The Phycologist

The Newsletter of the British Phycological Society
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Council member positions

Hilda Canter-Lund Winners

BPS project reports

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2024
British Phycological Society

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Ruby George, Swansea University;
Jasmine Ramshaw, Marine Biological Association

Editorial

A nice showing of project reports from work supported by the BPS in this issue which is exciting to see. Not to mention the usual visual feast that is the Hilda Canter-Lund photography competition, congratulations to the winners. Please take note of the advertised positions on the BPS council and ensure any nominations are in to the secretary by the 8th of November. Finally, I look forward to the 73rd Annual Meeting next January, hosted by the University of Hull.

Very best,

Amanda Burson

Remember - do keep sending in your contributions. Write to us with your phycological views, news, work events, or any matter you wish to share with readers of The Phycologist. *YOUR input is required; all relevant material will be considered (job adverts, science reports, book reviews, news items of topical interest, meeting announcements, research news, and suggestions for future articles are always welcome). Without YOU the newsletter would not exist.*

As a reminder, previous issues of *The Phycologist* can be downloaded at https://brphycsoc.org/the-phycologist-back-issues/

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Front cover picture credit: Audrey Sarin with “Cathedral“.

Back cover picture credit: Michaela Hittorf with “Welcome to funky town“.

Call for nominations for membership of BPS Council

In accordance with our constitution (https://brphycsoc.org/constitution/), Council positions are open for nominations, with successful candidates taking up office after the AGM in the University of Hull in January 2025:

The following Council positions are now open:

Ordinary member of Council (2025-2028), a three-year post ending at the AGM of January 2028 - **2 vacancies**

This is a good opportunity to get involved in the life of our Society, and gain experience in how a "learned society" works. The duties include attending the two full Council meetings a year (one in the summer, one at the Annual meeting), and involvement in discussions and decision-making by electronic means. Ordinary Members would be expected to become involved in one of the Society's sub-committees.

Student representative on Council (2025-2027), a two-year post ending at the AGM of January 2027 - **1 vacancy**

This is a good opportunity to get involved in the life of our Society, and gain experience in how a "learned society" works. The duties include attending the two full Council meetings a year (one in the summer, one at the Annual meeting), and involvement in discussions and decision-making by electronic means. As the Student Representative you will actively liaise with BPS student members and bring any issues or concerns from the student membership forward to the council and/or subcommittees. Student Representatives often get involved in the Outreach and Education sub-committee and the social engagement of the society.

Reasonable travel and other expenses are met by the Society. We would welcome applications from any of our members. Council is particularly keen to encourage early career researchers or people working in algal-related industries to consider this opportunity.

If you are interested in any of these positions, and would like to know more, please feel free to contact the President, Saul Purton, s.purton@ucl.ac.uk, who will be happy to have a conversation.

The formal process is for a nomination for a named post to be submitted to the BPS Secretary (secretary@brphycsoc.org). A valid nomination needs (i) the name and consent of the nominee, and the support of (ii) a Proposer and (iii) a Seconder (who both need to be a members of the Society). Email is an acceptable form of communication. **Nominations must be received by the Secretary by midnight on November 8th, 2024** (two months before the next Annual General Meeting).

If we receive more valid nominations than vacancies for each position, candidates will be asked to provide a short paragraph in support of their nomination and there will be a ballot of members. The Membership Secretary will circulate details to all members of the BPS one month before the AGM. All completed ballot papers shall be returned to the Secretary before the AGM, and the results declared during the AGM, which will be held at the University of Hull on Wednesday January 8th, 2025.

73rd Annual Meeting of the British Phycological Society University of Hull

The BPS is excited to announce that our 2025 Winter Meeting will be held at the University of Hull between the 6th and 8th of January 2025. Our main meeting will be hosted in the Canham Turner conference suite, with committee meetings in the historic Cohen building, where Sir Alister Hardy finalised the design of his plankton recorder nearly 100 years ago.

As usual, the Society will host a range of talks and poster sessions, including some special sessions that cover a suite of topical research ranging from picoplankton and flow cytometry to kelp forests. Our conference dinner will be held in The Deep aquarium, close to the centre of Hull and convenient for hotels.

Please check the meeting website at https://hull.brphycsoc.org where all the pertinent information regarding special sessions, registration and abstract submission will be available.

This is an in-person only meeting so I look forward to seeing everyone there!

Date:

January 6th to January 8th, 2025.

Registration and abstract submission deadline:

Friday, 15th November 2024.

72nd Annual General Meeting
Reading University, 10th January 2024

Meeting chaired by the President, Jane Lewis. Meeting was quorate with 37 in attendance.

1. Apologies for absence

Amanda Burson (AB, Editor Phycologist)

Andy Davies (AD, Webmaster)

Dan Franklin (DF, Chair O&E committee)

Esther Hughes (EH)

Phoebe Lewis (PL)

Mahasweta Saha (MS, Ordinary Member)

Graham Underwood (GU, Chair of BPS Journals Committee)

Martin Wilkinson (MW, Chair of Biodiv. Cons. Com)

2. Announcements

None

3. Approval of the Minutes of the 71st AGM, 25th January 2023 Newcastle University

JH proposed, SP seconded. Minutes were approved

4. Matters arising

No matters arising

5. Membership tiers (Jane Lewis, Nicky Slee)

JL brought to the meeting a proposal to remove the retired membership category and increase membership fees by a small amount from next year, to continue to support core activities, with a view that membership fees and structures should be reviewed on a regular basis. JH proposed and AL seconded the motion. Proposal was approved.

6. Reports from Elected Officers

(* reports will be made available at https://brphycsoc.org/annual-general-meeting/)

a) Secretary (Francis Bunker)

Over 2023 I have answered various queries from members and the public or passed them on the relevant Council / sub-committee members. These have been many and varied correspondence from people wanted to reach the British Psychological Society.

When correspondence has arrived relating to events which are of potential interest to BPS members, I have notified our Webmaster Andy Davies so notices can be posted on the BPS web site.

Council meeting minutes and the BPS Operating Manual are now stored on the web site. There have been updates to this manual in 2023.

A notice advertising Council positions was drafted and sent to the Phycologist for publication in the autumn issue. The number of people proposed for these positions matched the number of vacancies on Council so there was no need for elections.

The BPS Insurance was renewed at the end of November 2023 with Self Assured Underwriting Agencies Ltd.

b) Treasurer (Nicky Slee)

Paul Murray of LM Griffiths & Co Ltd on 16th February 2021 and has been efficient and effective as out Independent Examiner. The annual return and the Report of the Trustees with the financial statements for the British Phycological Society (Charity Number 246707) signed off at last year's AGM were uploaded to the Charity Commission Website (CCW) on 31st January 2023. Our reports have been on time since we have used Paul Murray as our accountants. The end of Year Tax date is 31st March. The YE2023 accounts (12th month period) have been prepared by the Treasurer and independently examined by Paul Murray of LM Griffiths & Co. Ltd. On 2.1.2024, see attached copy. During 2023 the finance subcommittee reviewed membership fees which was brought to the Summer Council meeting (2023) and new categories and membership are proposed for 2025 (see below)

Proposed BPS Membership categories and fees from January 2025:

Category	No Journal	With Journal	With Journal (online only)
Ordinary member	£14.00	£40.00 [26]	£36.00 [22]
Retired member	£8.00	£34.00 [26]	£30.00 [22]
Student member	£14.00	£33.00 [19]	£29.00 [15]
Student member (3 yrs, no journal)	£32.00		

Update on the accounts.

Account updates:

The BPS has three accounts with the Bank of Scotland:

i. A current account with online access that has been successfully used by the current treasurer to carry out the necessary payments. We received a legacy in the autumn and finance subcommittee will work on honouring the wishes of the legacy and conditions of the bequest and this will become a restricted account. The BPS have acknowledged thanks to the administrator of the Will.

ii. Another online account with a small balance in. At the summer meeting it was agreed that this can be merged into

the other current account; forms to be completed to action this. Aim to action by summer council meeting 2024.

iii. A BoS Savings account. A review of the Saving rate and compare with a new online Savings account. BUS Bank Instant rate from 10.1.2023 to 9.11.2023 were 1.30%. Next step is to get this with online access. October 2023 a letter from BoS detailed other options for Savings including a Fixed term deposit accounts (minimum deposit of £10,000) rates are:

Accounts Overview

BoS Current account:	£126571.29 (Balance on 5.1.2024)
BoS Linked Current account:	£27.61 (Balance on 5.1.2024)
BPS BUS ac (Savings account):	£38442.12 (Balance on 9.11.2023)
NSI Accounts:	£98189.27 (Balance on 1.1.2023)
Total:	£263,230.59 (Total on 22.1.2023)

Awards Allocated but money still in BoS Current account: comes to about to £96450. Also pending are some governance costs and journal costs still pending, some money has restricted use therefore the money available is about £136,000.; therefore, this will be considered when setting the Awards budget for the next year.

Members were asked to accept the Prepared Accounts. CM proposed, FB seconded, motion was carried.

Members were asked to elect Paul Murray of LM Griffiths & Co. Ltd as the Independent Examiners for the BPS YE accounts for YE2023. HT proposed and SM seconded, motion was carried.

c) Membership Secretary (Hilary Redden)

See summary report. Membership steady at 502. A question was raised regarding membership diversity and interest in types of algae. It was reported that questions regarding diversity are raised during funding application process but answers are voluntary and currently there doesn't appear to be a great bias.

d) Student Representatives (Hannah Thomas)

Not much to report, but if you wish to get involved please get in touch.

e) Joint Editors in Chief of the *European Journal of Phycology* (Christine Maggs and Juliet Brodie)

EJP has strengthened its team of Associate Editors. It published four issues to time in 2023, totalling 490 pages. There is a healthy pipeline of 15 articles published online, due to come out in 2024. These include a paper with an Altmetric score of 30 and five papers with >100 reads. The wide range of topics covers all aspects of phycology including applications of algae. The editors continue to offer transfers to *Applied Phycology* where appropriate. There were 86 new submissions in 2023, which corresponds to an acceptance rate of <50%.

f) Hon Editor in Chief Applied Phycology (John Beardall - delivered by CM and JB)

Applied Phycology published ten papers in 2023, and a total of 16 submissions were received. We were unable to publish a Special Issue this year, and the editors are seeking suitable areas for 2024. Inclusion in the Scopus database was an important step towards gaining an impact factor.

g) Editor of *The Phycologist* (Amanda Burson)

See report. Things are going well, any suggestions speak to Amanda. Current plans are to make *The Phycologist* searchable.

h) Webmaster (Andy Davies)

Nothing significant to report, just that the webpages continue to be updated rapidly, but please get in touch with any suggestions.

JA proposed we adopt all reports, JB seconded, motion carried.

7. Elections and Council Vacancies (Francis Bunker)

Council vacancies for 2023 were advertised in the autumn issue of the Phycologist and although all positions were filled, an election was not deemed to be necessary.

A vote of thanks is given to the following for the work they have done for the society whilst serving on Council.

Line Le Gall (Overseas Vice President)
Pippa Moore (Ordinary Council Member)
Jessica Adams (Ordinary Council Member)
Esther Hughes (Ordinary Council Member)

We would like to welcome the following people to serve on Council.

Jessica Adams (President Elect)
Kirstin Covington (incoming secretary)
Craig Schneider (Overseas Vice President)
Chris Williamson (Ordinary Member)
Mahasweta Saha (Ordinary Council Member)
John Griffin (Ordinary Council Member)
Pranali Deore (Ordinary Council Member)
Adam Lewis (Ordinary Council Member)
Phoebe Lewis (Co-opted Student Representative)

8. Hilda Canter-Lund Prize (Hannah Thomas)

Winners were highlighted and shared. Outreach committee are looking to display the pictures so get in touch with the committee members if you want to help.

9. Subcommittee reports

a) Awards and Training Committee (Jason Hall-Spencer)

b) Biodiversity and Conservation Committee (Martin Wilkinson)

c) Algal Outreach Committee (Dan Franklin)

d) Algal Applications Committee (Gill Malin)

SM proposed all reports are accepted, seconded by NS, motion carried.

10. Federation Reports (federation reports)**

a) Federation of European Phycological Societies (FEPS) (Jason Hall-Spencer)

A new FEPS website had been set up https://www.feps-algae.org/. EPC 9 in 2026 will be held in Krakau, Poland. Time of payment from BPS to FEPS has moved to 30th June. If you are a member of one of the following societies, you are automatically a member of FEPS. FEPS will no longer be taking individual memberships.

- British Phycological Society - represented by Jason Hall-Spencer on FEPS Council
- Czech Phycological Society Yvonne Němcová FEPS Council rep.
- French Phycological Society Line Le Gall FEPS Council rep.
- German Phycological Section Peter Kroth FEPS Council rep.
- Hellenic Phycological Society Sotiris Orfanidis FEPS Council rep.

b) Federation of European Microbiological Societies (FEMS) (Anne Jungblut)

Anne D. Jungblut represented BPS at the FEMS Council in Vienna, Austria, in September 2023. As of January 2024, four of the journals of the Federation of European Microbiological Societies (FEMS) have become fully open access (OA), with one journal remaining a subscription journal and free to publish in. Members of FEMS Member Societies are eligible for a 20% discount on the APCs of their articles.

FEMS is offering several Meeting Organizer Grant and an Early Career Meeting Attendance Grants as well as Early Career Project Grant: https://fems-microbiology.org/about_fems/network-and-activities/grants/. There are only two deadlines per year and application deadline for annual meetings held in January is in June of the previous year: 1 June 23:59 CET for meetings taking place between 1 December that year and 30 November the following year.

The next FEMS council meeting and AGM will be held in person in The Netherlands, in September 2024.

c) Royal Society of Biology (Jane Lewis)

JL flagged that the Royal Society of Biology can be joined by BPS members for a reduced fee and RSB membership comes with a number of benefits.

SA proposed to accept these reports, GM seconded, motion carried.

11. Future Annual meetings

JL announced the next annual meeting will be at Hull University, the week of the 6th January 2025, hosted by Prof. Rodney Forster.

12. AOB

JL thanked the outgoing secretary, Francis Bunker, for all his hard work over the many years he was secretary for the BPS council. SP also thanked the outgoing President JL for all her work as President Elect and then as President.

BPS Funded Project Reports

Digging into the past: Using museum DNA to reveal genomic responses of kelp to ocean warming

Submitted by Dan Smale
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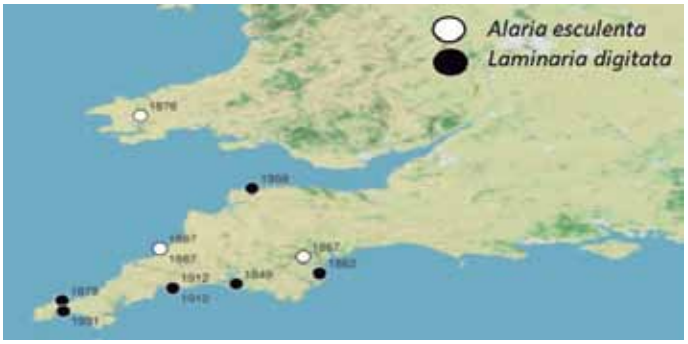
Anthropogenic climate change is driving a redistribution of biodiversity at the global scale. On the front line of distributional shifts are species' trailing range edges, as it is here that thermal thresholds are generally exceeded first and consequent population crashes and range contractions are most likely to ensue[1]. Indeed, the world has seen thousands of documented climate-mediated poleward range contractions across diverse groups and systems, which directly affects human society and well-being[2]. Trailing edges are also hotspots for genotypic and phenotypic diversity, which is directly threatened by recent and ongoing warming trends and can be eroded long before a contraction of the overlying population[3]. For northern hemisphere species, the Quaternary glaciations have skewed the distribution of genetic diversity towards areas that served as glacial refugia[4]. These are most often found at low latitude trailing edges that remained ice free during glacial maxima. Additionally, high selection pressures at trailing edges can facilitate natural selection, leading to the development of adaptive variation and unique phenotypes[5]. As such, permanent losses of genetic diversity at trailing range edges may have serious consequences for the adaptability and persistence of the wider species[6]. Direct measurements of temporal patterns in genetic diversity remain rare and challenging, as techniques have mostly focussed on neutral markers and/or reduced genomes and few time series or sample libraries span relevant temporal scales.

Recent advances in sequencing technologies have revolutionised approaches to measuring patterns in genetic diversity. It is now possible to utilise natural history collections to establish pre-decline baselines, enabling direct quantification of the rate of genomic change[7]. Moreover, the increasing accessibility of Whole Genome Sequencing (WGS) outside of model organisms, is allowing unprecedented insights into the genomic architecture of local adaptation. However, whilst museum genomics has been used effectively in a range of terrestrial systems, insights in marine systems including seaweeds are largely lacking. This is surprising given the extensive herbaria collections in museums across the world and their effective use in climate change ecologye.g.,[8].

Kelp species are found along one-third of the world's coastlines, where they play pivotal roles in supporting biodiversity and primary productivity. As foundation species, they provide biogenic habitat for highly diverse communities, which include species of commercial importance[9,10]. As with many coastal ecosystems, kelp forests are threatened by a range of contemporary stressors, including ocean warming. Indeed, the geographical distributions of kelp species



Map of the southwest England study region, indicating the identity, location and year of collection of historical kelp samples held at the NHM herbarium.

are strongly constrained by temperature[11], making them particularly responsive to warming trends[12]. The British Isles is an important Northeast Atlantic biogeographical transition zone[13] and two widely-distributed kelp species, *Laminaria digitata* and *Alaria esculenta* are found towards their trailing range edges along the coastline of southwest England. Recent genetic analysis using neutral microsatellite markers suggests this area was an important glacial refuge for both species[14] and common garden experiments suggest this area harbours unique adaptive phenotypic variation[15]. However, overall lower genetic diversity here, compared to more centrally located recolonization pathways, are indicative of the erosion of genetic diversity. Moreover, both species show early signs of climate mediated range contractions, which are anticipated to accelerate over coming decades. Therefore, this system represents an ideal model to examine genomic signs of adaptation through WGS and use historic herbaria samples to track climate mediated genomic erosion .

With support from the BPS, we identified and extracted tissue from historical samples of *Laminaria digitata* and *Alaria esculenta* held at the herbarium at the Natural History Museum (NHM). Seaweed samples that were originally collected from around the southwest of England between 1849 and 1959 were identified and prioritised for analysis. To examine temporal patterns in genetic diversity, we sampled contemporary populations of both species across the same geographic area, between 2021 and 2022. All tissue samples have been collated and prepared for WGS at an ancient DNA laboratory. Refinement of molecular methods is currently underway with the first whole genome sequences expected shortly. Thereafter, we will estimate levels of genome-wide heterozygosity in both historical and contemporary samples,

Example of an *Alaria esculenta* pressing held at the herbarium.

A recent field campaign involved the collection of contemporary samples of *Alaria esculenta* and *Laminaria digitata* from sites across southwest England.

and compare the extent of inbreeding by evaluating the lengths and extent of runs of homozygosity. Ultimately, comparisons between the sample sets will allow us to examine temporal shifts in genome structure and test the hypothesis that ocean warming has led to an erosion of diversity at the trailing range edge.

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Unlocking the role of Mediterranean rhodolith beds in the oceanic carbon flux

Submitted by Ragazzola F,[1] (and written with), Olivè I.[2], and Schubert N.[3]

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Introduction

With the current threat of climate change, the role of CO2 uptake and storage by marine ecosystems has become a hot topic of international research and policy, being targeted as a possible natural solution to slow down atmospheric CO2 rise. Through major research efforts, carbon pools and fluxes associated with coastal communities, such as mangroves, salt marshes and seagrasses, have been characterized and led to the inclusion of these "blue carbon habitats" into existing frameworks to combat climate change. A controversial point, increasingly discussed in recent days is the potentially important role of ecosystems that are built by calcifiers, such as those formed by free-living coralline algae, the rhodolith beds. Yet, even though rhodolith beds are most likely highly relevant contributors to the global carbon cycle, little to no efforts have been made so far to quantify their contribution. This is related not only to the scarce information about rhodolith bed global coverage, but mostly about the current lack of knowledge regarding their carbon stocks and carbon sequestration rates. This information is essential to ascertain if these ecosystems meet the requirements to be considered in climate mitigation policies, and hence, to support interventions needed to reduce, protect, or enhance the potential of these natural systems to sequester and store carbon. The aim of this project was to provide first-time evidence of the present-day carbon sink/source capacity of Mediterranean beds and hence, to reveal their potential importance in the oceanic carbon cycle, using sound and repeatable methodologies to quantify the magnitude and direction of the productivity-associated carbon fluxes.

Material and methods

Sampling:

In June 2023 rhodoliths were collected for physiological measurements at two locations: a shallow rhodolith bed at 2 m depth, located in Mare Piccolo di Taranto (Italy - 40°28.876N, 17° 16.158E) and a deeper bed at 51 m, located in Sicily (Italy- 38°14.050N, 13°18.726E) (Figure 1). Furthermore, rhodolith biomass was collected and oven-dried at 60°C, for at least 48 h, and weighted for dry weight (DW) determination.

Molecular identification:

DNA was extracted from dried rhodolith specimens, the psbA locus amplified, sequenced, and compared with publicly available sequences for this group of red algae in GenBank, as described in Schubert et al. (under revision).

Physiological measurements and carbon flux determination:

Rhodoliths (n=5 per species and location) were incubated in the laboratory at different light intensities, as described in Schubert et al. (2022), and seawater samples before and after incubation at each light intensity were collected, fixed and stored in borosilicate tubes for total alkalinity (TA) analyses. Afterwards, rhodoliths were dried (48 h at 60°C) and their dry weight was used to normalize metabolic and calcification rates.

Calcification rates of the rhodolith species were determined, based on the total-alkalinity anomaly technique (Smith & Kinsey, 1978) and total carbon uptake rates and those associated with net primary productivity were calculated using CO2SYS and the obtained TA and pH, as described in Schubert et al. (under revision).

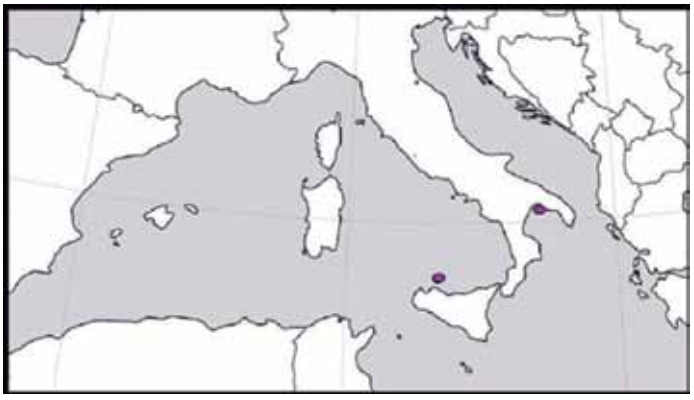

Figure 1. Map indicating the two sampled rhodolith beds (pink dots), in Sicily (51 m) and Taranto (2 m).

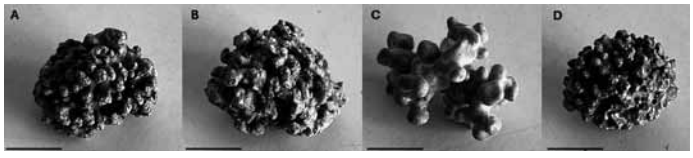

Figure 2. A: Spongites sp. (Sicily); B: *Lithothamnion* sp. (Sicily); *Lithophyllum racemus* (Sicily); *Neogoniolithon brassica-florida* (Taranto). Foto by Nadine Schubert.

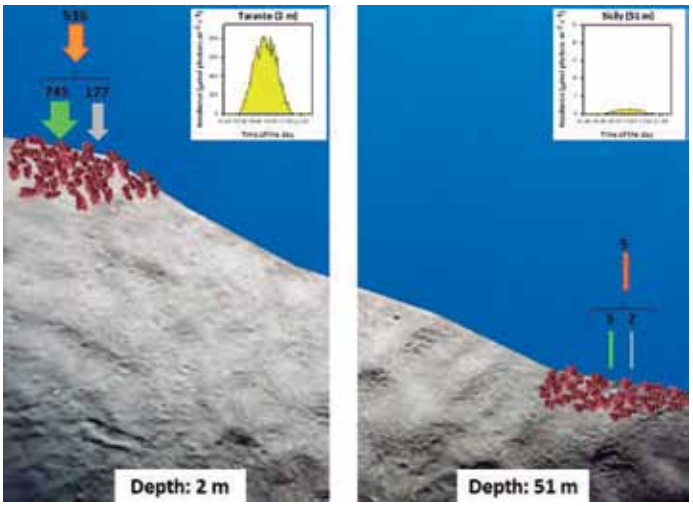

Figure 3. Daily net total carbon flux dynamics (orange arrows) of two rhodolith beds at different depths, resulting from carbon uptake/release, associated to rhodolith net primary productivity (green arrow, mmol C m-2 day-1), and net carbonate precipitation, associated to rhodolith calcification (grey arrows, mmol CaCO3 m-2 day-1). Mean daily light availability and variability at the two locations are indicated in the inlet graphs.

Daily integrated (24 h) productivity was calculated, using the in situ daily irradiance at the respective sampling site, averaged over the sampling week and the photosynthesis- and calcification light curves. Subsequently, the living rhodolith biomass (g DW m-2) of the rhodolith beds was used to calculate daily productivity of the rhodolith populations (m-2 rhodolith bed).

Results and discussion

Different rhodolith species dominated the studied rhodolith beds. While the shallow Taranto bed was monospecific, formed by *Neogoniolithon brassica-florida* (Harvey) Setchell & L.R. Mason, the deeper Sicily bed was formed by multiple species, such as *Lithophyllum racemus* (Lamarck) Foslie, *Lithothamnion* sp. and sp. (Figure 2). The productivity and associated carbon flux dynamics of the rhodolith populations in the two beds differed greatly, because of the differences in depths and hence, light availability (Figure 3).

The rhodoliths in the shallow Taranto bed showed high daily net carbon uptake rates due to primary production, as well as high calcification rates, resulting in a substantial daily net carbon drawdown. On the other hand, the light-limited rhodoliths at the deeper Sicily bed expressed a net carbon release, associated with the daily primary production and very low calcification rates, altogether resulting in a slight daily net carbon release of the rhodolith bed (Figure 3).

Conclusions

1) Rhodolith beds show a high variability regarding their productivity and associated carbon flux dynamics.

2) Light availability appears to be a strong driver for the magnitude and direction of rhodolith-bed associated carbon fluxes.

3) To establish the role of rhodolith beds in the oceanic carbon cycle, it is essential to augment research efforts, i.e. increasing the number of datasets at a wide bathymetric and geographical scale and to include seasonal productivity estimates to obtain annual budgets.

This work was made possible with funding provided by the British Phycological Society (2022-BPS-0117). We would like to acknowledge Dr. Thalassia Giaccone, Dr. Maria Cristina Mangano, Prof. Gianluca Sará, and Matteo Nannini for their contribution to the lab and field work, and Dr. Viviana Peña for her assistance with the molecular identification of the species.

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Distribution and biodiversity of rhodolith beds in Cabo Verde

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Introduction

Rhodolith beds are composed of free-living non-geniculate coralline algae and are recognized as global biodiversity hotspots and carbonate factories with a broad global distribution (Foster 2001, Riosmena-Rodriguez et al. 2017). Despite their increased recognition, as important and sensitive habitats at national/regional levels during the last decade, there is still a notable lack of accurate information regarding their distribution, extent and health status. In Europe, rhodolith beds, also often called maerl beds, have gained first attention through a previous successfully ERC-funded project (BIOMAERL, 1996-1999) on beds in the NE-Atlantic (Scotland, Galicia) and the Mediterranean (Alicante, Malta). The project gave a first detailed inventory of regional rhodolith bed biodiversity and of anthropogenic impacts these habitats suffer through direct exploitation, fishing impacts and pollution by organic matter and excess nutrients (Hall-Spencer & Moore 2000, Barbera et al. 2003) and led to the development of conservation strategies for these habitats. On the other hand, rhodolith beds in Southern Europe, including the Macaronesian region, have so far received very little attention. This is mostly related to the fact that the occurrence of these ecosystems had not been acknowledged and first reports only appeared in recent years, showing that rhodolith beds are particularly common and cover extensive areas around many islands of the North Atlantic archipelagos, including the Canaries, Madeira, and Azores (Rebelo et al. 2018, 2022, Otero-Ferrer et al. 2020, Ribeiro & Neves 2020, Neves et al. 2021). In contrast to the former archipelagos, little to no information is available regarding the occurrence and distribution of rhodolith beds in Cabo Verde. So far, only indirect evidence of their presence exists, i.e. through published reports of beach deposits of recent rhodoliths in Sal and Maio islands and interviews with conch divers on Sal (Johnson et al. 2016, 2017). Curiously, rhodolith beds often show up in videos posted by dive centers of the mostly touristic Cabo Verdean islands but are not recognized as ecosystems composed of living organisms due to their visual appearance as “pink rocks”. Thus, during a field campaign in February 2024 to Santiago Island, the largest Island of the Cabo Verdean archipelago (Fig. 1a, b), we explored the presence and distribution of living rhodolith beds around the island, to provide first-time scientific evidence of their presence. Furthermore, we performed a preliminary assessment of their habitat characteristics, such as depth range, cover, substrate and associated community, and collected samples from all locations for morphological and molecular identification of the rhodolith diversity (in progress).

Methods

Our campaign was performed in collaboration with the Cabo Verdean Ecotourism Association, a local NGO (https://www.ecocv.org/). They provided information on some locations, where rhodolith beds had been observed, and logistic support to access some of those location by SCUBA. Furthermore, considering coastal morphology (e.g., presence of protected bays), we explored other locations around the island, where access from the beach was possible. Altogether, out of 13 explored sites, at 11 sites shallow rhodolith beds were present (Fig. 1c). Most of the location were easily accessible from the beach at depths between 2 and 10 m, while some others were accessed by boat (10-35 m depth; Baia do Inferno, Faro, Portinho).

The rhodolith beds were highly diverse in their general habitat characteristics, but also rhodolith communities (Fig. 2). Some beds had a very high rhodolith density (80-100% cover of the seafloor) laying on coarse sediment (Fig. 2a), while in others the density was rather

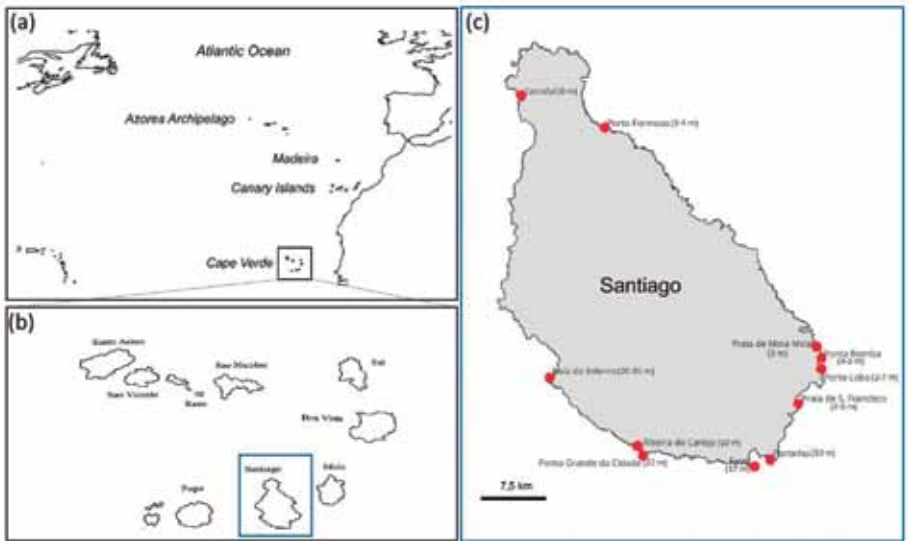

Figure 1. Map of the Macaronesian region (a), the Cabo Verde archipelago (b) and the study sites (red dots) at Santiago Island (c).

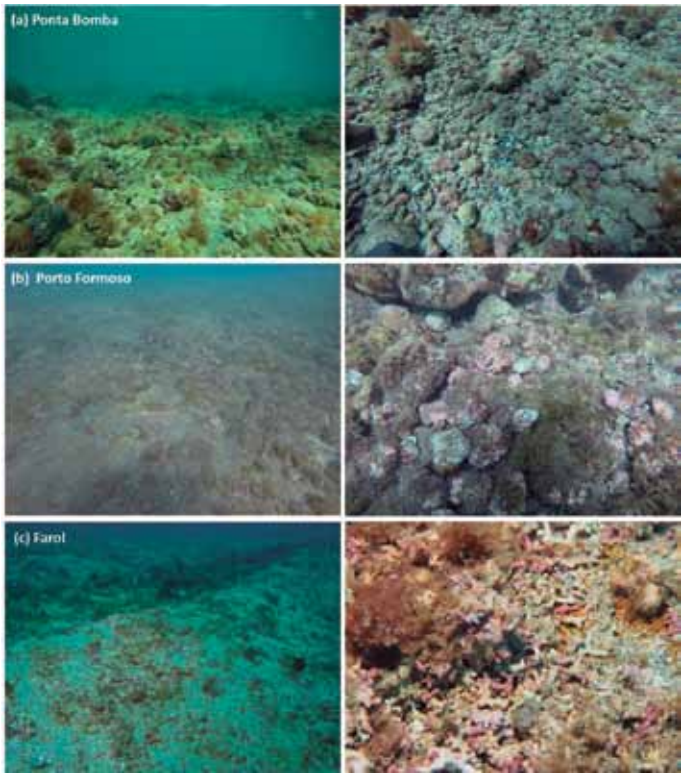

Figure 2. Rhodolith beds at Santiago Island, Cabo Verde. (a) Dense rhodolith bed at 5 m depth, at the southeastern coast in Ponta Bomba, (b) less dense rhodolith bed at 4-5 m depth, at the northeastern coast in Porto Formoso, and (c) patchy rhodolith bed, with ripple formation, at 17 m depth in the South of the island, at Farol (photos by Pedro Neves).

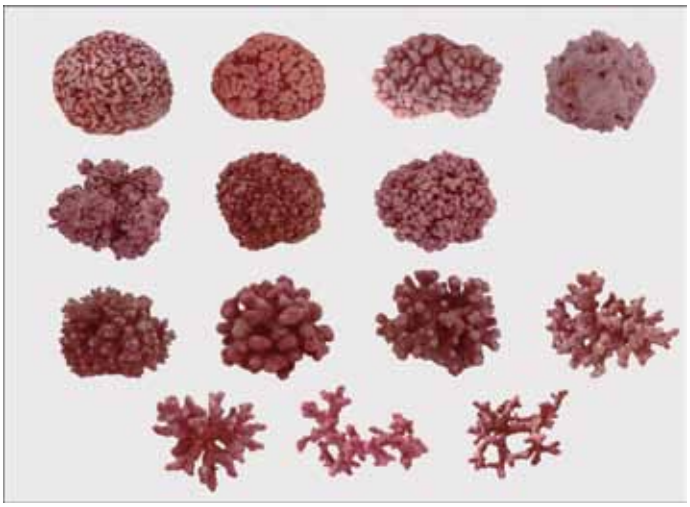

Figure 3. Diversity of rhodolith morphologies found in rhodolith beds of Santiago Island, Cabo Verde.

sparse or patchy and the rhodoliths were covered by fine sediment (Fig. 2b). Yet another bed (Farol) was characterized by dense patches of fine-branched rhodoliths in-between ripples (Fig. 2c). The associated community at most locations was composed of fleshy macroalgae and corals (*Siderastrea radians*) and rocky and coral reefs were often found adjacent to the rhodolith beds.

In each of these quite diverse rhodolith beds, a variety of different rhodolith morphospecies were found, ranging from spheroidal nodules to fine-branched morphologies (Fig. 3). The samples have been exported (authorized by the Direção Nacional do Ambiente de Cabo Verde, #110/DNA/2023) and their identification is currently in progress.

Conclusion

Our study provides conclusive evidence of the presence of highly diverse living rhodolith beds around Santiago Island and potentially other islands of the Cabo Verde archipelago. In fact, our survey and observations from local collaborators (E. Magileviciute and R. Freitas, pers. comm.) indicate that rhodolith beds might be one of the most prevalent, yet so far overlooked, coastal habitats of the archipelago. This is consistent with the recent reports of a wide distribution of rhodolith beds among the islands of the Macaronesian archipelagos, e.g. 132 confirmed sites in the Madeira archipelago (Neves et al. 2021).

Acknowledgements

This work was made possible with funding provided by the British Phycological Society (BPS award number 2023_BPS_0238). We would like to acknowledge Edita Magileviciute from the Cabo Verdean Ecotourism Association (ECOCV), Ana Cristina Rebelo and Prof. Wlodzimierz Józef Szymaniak (UniPiaget Cabo Verde) for their assistance during the field campaign, and Prof. Rui Freitas (Atlantic Technical University) for his support during the initial stages of organizing the campaign. Also, we greatly appreciate the support from Viviana Peña (University of A Coruña) with the molecular identification of the rhodolith species, and we thank the Direção Nacional do Ambiente de Cabo Verde (Ministério da Agricultura e Ambiente) for their support with the permit to export rhodolith samples.

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Production of climate-relevant isoprene in alpine lakes

Submitted by Michael Steinke and Alexander Kirkpatrick-De La Fuente
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Although lakes are recognised as hot-spots for CO2 exchange and the release of greenhouse gases such as methane (Northington and Saros, 2016), the contribution of lakes to the flux of isoprene and other biogenic volatile organic compounds (BVOC) is insufficiently researched (Steinke et al., 2018). BVOC can prolong the atmospheric lifetime of the potent greenhouse-warming gas methane, contribute to harmful ozone production in the troposphere, and lead to aerosol formation and cloud condensation nuclei that affect the Earth's climate (Petäjä et al., 2022). After methane, isoprene is the next most abundant climate-active trace gas in the terrestrial atmosphere (Exton et al., 2014; Kesselmeier and Staudt, 1999). Importantly, the current paradigm that land vegetation is the main source of isoprene in terrestrial atmospheres is shifting with the recognition that lakes can release substantial quantities of this gas (Seco et al., 2020; Steinke et al., 2018).

Some marine and freshwater phytoplankton are efficient producers of isoprene (Exton et al., 2013; Steinke et al., 2018). However, data on the variability of isoprene production in lakes and its possible sources are insufficient, including on possible differences between planktonic algae and benthic macrophytes. This knowledge gap needs to be addressed urgently to predict the contribution of lakes to the atmospheric gas burden in a warmer future. Notably, future conditions will create many new freshwater bodies due to permafrost thawing in the far North where lake-area density (limnicity) is often exceptionally high already (Figure 1a).

It is timely to investigate the production of isoprene and other BVOC in freshwater environments. This will facilitate the assessment of gas flux and its likely impact on methane processing in the atmosphere, paving the way for future research focusing on northern lakes that are experiencing rapid climate change and shifts in phototrophic communities.

With support from a 10-month International Fellowship funded by the Leverhulme Trust, this BPS Undergraduate Summer Internship (BPS project grant 2024BPS008) was used to spend five weeks (May-June 2024) working with Prof. Genevieve Chiapuso (Université Savoie Mont Blanc (USMB), Prof. Isabelle Laurion (Institut national de la recherche scientifique (INRS), Canada) and Prof. Riikka Rinnan (Center for Volatile Interactions (VOLT), Denmark) at the Alpine Center for Research on Trophic Networks and Limnic Ecosystems (CARRTEL) on the shores of Lake Geneva in Thonon-les-Bains (Figure 1b). Further support was provided by postgraduate students on this project: Riley Hughes (INRS), Ellen Slater (VOLT) and Elora Vergne (USMB). We quantified isoprene and other BVOCs in water from four lakes (Figure 1b), phytoplankton cultures, short-term incubations with plankton and macrophytes, diel samples and in the air. Emphasis was on method development to facilitate future data collection at remote locations in the far North. VOLT has many years of experience quantifying BVOC from atmospheric samples using thermal desorption (TD) technology (Schollert et al., 2014). This involves passing gas samples over an absorptive matrix that is packed into a short (~10 cm) piece of stainless-steel tubing. By closing both ends of the TD tube gastightly, these can be stored and shipped for desorption and analysis using gas chromatography with mass-spectrometric detection (GC-MS) later. After adapting our existing purge-and-trap methodology (Franchini and Steinke, 2017), we were able to remove gases from a known volume of lake water or culture samples, and concentrate them onto TD tubes. Immediate measurements using either gas chromatography with flame-ionisation detection (GC-FID) or a Fast Isoprene Sensor (FIS) provided ground-truthing of stored samples (Exton et al., 2010; Franchini and Steinke, 2017).

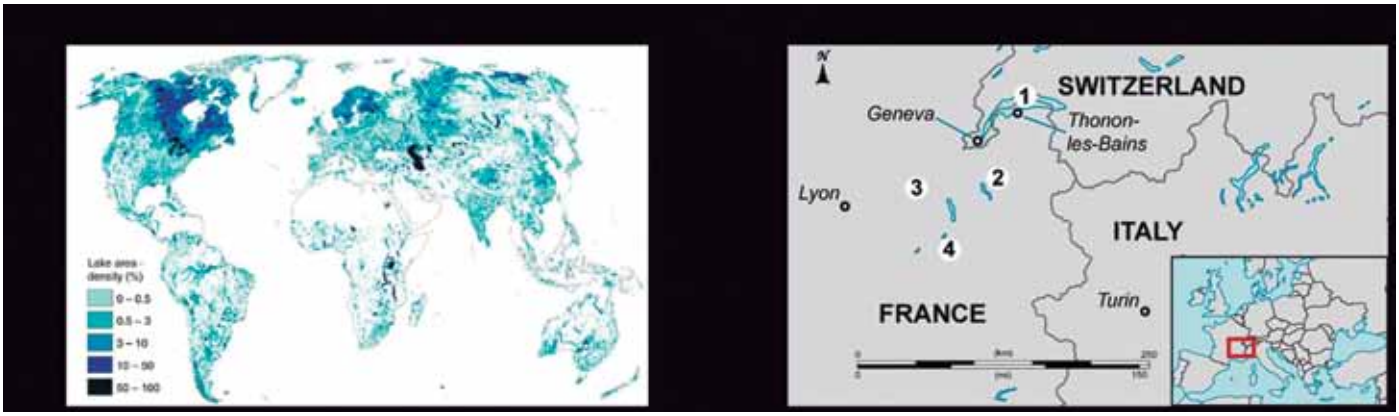

Figure 1. (a) Lake area density (limnicity) calculated as percent area covered by lakes within a 25 km radius (adapted from Messager et al. (2016)). (b) Map indicating location of sampled lakes with numbers showing: 1. Lake Geneva, 2. Lake Annecy, 3. Lac de Chavoley, 4. Lac d'Aiguebelette.

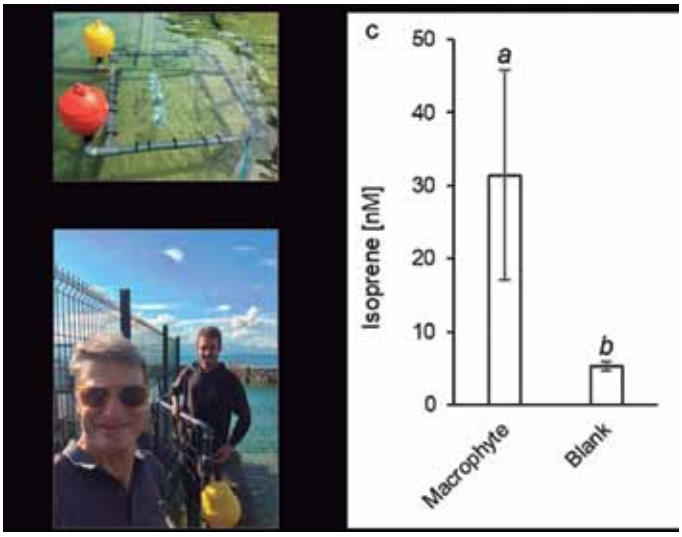

Figure 2. (a) In-situ incubations at the surface of Lake Geneva. (b) The authors retrieving equipment after an incubation experiment. (c) Fast Isoprene Sensor (FIS) measurements after a 4 h incubation of aquatic macrophytes using lake water as blanks. Shown are mean values with error bars indicating standard deviation (n = 5). Italicised letters indicate statistical groupings (T-test, P = 0.004).

With almost 280 gas chromatograms generated and more than 250 TD tubes awaiting analysis at VOLT, the analysis of our data is only at its beginning. Short-term incubations with freshly collected aquatic macrophytes suggested that epibenthic phototrophs can substantially contribute to overall water isoprene concentrations (Figure 2). Depth profiles for isoprene confirmed the previous observation that high concentrations exist around the deep-chlorophyll maximum with lower concentrations associated with the lake surface (Steinke et al., 2018). This may be due to a combination of (i) high production rates linked to phytoplankton biomass and (ii) the diffusive loss of isoprene across the lake-atmosphere interface, an important contribution of lakes to the atmospheric burden of this gas.

Conclusion and outlook

We confirmed that freshwater lakes produce isoprene, and flux estimations will likely indicate that lakes are a source of this gas to the atmosphere. The relative contribution of planktonic and benthic flora to aquatic isoprene is unknown but probably affected by, for example, lake bathymetry (steep versus gentle slope), sediment characteristics (rock versus soft) and light penetration (high versus low turbidity). It will be interesting to address the effect of environmental drivers such as temperature and light intensity on isoprene production and consumption processes to unravel the possible physiological roles of this gas in aquatic biota.

Acknowledgements

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The effects of water motion on the growth and phenolic content of the intertidal macroalga *Fucus serratus* (Phaeophyceae)

Submitted by Eoghan Mánus Cunningham
Co-Investigators: Dr Louise Kregting, Prof Christine Maggs, Dr Pamela Walsh
Queen's University Belfast

The serrated wrack *Fucus serratus* is among many intertidal fucoids harvested and exploited throughout Britain and Ireland for industrial purposes. A good example is its longstanding application in agriculture, an industry where fucoids have been utilised traditionally as a fertiliser, and more recently as a novel component in animal feed.

The inclusion of fucoids such as *F. serratus* in the animal feed market is a result of their naturally occurring antimicrobials, which are derived from polyphenols, more specifically phlorotannins, secondary metabolites produced in high quantities by intertidal Phaeophyceae in response to stressors like UV radiation and herbivory. These antimicrobials are being trialled as a replacement for therapeutic agents in pig feed such as antibiotics and the recently outlawed contaminant zinc oxide. However, questions remain around the most sustainable way of producing enough polyphenol-rich seaweed biomass for these markets.

The seemingly obvious route for producing high quantities of sustainably sourced macroalgal polyphenols would be through kelp farming; however, cultivated, and indeed naturally occurring kelps such as *Saccharina latissima* and *Alaria esculenta* have only a fraction of the polyphenol content found in intertidal fucoids. To make things more complicated, wild harvesting fucoids comes with a risk of overexploitation if future demand for macroalgal polyphenols becomes too great. Therefore, we need to be pre-emptive in our approach to any future requirements and explore ways of cultivating fucoids sustainably through aquaculture.

At the Queen's University Marine Laboratory (QML), on the shores of Strangford Lough SAC, we have been trialling different growing conditions for *F. serratus* both in the lab and the field. This began initially by conducting fertilisation trials using both male and female thalli from the shore and monitoring the early development of zygotes in petri dishes (Fig. 1).

The next stage was to get the zygotes to attach to different substrata including tiles and Dyneema twine and grow them into juvenile thalli in our macroalgal hatchery.

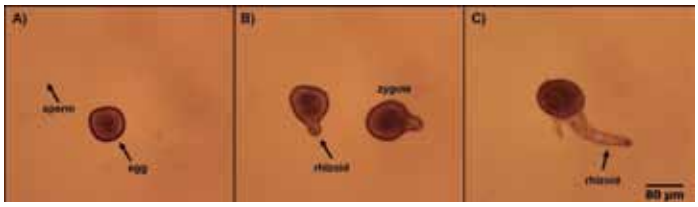

Fig. 1: The release and fertilisation of Fucus serratus gametes (A, B) and early development of zygote (C) after 48 hours Cunningham et al., 2024.

Finally, we initiated a subtidal growth experiment using our experimental seaweed farm in Strangford Lough and showed that our intertidal *F. serratus* can grow effectively on subtidal longlines, reaching up to 14 cm in length after 8 months in the hatchery and field (Fig. 2). Interestingly, we also showed that polyphenols could be successfully extracted from hatchery-grown fucoids, although phenolic content in our subtidal twine treatment was not as high as those grown on tiles in the laboratory. This arduous but rewarding process (for anyone interested) can be found in our recent Applied Phycology publication Cunningham et al., 2024.

Once the proof of concept was in place, we were granted a BPS project award to try and scale up the growth of *F. serratus* in subtidal environments and investigate ways of increasing the biomass and phenolic content through hatchery preconditioning. In a previous study at QML, we had determined that preconditioning hatchery grown kelp *S. latissima* to water motion prior to deployment at sea increased their overall growth by around 15%, highlighting the

Fig. 2: *Fucus serratus* thalli being harvested from subtidal longlines

Fig. 3: *Fucus serratus* thalli seeded on twine after 8 weeks (A) and 7 months (B) growth.

Fig. 4: Oscillating mechanical rig designed by David Glass (right), and a proud project supervisor (Mánus Cunningham; left).

effectiveness of optimal hatchery conditions for cultivation (See Kregting et al., 2023). Using both the aforementioned studies as a baseline, we began our BPS project, 'The effects of water motion on the growth and phenolic content of the intertidal macroalga *Fucus serratus* (Phaeophyceae)'.

In Oct 2023, we started by collecting fertile male and female *F. serratus* and inducing gamete release, fertilisation, and attachment of zygotes to spools of twine, in a similar way to that of kelp hatchery cultivation (Fig. 3A). The individual spools were then either subjected to oscillatory water motion or static conditions for two months before being spliced onto longlines and deployed at our experimental seaweed farm in Strangford Lough in Dec 2023.

The water movement conditions were provided by a bespoke mechanical rig, based on previous work from QML (Kregting et al., 2015) and designed by a Queen's University MEng student, David Glass, which oscillated the spools of *F. serratus* thalli back and forth in their tanks for the duration of the hatchery period (Fig. 4).

In May 2024, after much anticipation, we harvested the longlines and discovered that our juvenile thalli hadn't grown as well as we'd hoped. While some larger blades were observed (some reaching 20 cm: Fig. 3B), the density and biomass was exceptionally low compared to what we expected. So low, in fact, that we did not have the biomass needed to conduct our phenolic analyses.

After various highs and lows in the *F. serratus* cultivation process, we plan to refine and rebuild our work for the 2024 Autumn growth season. We are optimistic that a longer hatchery phase, which will allow juvenile thalli to become more established on their twine prior to deployment at sea, will provide a better overall yield. With any luck, this will be a yield big enough to properly assess the impact of water motion preconditioning on biomass and phenolic content of *F. serratus.*

Acknowledgements

We would like to thank the BPS for the opportunity to conduct this research with funds from BPS Award Number: 2023_BPS_0235, and particularly our senior technician at QML, Emma Healey, who has kept our seaweed hatchery and experimental site afloat for many years.

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Hilda Canter-Lund Competition

This award was established by the British Phycological Society in recognition of Hilda Canter-Lund, whose stunning photographs will be known to many members. Her photomicrographs of freshwater algae combined high technical and aesthetic qualities whilst still capturing the quintessence of the organisms she was studying.

Congratulations to all that made the shortlist, the competition was strong this year, and the BPS thanks everyone who submitted images and voted for their favourites.

2024 Winners

Macro category

Audrey Sarin with "Cathedral"

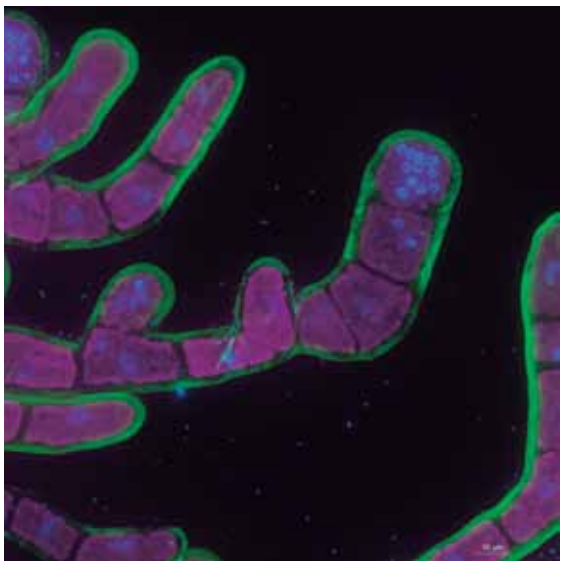
Audrey (she/her) is an American marine researcher with a lifelong love of the ocean. She spent the last few years in Central California, including Monterey, California, where this photo was taken. In Monterey, she researched sea urchin life history to inform kelp forest recovery planning as an intern at the Monterey Bay National Marine Sanctuary and a student at Moss Landing Marine Labs. Audrey is an avid diver and counts kelp forest ecosystems as her favorite to explore and photograph. She is currently a PhD student in the Massachusetts Institute of Technology/Woods Hole Oceanographic Institution joint program studying the effects of noise on benthic marine invertebrates.

Taken in Monterey Bay, California, this photo captures light filtering through tall stipes of *Macrocystis*. The sun's rays illuminate the kelp forest below. Streaming from high above, the lines of the photo center the ocean's natural beauty in the same way chapel ceilings elevate the divine.

Micro category

Michaela Hittorf with "Welcome to funky town"

Michaela Hittorf is a PhD student at the Institute of Microbiology at the University of Innsbruck, Austria. In her PhD project she works with intracellular parasites (i.e., Phytomyxea) of brown algae and plants and mainly focuses on the cell biology of these interactions. She always had a passion for microscopy and in her free time she likes to do photography and to draw, so this was the perfect opportunity to combine two passions: science and art. Long ago she fell in love with the sea and its inhabitants, but she still finds it very funny to work with marine organisms among the Alps in a landlocked country.



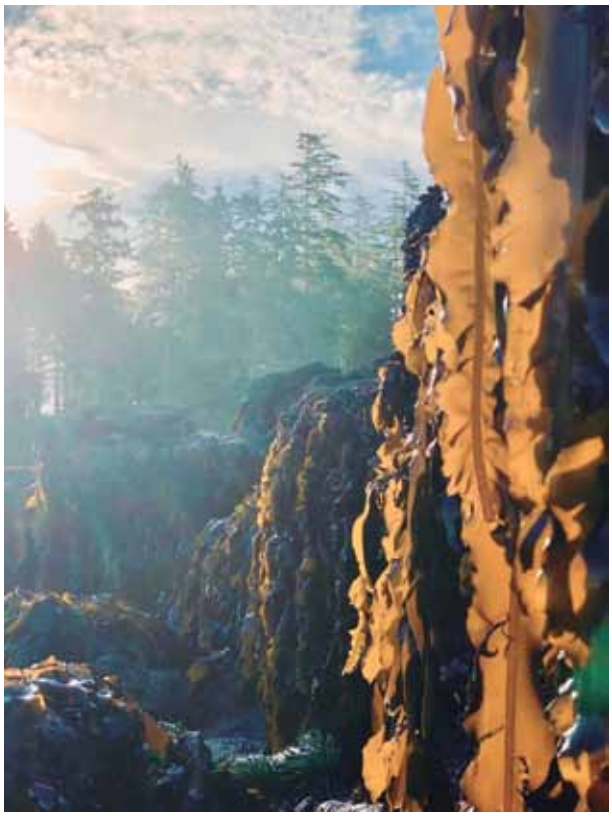
The parasite *Maullinia ectocarpii* in its brown algal host *Macrocystis pyrifera*. The antibody labelled brown algal cell wall is shown in green and the nuclei of the brown alga and the parasite are labelled with Hoechst (blue). Autofluorescence of algal chloroplasts (pink) can sometimes be troublesome when working with fluorescent dyes, but here it nicely completes the image. This image was taken with a Nikon Eclipse Ti2-E fluorescence microscope and is a maximum projection of a z-stack.

2024 Highly commended

Macro category

Maisie Roy-Musor with “Alaria in the morning“

Maisie is a Seaweed Biologist at Industrial Plankton in British Columbia, Canada, working on seed stock cultivation in seaweed bioreactors for kelp and red algae. A chemist turned phycologist, Maisie has always been fascinated by the diverse traits and strategies seaweeds use to interact with and thrive in their environments, particularly through metabolism and biogeochemistry. In her free time, she can usually be found reading, playing folk guitar, or out exploring nature with friends!

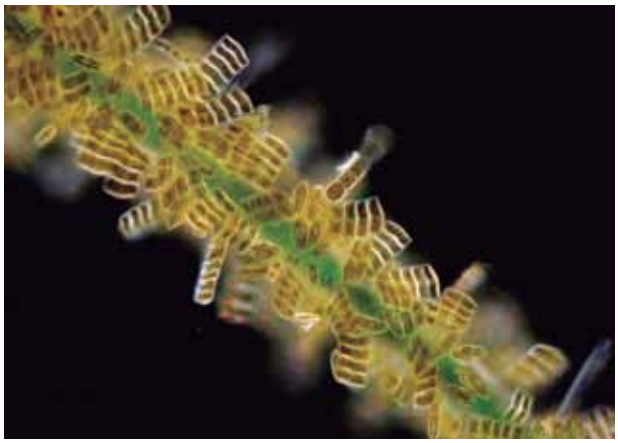


Even in the intertidal, an early morning sunrise can bring a sense of stillness. Soft light filters through the mountains and trees, speckling the shore and illuminating the vibrant but often discrete hues of *Alaria marginata* clinging to the rocky shore. This image was taken at Botanical Beach in British Columbia using an iPhone 14 camera.

Micro category

John Huisman: “A heavy load: *Achnanthes brevipes*“

John Huisman is the Curator of the Western Australian Herbarium (Department of Biodiversity, Conservation and Attractions) and also undertakes taxonomic research into the Western Australian marine plants. Other than a two year sojourn to the Hawaiian Islands, he has pursued a goal of a State-wide marine Flora since moving to Western Australia in 1985. John has written ten books and over 200 articles and chapters describing various seaweed related topics, including the recent pictorial guide, ‘Marine Plants of Australia (revised and updated)’ in 2023, which depicts over 640 species, mostly photographed in situ.



Achnanthes brevipes is an epiphytic diatom that forms short chains and is very common in the Swan Estuary, Perth, Western Australia. The photograph shows dense clusters growing on the green alga Chaetomorpha and was taken on a Nikon 80i microscope, using darkfield illumination, and a 20x objective. Several images were taken at different focal planes and then stacked in Adobe Photoshop. For scale the frame width is approximately 600 µm.

BPS Funded Travel Bursary Reports

72nd American Society for Mass Spectrometry Conference

Submitted by Jaspreet Sound
University of Birmingham,
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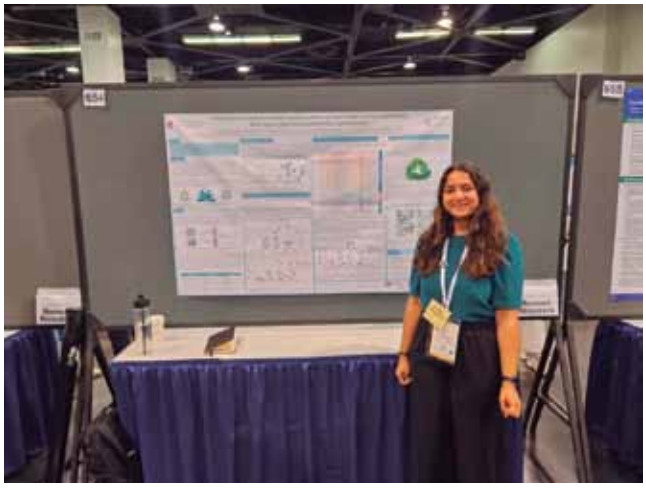
I recently attended the American Society for Mass Spectrometry's 72nd Conference on Mass Spectrometry and Allied Topics in Anaheim, California, USA. This meeting was attended by ~7000 academic and industrial experts within the field of mass spectrometry. Over 5 days, approximately 400 talks and 3,000 posters covered developments in mass spectrometry instrumentation as well as the applications of mass spectrometry in various scientific fields. The warm weather, tropical plants and Disneyland next-door were just a few added bonuses!



Through attending this conference, I wanted to disseminate my research on blue-green algae, highlighting the advantages that mass spectrometry can provide to this field. I also wanted to gain a deeper understanding of the fundamentals of the technique whilst simultaneously keeping up to date with the latest developments. I presented a poster on the use of mass spectrometry to explore the conservation of photosynthetic proteins within cyanobacteria over billions of years. The poster session was titled "Proteins: Conformation Analysis and Structural Biology" and featured research on many biological systems, ranging from humans to viruses, so I was glad to contribute an element of phycology to this session. There was obvious interest from the wider mass spectrometry community as I was constantly interacting with people over my poster. Presenting also raised great opportunities to network with academics, resulting in several new connections and meaningful conversations regarding my research.

As this was such a large conference, I was spoilt for choice when it came to choosing which talks to attend. For instance, the session 'Structural Biology' showcased techniques similar to those I use in my own research while 'Fundamentals: Ionisation Methods' provided technological updates to a main principle of mass spectrometry, and 'Ion Activation and Dissociation' was a great opportunity to learn more about an area of mass spectrometry that I had less experience in. A stand-out talk at the conference was the closing plenary by Dr Parag Mallik from Stanford University, an expert in both mass spectrometry and magic! In addition to performing tricks, his talk encouraged us to think about how science and magic are intertwined and to change our perspective of our experiments and data. Together, the broad range of sessions on offer at this conference highlighted the scope of mass spectrometry and provided me with many ideas of how to move my own research in phycology forward.

The conference closed with an event at the Grand Plaza of the Anaheim Convention Center where we were served amazing Mexican food and entertained by a Disney tribute band! This was the perfect end to the conference and our week in sunny Anaheim.

Ultimately, attending ASMS 2024 allowed me to fully immerse into the field of mass spectrometry and uncover the wide applications of the technology across a multitude of scientific fields. I am very honoured to have had the opportunity to showcase my research in phycology at this conference and I am excited to implement several techniques learned during this conference in the next steps of my research. Thank you to the British Phycological Society for making it possible for me to attend this conference through the award 2024BPS006.

International Conference on Algal Biomass, Biofuels and Bioproducts, 12-14 June 2023, Waikoloa Beach, Hawaii, USA

Submitted by Eleanor Wood
Scottish Association for Marine Science, UHI.
Email: Eleanor.wood@sams.ac.uk

I travelled from Oban, Scotland to the Big Island, Hawaii, for the Algal Biomass, Biofuels, and Bioproducts conference, chasing the sun to the other side of the world.

The conference was a very sociable event and I made a lot of new connections. I was also happy to reconnect with old colleagues and other algae scientists that I was not expecting to see at an event so far from home. I also met two other people working on *Chromochloris zofingiensis* so it was exciting to talk about our experiences working with this strain.

A photo taken by Dr Alla Silkina, Algae Swansea University, of me presenting my PhD findings on day 2 of the conference.

During the three days I saw some engaging talks. Valerie Harmon gave a plenary talk 'The Promise of Algae' and discussed her experiences working at large industrial scales of up to 1 million litres of microalgae. A talk that I found particularly interesting was presented by Heidi Kuehnle from Kuehnle Agrosystems who have developed a method of growing *Haematococcus* via fermentation using acetic acid. The red phase only takes two days and the patented strain does not have a cell wall and therefore no disruption stage is needed.

Sunset at the hotel on the night of the conference dinner.

There were different poster sessions each day which was a great way to network with new people. One of my favourite posters was presented by Marianna Venuleo from Instituto Tecnológico de Canarias who told me about their scale up facility and how they are using brine from a neighbouring desalination plant to grow algae.

For my presentation, I was in the Economic and Sustainability Analysis session and spoke about my research on biorefinery of *Chromochloris zofingiensis*. I covered cultivation at different scales, cell disruption, and product separation techniques. The audience were engaged and asked several questions at the end. One of which was

Images provided by Cyanotech Corporation from left to right: Raceway ponds with *Haematococcus* at different stages in the foreground and Spirulina in the distant background, the *Haematococcus* after being drum dried, *Spirulina* tablets that have been cold pressed on site at Cyanotech.

which biorefinery route I would take if setting up a company, a question I'm still undecided on due to the number of variables in terms of efficiency and economics. The presentation encouraged people to speak to me about my research afterwards too.

The conference dinner was in a very picturesque location and was complete with traditional Hawaiian music and dancing. It was great to see so many people working towards the creation of sustainable bioeconomies and solving global issues through the use of algae to reduce carbon emissions, for wastewater remediation, for energy production, and to reduce food inequality.

I also organised a visit to Cyanotech whilst I was there, a company producing *Spirulina* sp. and *Haematococcus* pluvialis at industrial scale. The facilities were unbelievable. The raceway ponds were 100,000 L and 200,000 L and the downstream processing equipment such as the centrifuge, drum dryer, and the supercritical CO2 system were huge. It was inspiring to see such a successful facility that cultures the algae and also creates their own products on site.

For the rest of the trip I spent my time exploring as much of the island as possible. I did some amazing snorkelling, including at night with manta rays, *Mobula alfredi*. The boat tours put lights in the water which attracts phytoplankton which the manta rays feed on. The volcano, Kilauea, also started erupting the day before I landed on the island, so I was lucky enough to get to see the incredible lava flow which stopped two days after I saw it.

Thank you to the BPS for their contribution (award#2023_BPS_0213) towards my trip, as well as my supervisors, UHI, and Algal BBB, it really was the opportunity of a lifetime!

Left: Manta ray feeding, taken by Fraser Andrews,a PhD student at Manchester University. Right: Kilauea volcano eruption within the Halema'uma'u crater, 17th June 2023.

Seaweed Identification Course

Submitted by Freya Alldred
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On the 6th May I began the long train journey from Durham to Plymouth for the annual Seaweed Identification and Collection Course delivered at the University Marine Station. This was the start of a fantastic week meeting fellow phycologists and learning together. The course catered to everyone, from marine biologists, students, and amateur enthusiast making for a fun week learning alongside each other. There were many opportunities to share our own interests and learn from each other. I am more of a geochemist than marine biologist, so the opportunity to talk with biologists was a highlight for me. The course location at the Plymouth Marine Station was a fantastic location too, the labs were very interesting to see and use and all field locations were on the doorstep.

Split into a mix of fieldwork, lab work and talks the varied structure of the course made for a fun and engaging week. Many topics were covered throughout the 4 days of talks, these were often informal but always informative and accessible to everyone in the room. Christine Maggs gave a very interesting talk on seaweed life history, this was helpful in my understanding of the triggers for blade growth (e.g., daylength and temperature). From this talk I found several papers relevant to my PhD on frond development in Laminaria hyperborea linked to daylight hours published in the 1970s. Christine Maggs was also helpful in suggesting the book Biology of Marine Plants by M. Dring to build on the life history she touched on in her lecture. I have since downloaded a PDF of this book and look forward to reading it. Of particular interest to me was Juliet Brodie's lecture on the brown seaweeds; this was very engaging and well summarised introduction to the major genotypes and characteristics. Most relevant to my work was her discussion on the *Himantothallus* sp. from South Georgia. This course provided an excellent opportunity to openly discuss with experts and learn from one another; Juliet was passionate about her work and was keen to hear about my own.

Plymouth Marine Station provided excellent fieldwork opportunities. The first day was spent collecting specimens from Tinside – only a 20-minute walk away. This was a very good site for Laminariales with many accessible at low tide. The second trip was to a local estuary – this was a fantastic spot with many smaller species and a large seagrass meadow. The final site was about an hour drive away – this led us to a beautiful sandy beach with very dramatic rock pools. Here, a wide variety of kelps were found as well as more delicate red species and I had the chance to see the iridescent species *Chondrus crispus*. We spent about an hour at each site collecting a range of species to bring back to the lab. The lab sessions were very relaxed, giving us time to work through the taxonomic keys to identify our species. Over the course of the week, I really improved in my identification of species. I became much more confident using the microscopes and even produced some slides of my own. On the final day of lab work a session was given on producing herbaria ma-

croalgae – dried seaweed often arranged artistically for decoration or for museum collections. We each had the chance to make our own herbaria – my *Ceramium* sp. is still being used as a bookmark in the seaweed guidebook and comes with me in the field.

My place was funded by the British Ecology Society Training & Travel Grant and the Stephenson College Connections Grant – so I am grateful to these two organisations for allowing me to attend the course. I enjoyed my time in Plymouth and learning more about the taxonomy and life histories of seaweed. All of the course leaders were passionate about their work and keen to share their knowledge with everyone. Finally, a special mention should be made for the weather – we were all very appreciative of the sun for staying out all week and made for some very enjoyable fieldtrips.

ORKNEY SEAWEED STORIES

The tangled tales of humans and algae

Submitted by: Rebecca Marr

Rebecca Marr is an artist living in Orkney. Her work has involved seaweed for the last 15 years and her interest led her to research the social history of seaweed in the Orkneys and turned up some intriguing connections. For example, L*aminaria hyperborea* was known as *Laminaria cloustonii* after the Rev Charles Clouston, founding president of the Stromness Museum, noted the differences between *L. digitata* and *L. hyperborea*, locally known as tangle and cuvie. In the island of North Ronaldsay she found a culture of seaweed use stretching back centuries. The stories about seaweed and Orkney and how the two are tangled up with each other through seaweed as food for humans, fodder for animals, fertiliser for the soil, a feature in Orkneys' folklore and the industries it spawned, has been presented as a website www.orkneyseaweedstories.wordpress.com

Here is an excerpt:

Stone structures dot the coastline of North Ronaldsay, monuments reflecting the island's seaweed utility. Round planticrues, built by the shore to protect kail seeds (an early cabbage variety believed to have arrived on a Dutch fishing vessel, rather than the kale we now know) from frost and winds until they were strong enough plants for the kailyard. These planticrues were manured with seaweed.

The 13 mile wall that encloses the island was built in 1832 to confine the sheep to the shore, reserving the pasture for cattle. The sheep, banished from the fields, thrived on the seaweed and their flesh took on an umami taste. Unlike grass-fed flocks the North Ronaldsay sheep, a registered rare breed, are at their best condition in the winter, this provided the islanders with a ready supply of meat when food was at its scarcest. Still today the mutton is eaten fresh in winter and frozen for year round consumption. The sheep have their favourite seaweeds, and in order they are: dulse; dabberlocks; tangle; knotted wrack; then other fucus varieties. The sheep may have been on to something, dulse was believed to have panacean properties. Taking dulse from Geo Odin with water from the Well of Kildinguie, on the island of Stronsay, allowed the pilgrim to 'escape all maladies except black death', the legend is included in Sir Walter Scott's The Pirate.

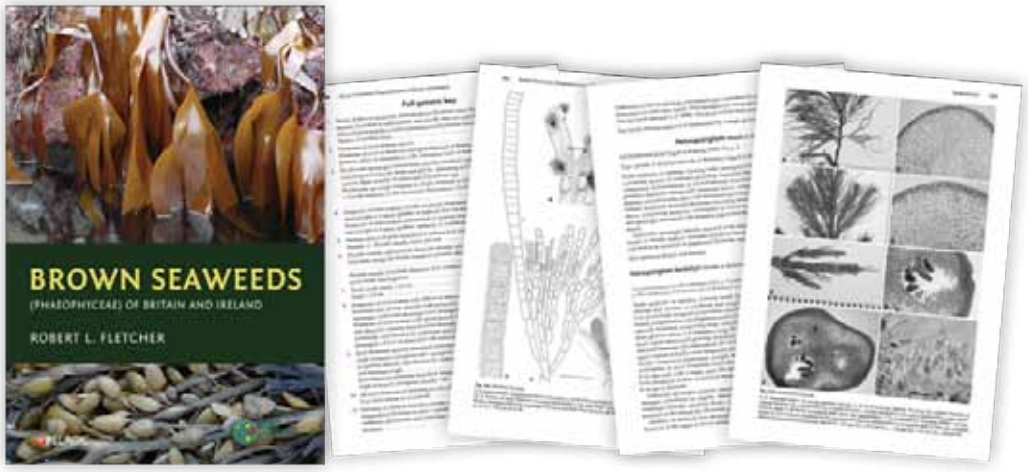
In the area between the two lighthouses in North Ronaldsay, stone lined kelp pits can still be seen. The word kelp would come to dominate the economic history of Orkney in the eighteenth and nineteenth centuries, employing around 3,000 people between 1780 and 1830. From the distance of time, and from archive photographs of women posed by the smoking shore, it might be possible to be sentimental about the kelp industry but the reality was less than romantic. It was a divisive industry, loathed by the kelp-workers and lucrative for the lairds. The initial period of the kelp industry was for the production of soda and potash, used as a source of alkali in the glass and soap industries and for bleaching and as an alum in dying factories. In this earlier phase the kelp was made with tang, rock cut wracks of the fucus species, and was carried out in summer.

In the later phase of the kelp industry, from the 1830s, kelp provided a source of iodine and relied on ware, the larger brown low water seaweeds such as the laminariae. This meant a shift to multi-seasonal work, gathering the tangles driven ashore by winter storms, stacking and checking the tangles were drying all through spring, gathering the fronds shed by the laminaria during the May cast, and the summer spent tending the kilns. The quantities of wet weed required were enormous, it took over twenty times the amount of raw material to produce the end product. The tangles were built up on walls to be dried by the wind. After the seaweed had been dried it was burned in a hole in the ground - the kelp kiln.

Low stone walls known as steeths used for drying seaweed in the kelp industry days were utilised once more postwar when the tangle industry arrived. The younger generation who had learned kelp-making technologies from their elders were now utilising the same resource for a different market but echoes of the past industry were clear. The tangle gatherers of the twentieth century were re-enacting work rituals found in the eighteenth century kelp industry: walking on the same stretches of beach, repeating movement across the shore from the ebb to above high-water mark, selecting, gathering and stacking tangles. Once again North Ronaldsay folk would gather tangle on the shore in an echo of the kelping days of their forebears, but this time there were marked differences. While the kelp industry was characterised by compulsory labour and injurious working conditions, working the tangles was, by contrast, freelance and although hard work, it was relatively healthy.

BROWN SEAWEEDS (PHAEOPHYCEAE) OF BRITAIN AND IRELAND

By Robert L. Fletcher



Brown Seaweeds (Phaeophyceae) of Britain and Ireland provides the first complete, up-to-date, detailed illustrated guide and keys to the nearly 200 species of brown algae present around the coasts of Britain and Ireland. It is the culmination of over 30 years of field and laboratory studies by the author.

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'Most welcomed is this long anticipated, comprehensive and authoritative treatment of the brown seaweeds of Britain and Ireland. An impressive book that is an indispensable reference source for anyone researching this environmentally and commercially important seaweed group in the North East Atlantic and beyond.'

Professor David M John, Natural History Museum, London

Phycological Society of America
2025 Meeting

July 29th to August 2nd
San Juan, Puerto Rico
Inter American University of Puerto Rico Barranquitas and Metro Campus
Theme: Sustainability

An exhilarating 7-day summer extravaganza. Our thrilling itinerary kicks off with hands-on workshops and adventurous field trips to the captivating IAU Barranquitas campus. Midway through, embark on an unforgettable journey to discover Puerto Rico's majestic mountains, pristine streams, and beautiful beaches. The highlight? A spectacular banquet set amidst the breathtaking mountains of Puerto Rico. And don't miss the incredible opportunity to explore the historic charm of old San Juan!

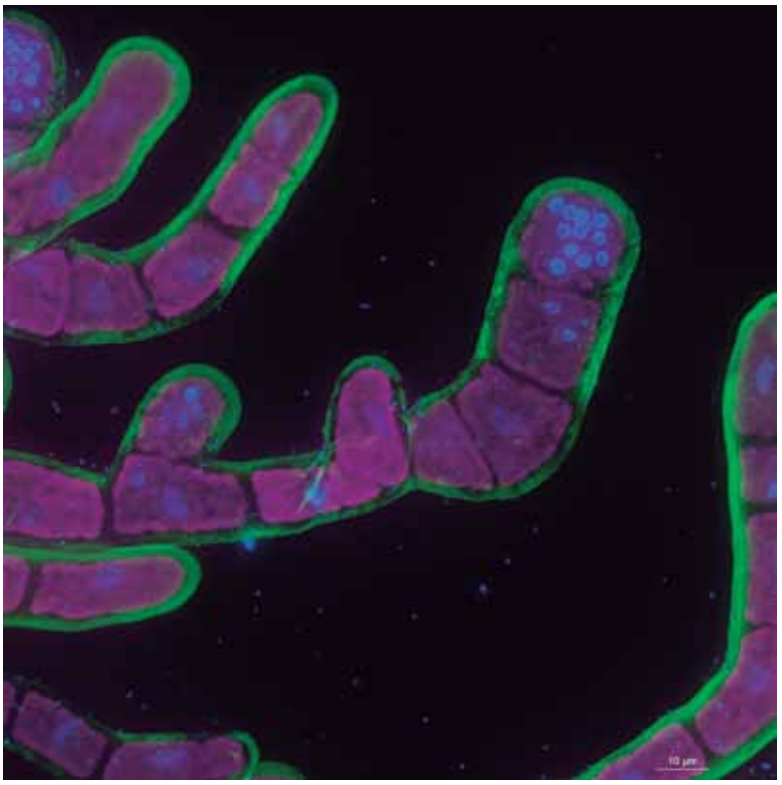
More at: https://www.psaalgae.org/

Seaweed cultivation in Europe is showing promise in terms of growth, however challenges in regulations, cost, and market viability could affect the pace of this growth in the future. The Seagriculture conferences focus on addressing those challenges in the seaweed industry, fostering collaboration among various stakeholders, and emphasizing the importance of sustainable practices, innovation, research, and regulatory adaptability for long-term success.

More at: https://seagriculture.eu/

INSTRUCTIONS FOR CONTRIBUTORS

Copy which is submitted for publication in *The Phycologist* should be concise and informative. Articles should be scientifically sound, as jargon free as possible and written in a readable scientific magazine style. Unless absolutely essential references should not be included. All types of relevant material will be considered, these include job advertisements, scientific reports, book reviews, news items of topical interest, meeting announcements, grant awards, promotions, appointments, profiles of eminent phycologists and obituaries. If you are interested in submitting material that does not fall within any of these broad categories, or you are unsure of the appropriateness of a potential article, then contact the editor. Suggestions for future articles or a series of articles are welcomed.



Copy should be submitted, preferably as attachments to email or on disc (MS Word for Windows or Rich Text Format). **Illustrations and photos to accompany copy are welcomed and should be supplied as JPEG or TIFF file-format no less than 600 dpi resolution**. The editor reserves the right to edit the material before final publication.

Submission of Copy and Deadlines

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