

Report for Shackleton Fund

The Brown Algal Biodiversity of the Falkland Islands Revisited

Our team of 4 – Aldo Asensi and Frithjof Kuepper as Shackleton award holders, Alexandra Mystikou as a joint PhD student of the University of Aberdeen and Pieter van West as long-standing Co-Investigator of our work in the Falklands – conducted a most rewarding expedition to the Falklands this January – March (AA and FCK from Jan. 23-Feb. 15, PvW from Jan. 23 – Feb. 5, and AM from Jan. 23 – March 15).

Particular highlights of the expedition include the following:

- (1) Rediscovery of the enigmatic *Cladochroa chnoosporiformis* from the west side of Port Philomel, West Falkland. This brown algal taxon had originally been described by Skottsberg, but never been reported by anybody else from anywhere since then. The material collected is of a sufficiently high quality which will enable molecular and microscopic studies to clarify the phylogenetic affinities of this taxon and provide further insight in its life mode.
- (2) Discovery of 2 epi-/endophytes from the kelps *Macrocystis pyrifera* and *Lessonia* sp., which are likely taxa new to science.

Field Trip (expedition 24 January to 15 March 2013)

The purpose of this expedition was to sample live isolates of macroalgae (seaweeds) and their pathogens around the Falkland Islands. Oomycete pathogens affecting algae and fish were collected as well. Moreover, the main aims of this expedition include the study of the molecular biology, ecology and physiology of macroalgae of this Subantarctic region. During this expedition samples of seaweeds for molecular identification, herbarium specimens and cultures of live isolates were collected.

Over the two months of this expedition, over 300 samples were collected from 16 different sites around the Falkland Islands and kept in silica gel and CTAB for molecular identifications. Around 300 seaweed herbarium specimens have been prepared.

The team surveyed and collected macroalgal species from 16 different sites around the Falkland Islands. Four sites at Sea Lion Island (Orca Pool, The Gulch, Smuggler's Cove and the west end of the Island), nine sites at the East Falkland including North Arm, San Carlos (Blue Beach), Rincon Grande, Port Louis, Mt. Kent Farm, Port William and Fitzroy; and Port Philomel, Fox Bay East and Fox Bay West at the West Falkland were sampled (Figure 2). A total of 4 dives were conducted, 3 in Port William and 1 at Fitzroy (East Falkland), with the support of Frithjof Kuepper and the Shallow Marine Surveys Group (SMSG) dive team. Maximum depth was the 20.1 m. The remainder of the sampling was conducted by extensive snorkeling and intertidal collections.

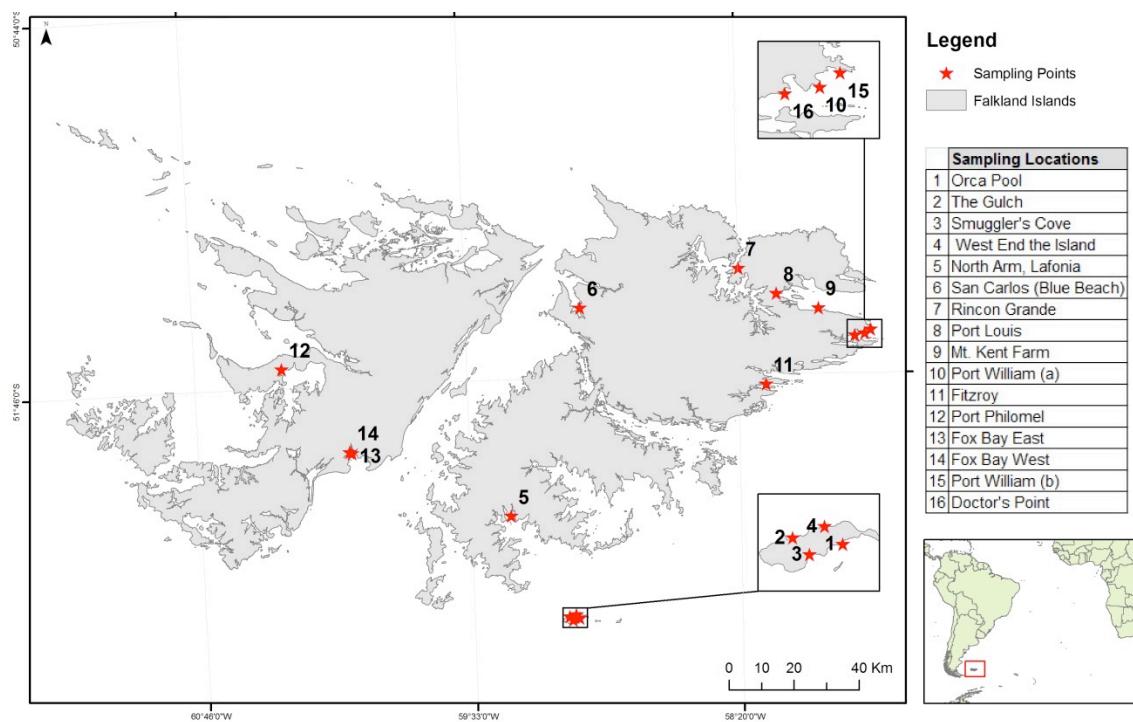


Figure 1: Sampling points around the Falkland Islands (expedition Jan-Mar 2013)

Sample preservation and preparation of herbarium specimens

Following each day of diving or in the field, herbarium specimens were prepared by mounting seaweed thalli on Bristol paper. Aliquots of each specimen were kept in silicagel and CTAB buffer (Phillips *et al.*, 2001), both of which conserve DNA for further molecular studies.

Given the limited time and obvious logistic constraints at these remote locations, inevitably leading to a limited coverage of the smaller representatives of the flora, collections of seaweed specimens were complemented by collections of substratum samples in sterile tubes during the dives. Following return to Europe and based upon a protocol developed for a similar study in the Juan Fernandez Islands (Chile; Mueller and Ramirez, 1994), these samples were incubated in Provasoli-enriched sea water (Provasoli *et al.*, 1957; Starr and Zeikus, 1993) in the laboratory of Akira F. Peters (Roscoff) under light and temperature regimes corresponding to their regions of origin. Over the next roughly 3 months, they were monitored for algal outgrowth, from which unialgal isolates were made.

Recent highlights from the exploration of seaweed biodiversity around the Falkland Islands

During our last expedition in 2013, two likely new species of brown epiphytes on the two kelp genus that occur at the Falkland Islands (*Macrocystis* and *Lessonia*) have been discovered. The brown epiphyte that has been found on the Giant Kelp, *Macrocystis pyrifera*, collected from Port William (East Falkland) between the 10-14 m depth (Figure 5). The brown epiphyte that has been found on *Lessonia nigrescens* collected from Fitzroy (East Falkland) at 7 m depth. No epiphytes of *Macrocystis* and *Lessonia* are identified from South Atlantic and nothing of comparable morphology is known from elsewhere in the world.

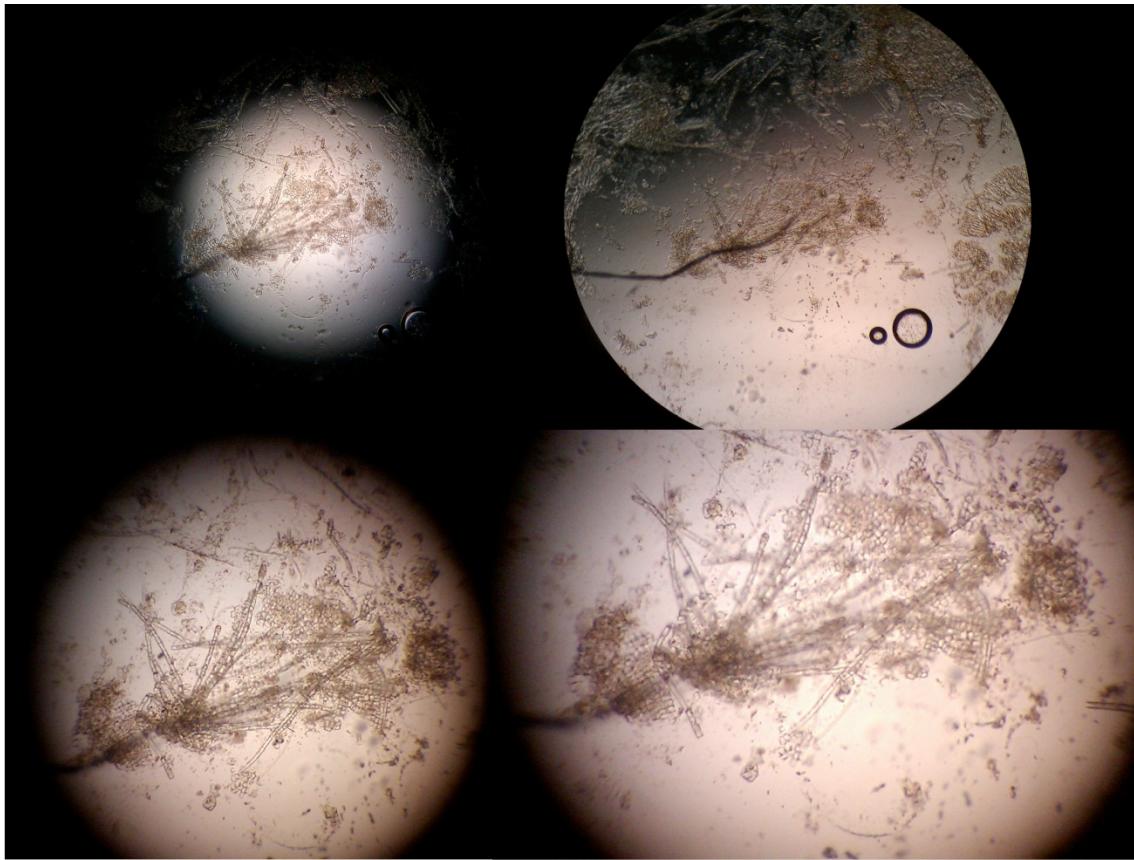


Figure 2: Epiphyte of brown algae found on *Macrocystis pyrifera* under the microscope.

Furthermore, three new records of *Colpomenia peregrina*, *Punctaria* sp. and *Dictyota* sp. that have not been recorded before in Falkland Islands were made. *Colpomenia peregrina* and *Punctaria* sp. sampled intertidal and *Dictyota* sp. found at 5 m depth. All of the new records are coming from San Carlos (Blue Beach) in East Falkland Island.

The presence of “red sand” (as called by local people, Figure 6) has been noticed on various beaches around the Falkland Islands. After microscopic observations we hypothesize that this might be due to a mass proliferation of a unicellular red alga of the group *Porphyridiophyceae*. Members of this group usually occur in tropical and subtropical areas; if our hypothesis was right, this would constitute something quite novel for the Subantarctic region. We are currently collaborating with John A. West, an expert for *Porphyridiophyceae*, in order to investigate this further, in particular through culturing attempts.

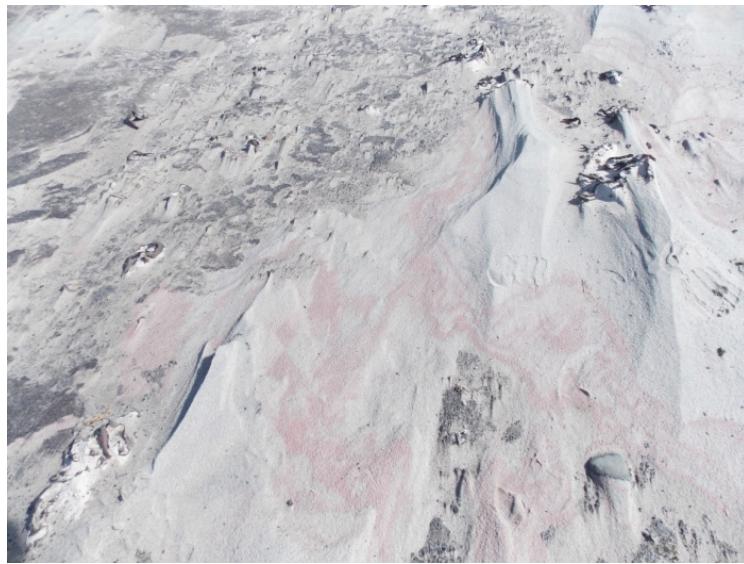


Figure 3: “Red sand” (*Porphyridiophyceae*) from Sea Lion Island.

Moreover, within the Falkland Islands, we observed an exceptionally high seaweed biodiversity at North Arm (Lafonia, East Falkland) where we found 63 species. This is twice the number of individual species found in any other sampling area (Figure 7).

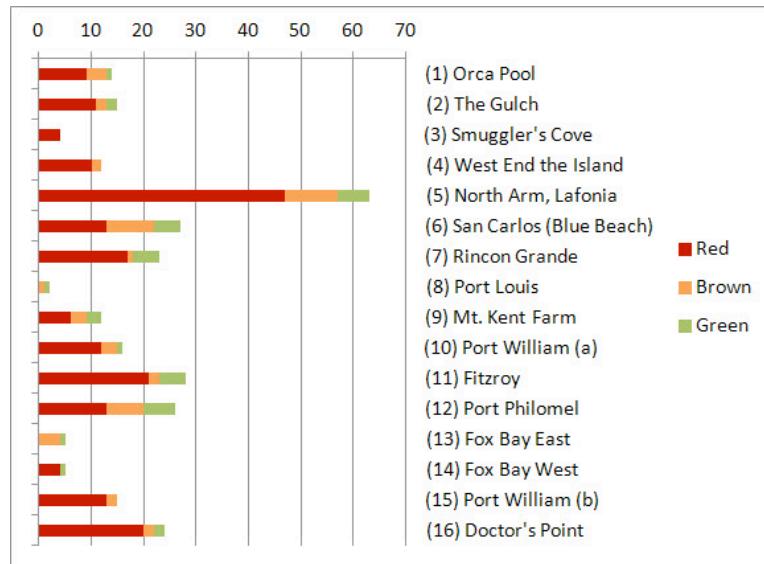


Figure 4: Algal specimens collected during the expedition Jan-Mar 2013 – arranged by class)

Rediscovery of Cladochroa chnoosporiformis Skottsberg, a poorly known endemic brown alga from the Falkland Islands

Another significant finding was the rediscovery of *Cladochroa chnoosporiformis* in Port Philomel, West Falkland, which had not been seen across the world for a century. Scientists were not sure about its current existence as it has been recorded for the first and last time only by Skottsberg in 1921.

Cladochroa chnoosporiformis was first described by C. Skottsberg in 1921 as a new genus and species, following the Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande 1907-1909.

The study site given by the author in 1921 was "West Falkland, near Halfway Cove, on slate in the littoral region". In his later publication in 1941, he clarified "West Falkland, Port Philomel, W. of Halway Cove 21.11.1907, sheltered flat sand beach with emerging rock slabs of slate. Halfway. Middle littoral. on rocks, *Adenocystis* Ass. - *Adenocystis utricularis*, *Cladochroa chnoosporiformis*, *Caepidium antarcticum*, *Scytothamnus hirsutus* (on *Adenocystis* and *Cladochroa*)".

Scytothamnus hirsutus is currently recognized as *Dictyosiphon hirsutus*, which we have found in great abundance. After the first finding of the alga and also according to the 1941 reference, no later findings of specimens of *Cladochroa* are mentioned.

Also, among our own, numerous surveys and collections at many different localities around the Falkland Islands, we have never encountered *Cladochroa*.

In February 2013, during a visit the bay of Port Philomel, we found the species at the site indicated by Skottsberg – interestingly, in a particularly limited perimeter of around 100 m. Specimens were found on rocks and on the beach, mixed with other macroalgal material deposited here by wave action – most of which originated from the mediolittoral.

The many thalli found were apparently very mature, around 10 cm in size, of dark brown colour, of very tough consistency, and generally covered by epiphytes (especially *Dictyosiphon hirsutus* and *Myriactula* sp.).

Microscopic observation shows a medulla region formed by vertical filaments, constituting a pseudoparenchym, surrounded by an epidermis covered by unilocular sporocysts at the basis of a club-like paraphysis. Similar to Skottsberg's description, and even though we have not found

the apical, piliferous conceptacle nor the laterals, which had been reported by Skottsberg – despite a large number of lateral hairs, this can be due to the age of our plants. The specimens of Skottsberg had been collected on November 21, 1907, while our collections were made on February 8, 2013.

We are most grateful to the Shackleton Fund for the very generous support of our most rewarding expedition to the Falklands in January-February 2013. The support will be duly acknowledged in two manuscripts which are currently in preparation.