from cellular lipids and carbohydrates, respectively, isolated from Microalgal biomass. Fifteen South African Indigenous microalgal isolates were cultivated and characterised to derive their biofuel production potential. Biodiesel production potential was analysed by Fatty acid methyl ester gas chromatography. Bioethanol production potential was analysed by Dubois phenol/sulphuric acid colorimetry. The isolate referred to as WCB 4.1 had the highest biofuel production potential. This isolate was cultivated in eleven different microalgal cultivation mediums. Two candidate mediums were identified for the cultivation of WCB 4.1 at large scale. Isolate WCB 4.1 has the potential to be cultured for bio-energy purposes using one of the two candidate mediums.

Mahamba, Y.

Title: Epibiotic seaweed diversity on the brown mussel *Perna perna* along the East Coast of South Africa

Abstract: Rocky shores often have limited space for organisms to settle as a result epibiosis occurs whereby some rocky shore organisms grow on others. This study aimed to compare seaweed diversity on mussels in different sites. More seaweed diversity was recorded in Hluleka ($H' = 1.19 \pm 0.01$) compared to Kayser's Beach ($H' = 1.22 \pm 0.17$). In Kayser's Beach, a negative relationship ($R^2 = -0.04$) between shell length and diversity was detected with shorter mussels having more seaweeds. Broader mussels had more seaweeds than the narrow mussels. In Hluleka, both shorter and narrower mussels had more seaweeds than longer and broader mussels. *Ulva rigida* and *Ralfsia expansa* were the most dominant species while *Calithamnion stuposum* was the least dominant in Kayser's Beach. In Hluleka *Phymatolithon foveatum* and *R. verrucosa* were the most dominant species while *Sargassum ilicifolium* was least dominant. The brown mussels were found to increase the surface area in the rocky shores.

Majewska, R.

Title: Charismatic microflora: recent discoveries of unique sea turtle-associated diatom communities

Abstract: Aquatic animals, both marine and freshwater, provide unique habitats for various macro- and microorganisms. Although diatoms have long been known to grow on aquatic vertebrates such as birds, whales, and dolphins, only recently have the first studies exploring sea turtle-associated diatoms been conducted and several new diatom taxa, including three new genera, have been described. These new taxa show traits of obligate epibionts, which means they may require a direct contact with their basibionts (i.e. the host organism) to develop and survive. Since their first discovery, sea turtle diatoms have attracted growing attention, partly due to their potential use as indicators of sea turtle behavior and health. Research here may help to bridge various gaps in general understanding of both sea turtle and diatom ecology, evolution, and biogeography. However, at present many aspects of the symbiosis-like relationship between these micro- and macro-organisms remain unaddressed and it is not yet understood what factors influence epizoic diatom composition and abundance, and what ecological role and function they have in marine ecosystems. This talk will summarize the on-going investigations and recent findings in sea turtle diatoms that may open many new avenues for future research into marine epibiosis and related areas of study.

Majewska, R.*

Title: Zoological museum collections as a valuable source of information for epizoic diatom studies

Abstract: Aquatic animals, both marine and freshwater, provide unique habitats for various macro- and microorganisms. Although diatoms have long been known to grow on aquatic vertebrates such as birds, whales, and dolphins, only recently have the first studies exploring sea turtle-associated diatoms been conducted and several new diatom taxa, including three new genera, have been described. These new taxa show traits of obligate epibionts, which means they may require a direct contact with their basibionts (i.e. the host organism) to develop and survive. Since their first discovery, sea turtle diatoms have attracted growing attention, partly due to their potential use as indicators of sea turtle behavior and health. Research here may help to bridge various gaps in general understanding of both sea turtle and diatom ecology, evolution, and biogeography. However, at present many aspects of the symbiosis-like relationship between these micro- and macro-organisms remain unaddressed and it is not yet understood what factors influence epizoic diatom composition and abundance, and what ecological role and function they have in marine ecosystems. This talk will summarize the on-going investigations and recent findings in sea turtle diatoms that may open many new avenues for future research into marine epibiosis and related areas of study.

Mansfield, L.

Title: South Africa's participation in HAEDAT and OBIS

Abstract: The Harmful Algal Event Database (HAEDAT) and Ocean Biogeographic Information System (OBIS) serves the need for an authoritative and co-ordinated world-wide on-line source of information regarding Harmful Algal Blooms (HABs) and their environmental impacts. The latest HAEDAT on-line platform contains summarised records of harmful algal events or Toxin Producing Algae (TPA) around the globe and their impacts whether economical or environmental. The Ocean Biogeographic Information System (OBIS) provides a record of known geographical occurrence of individual species, and is supported through reliable sources such as peer reviewed literature. Through the collection and unification of global HAB data (in HAEDAT and OBIS) the Global HAB Status Report (GHSR) will provide an overview of HAB events and their impacts on society in a worldwide appraisal of TPA, along with an assessment of the status and probability of change in HAB frequency, intensity and range in response to environmental change at local, regional and global scales. South Africa will actively contribute substantially to both databases and the GHSR initiative.

Marcus, L.

Title: Enigmatic Human Parasite Finds Taxonomic and Pathogenic Home: Or Has It?

Abstract: The fascinating organism *Blastocystis hominis* remains a mystery to molecular scientists, clinical parasitologists and medical practitioners regarding its classification, pathogenicity and the treatment of patients. It has been (mis)classified as the cyst form of a flagellate, an amoeba, a yeast, and a sporozoan. Subsequent sequencing of the complete *Blastocystis* small-subunit ribosomal RNA genes unequivocally places it within the stramenophiles – albeit a very unusual stramenophile. Medical pathology laboratories identify this organism in stool samples submitted as part of the investigations to determine the etiology of diarrhea, abdominal pain and fever. The issue of pathogenicity is still unclear, and this talk will attempt to demystify the topic by examining the medical importance of this organism and other algae that cause disease in humans, including saxitoxin and shellfish poisoning.

Matshamba, L.

Title: Habitat and site effects on the morphology of *Ecklonia radiata* along the Eastern Cape coastline

Abstract: The brown alga, *Ecklonia radiata*, occupies different habitats along the infratidal zone of coastal rocky shores. The morphology of this species is thus influenced by different habitats and sites such that the current study investigated how the morphology of *E. radiata* was influenced by tidal rock pools and gullies across different sites. No differences were detected in stipe length of Keyzer's Beach pools (8.44 ± 0.46 cm) and gullies (8.51 ± 0.57 cm) while stipe was longer in Gonubie pools (8.15 ± 0.89 cm) than in gullies (6.81 ± 0.69 cm). Stipe diameter was biggest in Keyzer's Beach gullies (1.23 ± 0.06 cm) than rock pools (1.13 ± 0.05) while Gonubie stipe diameter was biggest in pools (0.94 ± 0.07 cm) than gullies (0.80 ± 0.06 cm). Gullies had wider fronds while no differences were recorded in the number of fronds, frond length and frond thickness between the two habitats. Longer stipe reduced the number of fronds in Gonubie gullies ($R^2 = -0.05$) while longer stipe increased the number of fronds in Keyzer's Beach gullies ($r^2 = 0.23$). Overall, site had more effect than habitat on the morphology of *E. radiata* with Keyzer's Beach having bigger individuals than those in Gonubie.

Mayombo, S.

Title: Epi- and endophytic diatoms associated with two South African kelp species: *Ecklonia maxima* (Osbeck) Papenfuss and *Laminaria pallida* Greville ex. J. Agardh

Abstract: Kelp forests host a large biomass of epiphytic fauna and flora, including diatoms, which constitute the base of aquatic food webs and play an important role in the transfer of energy to higher trophic levels. Epiphytic diatom assemblages associated with common South African kelps, *Ecklonia maxima* and *Laminaria pallida*, were investigated in this study. Primary blades of adult and juvenile thalli of both kelp species were sampled in July 2017 and analyzed using a scanning electron microscope (SEM). Our results showed that both kelp species hosted low diatom densities. Although, the non-metric multidimensional scaling (nMDS) graphs showed overlapping and largely scattered sample sets, a two-way analysis of similarities (ANOSIM) indicated a correlation between the epiphytic diatom assemblages and both species and age of the host macroalgae. In general, higher diatom abundances were observed on juvenile thalli, with *Gomphoseptatum* spp. and *Nagumoea* spp. dominating on *L. pallida* and *Amphora* spp. and *Rhoicosphenia* sp. being more abundant on *E. maxima*. Two-way SIMPER analysis across host species showed low similarity within both age groups, with 66.9% average dissimilarity between them. The same analysis across host age groups demonstrated relatively low within-group similarity for *L. pallida* (31.4%) and *E. maxima* (39.0%) samples with average dissimilarity of 67.2%. We suggest that the low epiphytic diatom densities were directly related to the observed sloughing off the epithelial cells by both kelp species. On such unstable substrate some diatoms seemed to prefer endobiotic life dwelling in what appeared to be a damaged or growing tissue.

Mokoena, K.

Title: Cryopreservation of four species of *Pyramimonas*: Effects of varying concentrations of Dimethyl Sulphoxide (DMSO) and the slow cooling method

Abstract: Algae are important for the regulation of aquatic food chains, biogeochemical cycles and are crucial for regulation of the Earth's climate. For research purposes, microalgal cultures need to be established and maintained in batch culture. Batch culturing is unfavourable due to space requirements, high maintenance costs and risks of contamination or genetic drift. Cryopreservation has been introduced as a good long-term method to store materials to overcome such unfavourable aspects. The aim of this study was to determine whether cryopreservation can be achieved for four species of the genus *Pyramimonas*, each representing one of the four well described subgenera, using Dimethyl Sulphoxide (DMSO) as a cryoprotectant and the two-step slow cooling method. The appropriate age of a thick, healthily growing culture as a source of cells for cryopreservation was first determined for each species. The appropriate DMSO concentration was determined by subjecting such cells to three concentrations of this cryopreservant (5%, 10% and 15%) and determining their effect on cell viability, both short (hours) and long term (one week). A DMSO concentration of 10% was found to be least toxic and was used to in the next step, which was to determine whether the cells could survive cryopreservation. Cryo-success was achieved for three out of the four species, using 10% DMSO and the two-step cooling method. It was concluded that cryopreservation methods across the genus might be species-specific.

Mtambanengwe, K.

Title: The important and justified control of rotifers in open raceway microalgae cultivation systems

Abstract: The cultivation of microalgae in open raceway ponds is desirable on the basis of ease of construction and set up, as well as operation and maintenance. However, it is important to note that the system has biotic and abiotic disadvantages. The biotic disadvantages include potential for contamination by other environmental algae species and introduction of algae grazers. We have identified algae grazers especially rotifers and to a lesser extent organic filtering microorganisms such as ciliates to be an antagonistic feature against optimum cultivation of microalgae. Upon invasion of the cultivation system with rotifers, there is empirical evidence that without control measure a total loss of algae biomass can occur. We compared various methods of control and elimination that included chemical, mechanical and biological in trying to identify solutions for the elimination of the invading grazers without negatively affecting the algae or the composition of the algae system. We established economically viable methods that are effective in rotifer control and can be used over a prolonged period without negatively affecting the microalgae.

Narine, R.*

Title: Optimization of simultaneous dairy wastewater treatment and *Chlorella* cultivation using a miniaturized raceway pond.

Abstract: Utilizing wastewater for microalgae cultivation and concurrent wastewater treatment has the potential of producing low-cost lipids for biodiesel production. The aim of the study was to optimize the simultaneous cultivation of *Chlorella* and dairy wastewater treatment in a miniaturized raceway pond. Response surface methodology (RSM) was used to optimize the runs with input parameters of wastewater concentration (20, 60, 100%), pH (7, 9, 11) and renewal rate (20, 60, 80%). All runs were conducted in a miniaturized raceway pond under a semi-continuous system. The highest biomass and lipid accumulation were 1.55 and 0.66 g/l, respectively. Additionally, the highest nutrient removal for chemical oxygen demand (COD) and ammonia were 96.6 and 94% respectively. RSM analyses were significant for all models. The optimum RSM predicted and validated conditions for increased lipid productivity and nutrient removal included, 100% dairy wastewater, pH of 9.36 and renewal rate of 80%. Furthermore, the lipid profile indicated suitable characteristics required for biodiesel production. *Chlorella* was found feasible for the treatment of dairy wastewater and subsequent accumulation of biomass and lipids for biodiesel production.

Ndhlovu, A.

Title: The thecal structure of the red tide forming dinoflagellate *Prorocentrum triestinum*

Abstract: Harmful algal blooms (HABs) continue to be a pressing ecological and economic challenge in South Africa and globally as the incidence of HABs increases. Accurate identification of the causative HAB species and species-specific related information are key to understanding HAB drivers that may lead to the establishment of predictive models and consequent mitigation measures. In 2015, St Helena Bay on the west coast of South Africa was subject to mortalities of approximately 415 tons of rock lobster and 6 tons of various fish species caused by low oxygen waters following a high biomass HAB. We identified the dominant causative organism as the dinoflagellate *Prorocentrum triestinum* using phylogeny reconstruction based on ribosomal DNA sequence data. In addition, we carried out a morphological study of *P. triestinum* using scanning electron microscopy (SEM). Here, we present data on the thecal structure and periflagellar platelet pattern of *P. triestinum* obtained from SEM. We identified smooth thecal plates, marginal trychocyst pores and a missing platelet 7 to be diagnostic features of *P. triestinum*. Furthermore, we identified the presence of an accessory pore previously thought to be missing in *P. triestinum*. We provide these data to address morphological confusion with similar taxa in future comparisons.

Oberholster, P.

See plenary speaker 1.

Pitcher, G.

Title: Devastating farmed abalone mortalities attributed to yessotoxin-producing dinoflagellates

Abstract: In January 2017 the development in Walker Bay of large dinoflagellate blooms (often referred to as red tides owing to their discoloration of the ocean) impacted 3 land-based abalone farms (Abagold, HIK Abalone, and Aquion Whale Rock) located in the vicinity of Hermanus with devastating results. The death of several million abalone served to demonstrate the vulnerability of these farms to HABs on the South African coast. This paper details various aspects of this bloom and its impact on abalone and abalone farming. Bloom development monitored remotely through satellite derived observations of ocean colour is described in conjunction with the collection and enumeration of phytoplankton samples collected at farm intakes. The dominant dinoflagellate species were identified by means of light microscopy and genetic sequencing data. The presence of yessotoxins (YTXs) was established in both phytoplankton and abalone, and the effect of these toxins on abalone was examined by histological analysis. The impact on abalone farming in the region is documented and potential mitigation measures for future bloom events of a similar nature are discussed.

Reddy, M.

Title: Three decades of molecular systematics of seaweeds in South Africa, what have we learned?

Abstract: Seaweed systematics has seen a major paradigm shift in recent years, towards the inclusion of molecular sequences in taxonomic investigations. We use South African seaweeds as a case study to trace major changes in systematic studies, discuss their implications and potential limitations, and predict future trends. An extensive literature search of molecular systematic studies focused on, or including, South African seaweeds was conducted. The first molecular systematic study of South African seaweeds was only 15 years ago, although the first South African seaweed used in a global study was almost a decade earlier. The major trends that emerged from our study was a peak in the number of molecular systematic studies conducted specifically on South African seaweeds during 2000 to 2009, and a steady increase in the number of studies that include South African seaweeds in a global context. There has also been a gradual increase in the number of molecular markers used, an improvement in the types of molecular markers, advanced data analyses, and an increase in the number of individuals per study. Overlooked diversity and misapplied names were consistently found in South African seaweeds. These in turn have affected regional estimates of biodiversity, endemism and distribution patterns.

Rothman, M.

Title: Geographical variation of the two dominant kelp species, *Ecklonia maxima* and *Laminaria* (Phaeophyceae, Laminariales), on the west coast of Southern Africa

Abstract: *Laminaria pallida* and *Ecklonia maxima* are large, commercially valuable kelps that co-dominate inshore waters of the west coast of Southern Africa in a geographically changing pattern. In the south, *E. maxima* dominates and forms a canopy in shallow waters (< about 5m deep), with *L. pallida* forming a sub-canopy and extending down to 20 m or more. Northward, *E. maxima* is progressively replaced by *L. pallida*. Corresponding with this change in dominance, *L. pallida* shows certain morphological changes along the south-to-north geographical gradient. We examined a range of morphological characters in both kelps, and various environmental factors. Our results, based on measurements at seven sites along 1600 km of coast between Cape Town and Swakopmund (Namibia), quantified and confirmed the change in dominance and the northward increase in stipe-hollowness in *L. pallida*. Furthermore, the hollowness of *L. pallida* was also not related to the flexibility of the stipes. Our results suggest that *L. pallida* sporophytes may progressively outcompete *E. maxima* northward, perhaps because they are more low-light tolerant, and we suggest that by developing a hollow stipe, the sporophytes may grow faster in length, potentially increasing their competitive advantage in the shallow water where they must compete with sporophytes of *E. maxima*.

Schlegel, R.

Title: Projected impacts of climate change on the distribution of South African algae

Abstract: Temperature is consistently found to be one of the primary factors determining the success of marine organisms. Therefore, as ocean climates change, the ranges of many species have been observed to undergo expansions or contractions. Recent research has shown that even though the coastal waters of South Africa have been increasing by ~0.1°C/dec since record keeping began in the 1970s, many algal species have been thriving. This is counterintuitive as many of the algae of South Africa are cryophilic and it has been shown that cooler winter temperatures are the best predictor of their range. To better understand this apparent contradiction, the thermal regimes along the coastline of South Africa were closely scrutinised. Looking beyond simple decadal trends and monthly climatologies, the occurrence of extreme events, changes in phenology, and the exceedence of species dependent temperature thresholds were related to the observed range shifts of the algae of South Africa. Building upon this multivariate relationship we then created a map of future algal distributions based on projected changes in the coastal marine climate. Phenological changes of winter low temperatures provided the best explanation for range shifts and it was shown that most species will continue to thrive into the future.

Smit, AJ

Title: Malleable macroalgae: The effect of environmental drivers on kelp morphology

Abstract: Two species of kelp, *Ecklonia maxima* and *Laminaria pallida*, dominate the nearshore environment around the Western Cape coast. The kelps exhibit a range of morphological characteristics across a region where the thermal and wave energy regimes vary significantly. The morphology of macroalgae is known to be influenced by wave exposure; however, waves can be quantified by various wave parameters, such as wave height, wave direction, period, and total energy. The influential role of these specific wave parameters on macroalgal morphology is unknown. Another unknown as far as the kelps' morphometric properties is concerned is that of thermal drivers. To this end, we used thermal and wave parameter data for 18 sites around the Western Cape coast, and investigated how the individual abiotic parameters influence the morphology of each species. Whilst temperature influences kelp distributions most strongly at regional scales, localised variation in the morphology of kelps are determined predominantly by wave parameters. The biggest wave influences are wave direction, significant wave height, and wave period, which explain much of the site-specific lamina thickness and stipe circumference of each species. The thermal variables, on the other hand, influenced mainly the total mass and size parameters of kelps, with colder sites exhibiting larger kelps.

Smit, M.

Title: Fatty Acid Profile of Indigenous Microalgae Cultivated on Mine Impacted Water

Abstract: Mine impacted (MI) water can severely affect the quality of surface water. Current treatment protocols of these acidic and metal-contaminated waters are via chemical methods, which in turn are harmful to the environment. As an attractive alternative, microalgae capable of accumulating heavy metals are considered as a more environmentally friendly option. More importantly, as a combined offering, microalga growing on the contaminated water can produce high-value compounds which can provide a competitive commercial offering. In this research, isolates were cultivated on mine impacted water, and fatty acid profiles were investigated at the end of the growth study. Preliminary results show that volumetric fatty acid concentrations produced by various isolates were comparable to that reported in the literature (up to 0.5 g.L⁻¹ fatty acids). Also, these strains were capable of producing a range of fatty acids including palmitic acid (C16), oleic acid (C18; omega-9), linoleic acid (C18; omega-6) and linolenic acid (C18; omega-3). This is commercially attractive as the C16-C18 fatty acids are common feedstocks suitable for biodiesel production as they are mono-unsaturated, which results in a suitable quality biodiesel product. The results from the study demonstrate the potential use of microalgae as both a waste-remediation and waste-beneficiation technology for commercial application.

Smit, M.*

Title: Bioenergy Indicators of Microalgae from the Microalgal Culture Collection of South Africa (MiCCSA)

Abstract: The Microalgal Culture Collection of South Africa (MiCCSA) was established in 2017 as a joint initiative by CSIR, WITS and SANEDI. The Bioprocessing Group at CSIR was tasked with analysing microalgal isolates from the collection on a biochemical level for the production of lipids and carbohydrates. Microalgae are considered commercially attractive for the production of renewable feedstocks for biofuel production. Isolates were grown for 15 days and analysed for the production of biomass, fatty acid content and carbohydrate accumulation. Results showed a change in fatty acid and carbohydrate profiles for all species during the cultivation period. The highest fatty acid content observed was for isolate MP 19.1 (55%) followed by WCB 4.2 (23%), WCC 31.2 (23%), GPA 29.3 (22%) and WCB 7.1 (21%). Two isolates, LPB 15.1 and NWA 11.1, produced superior quality oil which corresponded to feedstock having acceptable specifications for good quality biodiesel production. Furthermore, isolates WCC 1.1, MP 53.1 and WCA 4.1, had the highest reported carbohydrate accumulation. From the selection matrix, the top scoring isolates for oil production were MP 19.1, WCC 31.2 and WCC 1.1 which were presumptively identified as *Chlorella* sp., *Stichococcus* sp. and *Chlorella* sp. respectively. The biochemical analysis of these strains demonstrates that these are potential candidates for further research for use in biodiesel production.

Stapelberg, J.*

Title: Development of a heterologous expression platform for indigenous South African algae

Abstract: Microalgae, as an expression vector, could produce therapeutic recombinant proteins. A microalgal system would offer many benefits over existing methods such as lower production costs, faster growth rates, easier culturing, simpler transgenic manipulation as well as modified abilities of transcription and translation. South Africa boasts one of the most bio-diverse regions globally. In this study over 500 microalgae were isolated across South African freshwater and recorded as part of the CSIR Microalgae Culture Collection Database. After microscopic identification, 40 isolates were chosen based on selected morphological features. These 40 isolates underwent a growth curve analysis and optimal growth conditions were established. Those isolates which grew the best were identified based on Sanger sequencing of the 18S rRNA region. The microalgae identified belonged to either the Chlorellaceae or the Chlorophyceae families. The biochemical profiles and low costs associated with these species allows them to have huge potential within biotechnology industries. Therefore, a nuclear transformation system is being tested on these isolates using electroporation. This research enables the first step to the development of a heterologous expression platform in South African microalgae strains. The strains have desirable characteristics and they could be used for the production of value-added products in the future.

Stirk, W.

Title: Role of brassinosteroids and gibberellins in microalgae growth and metabolite production

Abstract: A hormonal network regulates growth processes and stress responses in vascular plants. There is evidence for a similar hormonal network in microalgae. This study investigated the role of brassinosteroids and gibberellins in microalgae. 1) When six microalgae were subjected to salt (36 g l⁻¹ NaCl) and low temperature stress (25°C to 15°C), there was a rapid response to salt stress with the brassinosteroid content (mainly castasterone with lower amounts of brassinolide, homocastasterone and typhasterol) increasing within 30 min of salt treatment and remaining at these elevated levels after 7 h. The decrease in temperature had little effect on the brassinosteroid content. This was the first study to show that endogenous brassinosteroids increase in response to abiotic stress in microalgae. 2) Exogenous gibberellins (GA3 and GA4) applied to *Chlorella minutissima* either stimulated (10⁻⁶-10⁻⁵ M) or inhibited (10⁻⁸-10⁻⁷ M) growth. This was accompanied by an increase in endogenous gibberellin, chlorophyll and soluble protein content and a decrease in phenolic acid content. Changes in endogenous gibberellin content provided evidence that similar gibberellin biosynthetic pathways exist in microalgae as in vascular plants, with the main pathway probably being the hydroxylated pathway to form GA6 and GA1. Understanding the role of phytohormones in growth and stress responses of microalgae could enhance the value of in vivo production of bioactive microalgae metabolites.

Sym, S.

Title: New insights into the subgenus *Trichocystis* of *Pyramimonas*

Abstract: The primitive green alga, *Pyramimonas*, has been divided into six subgenera, only four of which are well characterized (*Pyramimonas*, *Punctatae*, *Trichocystis* and *Vestigifera*). Two novel species of *Pyramimonas* from Okinawa have been shown, by phylogenetic inference using SSU rDNA sequences, to have affiliation with the subgenus *Trichocystis*, both rooting most-deeply but separately in the subgenus, although there are relatively few (three) existing sequences available for the subgenus. The morphologies of the various scale complements (three different types, each in three separate layers on the cell body and three types in two different layers on the flagella) are of the type expected for the subgenus as are their chloroplast morphologies and the absolute configurations of their flagellar apparatus. While the most characteristic feature of the subgenus (the presence of trichocysts) is indeed present in one of these (the less deeply-rooted species), they are notably absent in the other (most primitive) species. This latter species rather possesses puncta (osmiophilic subsurface vesicles) and muciferous inclusions, a character set more affiliated with the subgenus *Punctatae*. This then erodes the neatly clear-cut character set for the subgenus *Trichocystis* by presenting a grade between it and *Punctatae*, but affords an insight into the primitive condition for the subgenus as a whole.

Van Niekerk, K.

Title: The molecular evolution of the dinoflagellate *Prorocentrum triestinum*

Abstract: Dinoflagellates are a large group of flagellate eukaryotes within the superphylum Alveolata, remarkably diverse in form and adaptation to different environments. Most studies have focused on their role as ecologically and environmentally important organisms in algal blooms and as endosymbionts in coral reefs. The dinoflagellate of interest is *Prorocentrum triestinum*, which was identified as the dominant causative organism in a large algal bloom off St Helena Bay in South Africa in 2015. This red tide caused low oxygen events in the ocean, resulting in high marine mortality. A review of some features in trypanosomes and dinoflagellates regarded as “unusual” for eukaryotes shows that protists have adapted in highly divergent ways: could Programmed Cell Death (PCD) be an adaptive process in this unicellular organism, as it has been shown to be in multicellular organisms, by removing damaged and aging cells? In phytoplankton, PCD genes are triggered by environmental stressors, both abiotic (nutrients, light, osmotic) and biotic (virus infection, allelopathy). The early development of PCD raises questions about its significance in the ecosystem and its selective advantage: does PCD increase the inclusive fitness of *P. triestinum* in an algal bloom? How does the *P. triestinum* transcriptome change during PCD?

Williamson, R.

Title: Drivers of short-term sea water temperature variability and uncertainty of long-term trends in nearshore in situ observations

Abstract: Of paramount concern to coastal marine ecosystems are anomalous changes in sea temperature, as most marine species are ectothermic, so physiological functions that ultimately affect population growth are directly impacted by changes in ambient temperatures. Within the coastal zone the spatial heterogeneity of warming rates both across and alongshore is an extremely important consideration for coastal ecology as relying on broad-scale measurements of the physical environment runs the risk of potentially making inaccurate predictions of the future effects of climate change on nearshore systems. Satellite-derived sea surface temperature (SST) is a widely used proxy for climate change in coastal systems but it has been argued that the differences between remote sensing and in situ temperatures are too large for it to be considered an accurate proxy. The South African Coastal Temperature Network has a coast-wide network of ongoing temperature recorders in shallow waters that are maintained by various stakeholders. Different methods and instruments introduce uncertainties that need to be addressed before a reliable scientific product can be disseminated for research purposes. Here, we evaluate the time-series in terms of spatial covariance and response to forcing and consensus on long-term patterns.