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Pink Barnacles on Pumice: additional information ~ *Hazel Britton, Sarah Lloyd and Julie Serafin*

Sixteen Legs ~ *book review by Jim Nelson*

No Birds But Lots of Frogs - *letter to the editor by Richard Ashby*

Iridescence ~ *Sarah Lloyd*

Syridium obcordatum at Hawk Trap Hill ~ *Phil Collier*

Pink Barnacles on Pumice - additional information

Hazel Britton, Sarah Lloyd and Julie Serafin

Shortly after publishing *Pink Barnacles on Pumice* in The Natural News 63 (April 2016), Dr Alastair Richardson suggested that Dr Diana Jones, (Executive Director, Western Australian Museum, Perth, Museums and Collections) would be able to identify the barnacles.

After our initial email correspondence, Hazel's and Julie's pieces of pumice were posted to Dr Jones. In July 2016 she returned our samples with notes on identification, some scientific data on the species mentioned, as well as her research photos of two of the species involved: *Balanus trigonus* and *Lepas pectinata.*

Dr Jones wrote that the two sessile barnacles on both pieces of pumice were the large *Megabalanus rosa* and the smaller *Balanus trigonus*. The stalked barnacle *Lepas pectinata* was also found on Julie's pumice but they were tiny, newly settled juveniles that would not have been seen without a microscope.

Megabalanus rosa has a steeply conical, sub-cylindrical shell with a large ovate orifice. The six strong wall plates are smooth without raised ribs and are various shades of pink with darker longitudinal stripes. The dark pinkish brown radii (areas of shell plates that resemble side plates) are wide and transversely grooved. Also found were pieces of the opercular plates.

The large *Megabalanus rosa* have an ovate orifice whereas the smaller *Balanus trigonus* has a triangular orifice. Photo: Hazel Britton.

M. rosa was native to Japan, China and Taiwan but introduced elsewhere by fouling. It attaches to hard surfaces such as rocks, molluscs, buoys, rocks, ships and floating structures or it becomes embedded in sponges or encrusted with bryozoans.

In 1953 it was recorded on aircraft carriers and other vessels returning to Australia after service in Korean and Japanese waters. Because the records are from areas that receive international shipping it is believed that Ship fouling is the dispersal mechanism for the species.

Balanus trigonus has a steeply conical shell made up of six deep pink plates with raised longitudinal white ribs. The orifice is broadly

Plates of *Megabalanus rosa* (left) and *Balanus trigonus* (right). Photos: S. Lloyd.

triangular with an acute angle. There are two pairs of plates (two terga and two scuta) that in life seal the orifice. The scuta are diagnostic for this species as each one has characteristic longitudinal rows of small pits on the outer surface. As above there were pieces of the opercular plates.

Balanus trigonus was first described by Charles Darwin in 1854 from material collected from Java, Peru, Colombia, California, Sydney and New Zealand. It is a cosmopolitan species that inhabits tropical, sub-tropical and warm temperate seas. It does not pose a threat to Australia's marine fauna.

Nauplius larva of *Elminius modestus*. http://planktonnet.awi.de/index. (Creative Commons Attribution-Share Alike 3.0 license.)

Goose barnacles with their cirri extended for feeding. Photo: M.Buschmann, Creative Commons Attribution-Share Alike 3.0 license.

The life cycle of barnacles

Barnacles are arthropods that comprise the infraclass Cirripedia (L. 'curl-footed') in the subphylum Crustacea which includes crabs and lobsters. They are exclusively marine and tend to live in shallow and tidal waters. They are nonmotile suspension feeders, with two nektonic (actively swimming) larval stages, the nauplius and the cyprid. There are approximately 1,220 described species.

The fertilised egg hatches into a nauplius, a one-eyed larva comprising just a head and a telson, the final abdominal segment of an arthropod. The nauplius grows for six months and passes through five instars before transforming into the cyprid stage. Typically, nauplii are brooded by the parents and released after the first moult as free-swimming larvae. They use setae for locomotion.

The cyprid larva, the final larval stage before adulthood, lasts from days to weeks. Its role is not to feed but to find a suitable place to settle. It does this by exploring surfaces with its modified antennules, assessing their suitability based on surface texture, chemistry, relative wettability, colour, and the presence or absence and composition of a surface biofilm; swarming species are more likely to attach near other barnacles. Once a suitable spot is found, it attaches head-first using its antennules and a secreted glycoprotein. It then undergoes metamorphosis into a juvenile barnacle.

Barnacles attach themselves permanently either by growing their shells directly onto the substrate, (e.g. the common sessile "acorn barnacles") or in the case of the goose barnacles and others, by means of a stalk.

Typical acorn barnacles develop six hard calcareous plates to surround and protect their bodies much like the carapace of other crustaceans. The plates are held together by various means, depending on species, in some cases being solidly fused.

The animal lies on its back inside the carapace with limbs projecting upwards. The six pairs of limbs (called 'cirri') attached to the thorax are long and feathery. They filter food such as plankton and move it towards the mouth.

Barnacles' main sense appears to be touch, with the hairs on the limbs being especially sensitive. The adult has one eye, which is probably only capable of sensing light and dark.

Once metamorphosis is over and they have reached their adult form, barnacles continue to grow by adding new material to their heavily calcified plates. These plates are not moulted but the barnacle itself will moult its cuticle.

Most barnacles are hermaphroditic.The ovaries are located in the base or stalk, and may extend into the mantle, while the testes are towards the back of the head, often extending into the thorax. Self-fertilization, although theoretically possible, is rare in barnacles.

Barnacles can't leave their shells to mate so they have extraordinarily long penises believed to be 40x the length of their body; the largest penis relative to body size in any animal.

Barnacles can also reproduce through a method called spermcasting, in which the male barnacle releases his sperm into the water and females pick it up and fertilise their eggs.

Acknowledgements

We thank Dr Diana S Jones for her time and expertise in identifying the barnacles, for the extra information she supplied and her interest in our beachcombing finds.

https://en.wikipedia.org/wiki/Barnacle

P.S. Analysis of barnacles found on a flaperon from MH370 has added to the mystery surrounding the plane's final resting place, with scientists in France and Australia reaching different conclusions. http://www.dailytelegraph.com.au/news/national/what-flaperon-barnacles-revealed-about-mh370-mystery/news-story/cfbbafabc138a6756dcddebc109c0dc7

Coral (left) and 2 mm long exoskeleton (right) collected from inside one of the barnacles. The images are made of a series of photographs taken with a Canon EOS 70D on a Leica dissector microscope and 'stacked' using Photoshop. Photos: S. Lloyd

BOOK REVIEW

SIXTEEN LEGS - KINKY LOVE:
A Study of The Tasmanian Cave Spider
By Niall Doran, Alastair Richardson & Joe Shemesh (illustrator)
A book review by Jim Nelson

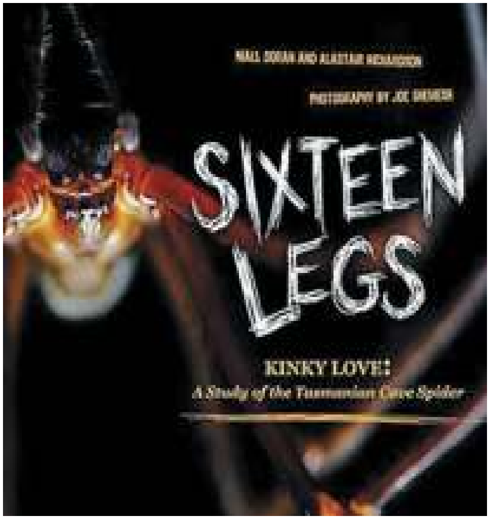
Niall Doran and Alastair Richardson are noted Tasmanian zoologists who have involved themselves over the years in educating the public about invertebrates in our environment. They have been particularly active in visiting schools and taking students on excursions to show them the diversity and interesting features of our invertebrate fauna. Their recent publication, Sixteen Legs, is a welcome addition to educating the general public about a special Tasmanian creature, the Tasmanian Cave Spider, or *Hickmania troglodytes*.

The TCS (as I will refer to the species) is a quite remarkable Tasmanian creature that has survived for perhaps over 200 million years. It was around when Australia separated from Antarctica and South America, and is a Gondwanan species now found only in Tasmania.

The TCS was first described in 1883, but little was known about it until research in the 1990s. It is thought that caves probably provided a refuge for this species during climatic changes. These days it can be found in wet forest and in dark, sheltered habitats that are either caves or cave-like places.

This book contains some excellent information and photos of the TCS and its habitats. Research carried out by Tasmanian biologists has been published internationally, and the publication of *Sixteen Legs* has gained wide attention.

For those who don't particularly like entering caves, this book provides some very special shots of the reclusive spider and its environment, along with an interesting history of the species and its world. Congratulations



and thank you to Niall, Alastair and Joe for bringing us visions of the Tasmanian Cave Spider and information that most of us would never be able to access.

For more information about the Sixteen Legs project and the work of the Bookend Trust:

http://www.bookendtrust.com/home-link

'Tales of love, lust, death & dark webs'

Niall Doran was interviewed by Jonathon Green on *Blueprint for living* (ABC RN March 4 2017). Check the ABC website for a podcast:

http://www.abc.net.au/radionational/programs/blueprintforliving/sixteen-legs/8318856

No birds but lots of frogs

Letter to the editor by Richard Ashby

Back in May 2010 I did a 500 m radius/one and a half hour bird survey for Birdlife Australia's Atlas project in a previously unsurveyed patch of typically scrappy west coast heathland (quartzite substrate) near the Lindsay River on the Western Explorer. I saw or heard twelve species.

I visited again in September 2016 and discovered the same patch and all around it so devastated by the lightning strike fires of January 2016 that not a single bird was in evidence during a 2 hectare/20 minute survey. The only other time that I have found no birds at all in the 2 ha/20 min format in 17 years of Atlassing all over Tasmania was on the summit plateau of Cradle Mountain on a frosty late autumn morning in 2011.

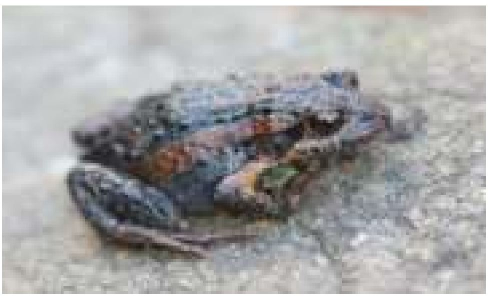
However, amidst all the ash, charcoal and apparent absence of new growth there were wet channels and sedgy crevices from which numerous frogs of a species I cannot recall having heard before were calling enthusiastically.

Knowing next to nothing about frogs I have no idea whether these hardy creatures have recolonised the area from adjacent, unburnt refugia or survived the fires by lying low in their wet channels but perhaps the channels have only been wet since winter.
— Richard Ashby, Sisters Beach

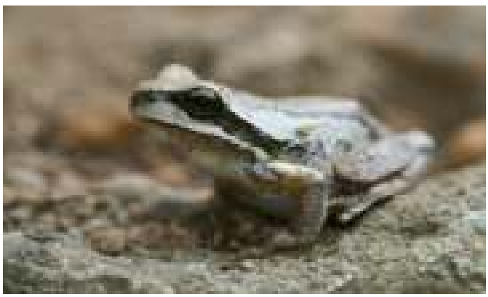
Which frog?

One possibility is the common froglet *Crinia signifera* (*crick..crick..crick*) that breeds year round …

… or the Tasmanian froglet *C. tasmaniensis* (sounds like a lamb) that breeds in spring and early summer.



It is unlikely to have been the Southern smooth froglet *Geocrinia laevis* because it breeds in late summer and autumn and calls from concealed sites under litter or from the base of tussocks.



It could have been the Brown tree frog *Litoria ewingi,* but this a widespread species with a very familiar call (*cree … cree … cree*).

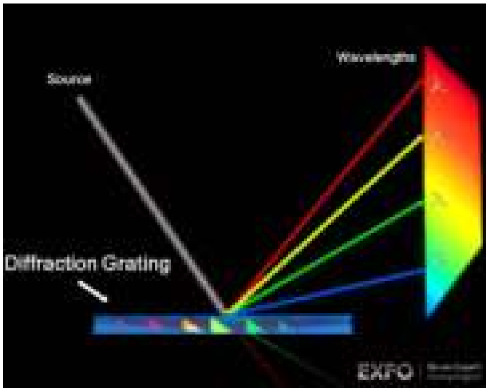
Iridescence

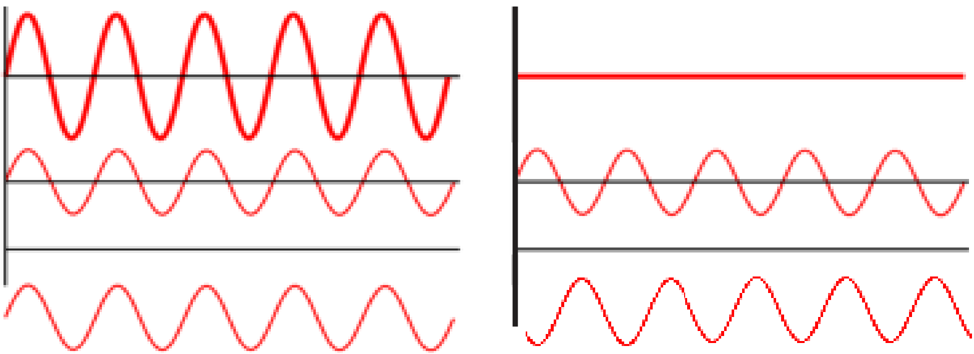
Sarah Lloyd

Iridescence is a widespread phenomenon in the natural world. It is common in invertebrates including in the eyes, wings and other parts of insects such as flies, wasps, bees, beetles, butterflies and bugs; the setae and other parts of crustaceans; in squid, octopus and cuttlefish and in arachnids, especially the jumping spiders (see front cover). Iridescence is also common among vertebrates such as on the scales of fishes, the scales of some reptiles and on the plumage of birds. It is present in some minerals, on the inside of sea shells, on soap bubbles, oil slicks and the surfaces of CDs and DVDs. Recently it has been shown to occur in flowers where it is visible to pollinating insects, but invisible to humans because the iridescence is masked by pigments. It also occurs in many myxomycetes.

Iridescence is not caused by a pigment but by the physical interaction between light and the nanometer-scale structure of a surface. These structural colours can be produced by either interference, diffraction or scattering, depending on the characteristics of the surface. (In many cases in the natural world, colour is produced by both structural characteristics and pigments.)

Put simply, the interference of many light waves reflected from different layers within an object creates iridescence. The light may be reflected from the front and back surfaces of thin layers, from layers of particles or air pockets, and/or from the faults and boundaries in crystalline materials. Light waves interfere positively with each other and produce a light wave with double the intensity of colour. (see image below). Diffraction occurs when light waves bend around the corners rather than continue straight ahead from a surface made up of parallel grooves or depressions (e.g. CDs and DVDs). Because some wavelengths are diffracted more than others, light is separated into the spectral colours.





Interference: when two light waves are in phase (left), they interfere positively with each other and produce a wave with double the intensity of colour. When two waves are out of phase (right) they cancel each other and no colour is seen.

Functions of iridescence

Iridescence has evolved many times in numerous different organisms so it probably has a range of different functions, some of which are yet to be scientifically tested. They include: visual communication, camouflage, indications of age or environmental stress, assistance in flocking or schooling, predator avoidance or deterrence, warning, thermoregulation, friction reduction, water repellence, strength and vision enhancement – among others. Here are some examples:

Visual Communication

Iridescent surfaces appear to change colour as the angle of view or illumination changes, making the colours highly directional. Animals can use the intense colours for species recognition, to communicate with mates, and to avoid potential predators.

Hundreds of species of iridescent hummingbirds live in South America. Many have dark plumage containing melanin pigments which allows them to remain well camouflaged in the shaded rainforest where most of them dwell. To advertise their presence to potential mates—or to startle potential predators—they move their bodies to catch the light and display their highly contrasting, iridescent colours.

Mate choice

Some iridescent butterflies with intact Ultra Violet reflectance achieve greater mating success than males with experimentally reduced UV reflectance. In addition, the brightness and degree of iridescence of the eyespots on peacocks' tails has been found to be an important cue for mate choice.

Left: The Sparkling Violetear from Ecuador. Right: The black feathers that surround the iridescent throat of the male Victoria's Riflebird of northeast Queensland may help to accentuate the 'signal'.

Age and condition

Iridescent surface structures such as butterfly wing scales and feather barbules are likely to be more vulnerable to wear and tear than pigmented areas and thus could indicate the age and environmental stresses experienced by an individual.

Colour-producing nanostructures might change in response to an animal's physiological state. For instance, in Black-winged damsel flies the fatter males are iridescent blue and the thinner males are green. The fatter males achieve their blue colour through compression of the chitin and melanin layers that produce iridescence.

Thermoregulation

The reed frog (*Hyperolius viridiflavus*) inhabits the seasonally hot dry African savannas where it aestivates unhidden on plants. (Aestivation is dormancy or sluggishness that occurs in some animals when conditions are hot and dry. It is analogous to hibernation and usually lasts an entire season.) Increases in temperature during the dry season induces changes in its colour from white, through a copper-like iridescence to green iridescence. This results in higher overall reflectance and is thought to help the frogs regulate their temperature.

Camouflage and warning

The well documented colour-changing abilities of cephalopods (cuttlefish, squid and octopus) are used for camouflage and advertising. For example, the flashing blue rings of the blue-ringed octopus often observed by CNFN members during field trips to Penguin shelf are a warning to steer clear of one of the most venomous animals in the world.

When at rest, the pale yellow-brown of the

The blue-ringed octopus can flash 50-60 iridescent blue rings in a third of a second.

The colours on this metallic fly change as it moves which may confuse potential predators.

blue-ringed octopus blends with its surroundings. But when warning the unwary, an octopus can flash 50-60 iridescent blue rings in a third of a second.

Cephalopods change their appearance by using chromatophores, i.e. small sacs of pigments that they compress or stretch using their muscles, or by using iridophores which are light reflectors composed of stacked thin plates that produce iridescent colours. In most cephalopods, the iridophores are switched on and off by chemical signalling of neurotransmitters. Experiments showed that, despite the blue-ringed octopus's ability to make its rings visible or invisible, they had no chemical 'off' switch.

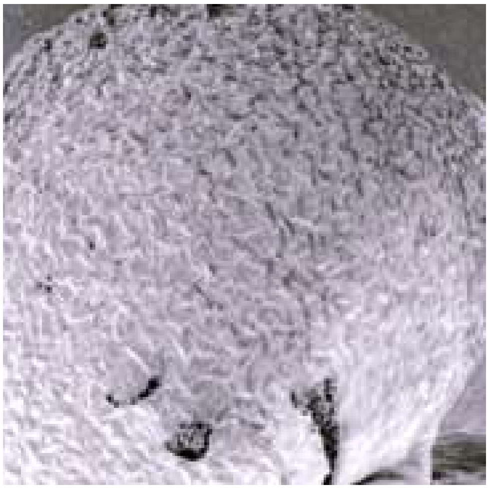
The researchers found that the iridophores are tucked into modified skin folds so the iridescence is not visible when the octopus is relaxed. When threatened, the octopus relaxes one set of muscles and contracts another set to move the skin folds and expose the iridescence, a mechanism of producing iridescent signals that has never been seen before. The blue-ringed octopus is the first reported cephalopod to employ this mechanism, but it may occur in other cephalopods.

The iridescent colours of many insects may warn predators that they contain unpalatable or toxic substances. Known as aposematic colours, iridescence may be aposematic in butterflies, some beetles, and frogs. Aposematic colours are often mimicked by non-toxic species (Batesian mimicry).

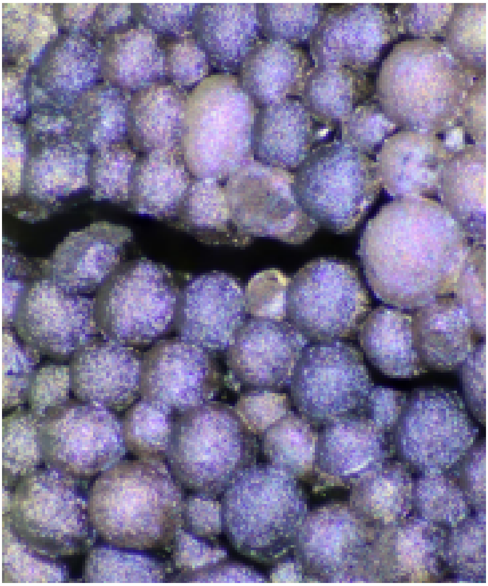
The bluestriped fangblenny fish (*Plagiotremus rhinorhynchos*) uses iridescence in aggressive mimicry. They mimic juvenile cleaner fish but instead of cleaning their target, they attack them by removing scales and other skin tissue.

Anti-predator defense

Research has found that iridescence in insects can confuse potential predators because of the extremely rapidly changing colours that occur when the prey moves (e.g. flicks its wings or moves other body parts) or as the predator approaches. This makes pinpointing the exact location of prey difficult.



Left: The slime mould *Elaeomyxa cerifera* has an iridescent membranous peridium that splits into pennants. Right: Scanning Electron Micrograph of the peridium of *Elaeomyxa cerifera* showing complex nanostructure. Photo: Dr Colin Ingham.



Iridescent peridium of closely-packed, 0.5 mm diameter sporangia of *Paradiachea caespitosa.*

The fungus *Polycephalomyces tomentosis* colonises representatives of the order Trichiales whose peridia display little or no iridescence.

Iridescence in myxomycetes

Many species of myxomycetes (acellular slime moulds) have an iridescent membrane (a peridium) that encases the spore mass. The function of the iridescence has intrigued me since I started collecting slime moulds.

It is unlikely that the intense colours are for attracting invertebrates to assist in spore dispersal as most species occur in dark places where there is little chance of illumination. Furthermore, the spores of most species are wind dispersed and the invertebrates that are observed feeding on slime moulds are usually seen on the larger species such as dog's vomit slime *Fuligo septica* that are not iridescent.

It could be that the complex nanostructure of the peridium provides a protective water-repellent layer in some species. The *raison d'être* of slime mould fruiting bodies is to produce and disperse spores. The spores themselves are hydrophobic—they resist wetting—so the peridium possibly provides added protection.

The structure of the peridium may also strengthen it, although in some species the peridium splits as soon as the fruiting bodies mature, so strength is unlikely to be an advantage (see *Physarum flavicomum* page 20). However, in other species a strong water-repellent peridium may help to resist fungal attack that is a common feature of many fruiting bodies. Those species with a fugacious non-iridescent peridium (i.e. one that rapidly falls away) such as *Comatricha* and *Stemonitis* spp. are particularly prone to fungal attack. Members of the order Trichiales have a peridium that displays minimal iridescence, and they too are vulnerable to being colonised, especially by the fungus *Polycephalomyces tomentosis* Once infected by fungi, myxo spores are rendered nonviable.

If the surface structure of the myxomycete peridium is for strength and water repellency, as seems likely, the iridescent colours are simply a by-product of the structure.

Seeing blue

Iridescent signals enable animals to produce short wavelength colours ranging from blue to ultraviolet. (e.g. all the photos accompanying this article). Blue pigments are rare in animals and are only found in a few invertebrates and a couple of fish species. And yet, most animals can see blue wavelengths and many can detect ultraviolet wavelengths.

Some animals may use these short wavelength colours as a private communication channel if their primary predators lack ultraviolet vision.

References and Acknowledgment:

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http://www.iflscience.com/plants-and-animals/invisible-butterflies/ (accessed 20 April 2017)

Dr Colin Ingham, a researcher from the Netherlands studying iridescence surfaces and other biological materials for technological applications, kindly sent me a Scanning Electron Micrograph of the peridium of *Elaeomyxa cerifera* that I supplied for his research.

Many duck species have an iridescent speculum. It may be for species recognition, threat displays, or to indicate the health of an individual. It may also help signaling in flying birds and thus assist in flocking behaviour.

Iridescent eyes of fly *Scaptia* sp. (Family Tabanidae)

Cuckoo or Jewel Wasp *Chrysis* sp.

The nanostructures on the wings of Glass-winged butterflies of South America are completely random rather than regular as is usually seen in nature. Researchers are using this for inspiration to create coatings for digital screens that can be seen in the glaring sunlight. Furthermore, they have found that this type of surface coating is water-repellent and self-cleaning.

Spyridium obcordatum at Hawk Trap Hill

Phil Collier

Background

In The Natural News # 52 (December 2012) I reported on the initial stages of a caged-uncaged experiment at Hawk Trap Hill, Port Sorell, conducted by members of the CNFN. We were studying creeping dustymiller, Spyridium obcordatum, plants.

S. obcordatum is restricted to a small area near the central north coast of Tasmania and is listed as vulnerable both in Tasmania and nationally. At the start of the experiment we thought that the coastal sub-population was particularly scarce, with small numbers of plants known mainly on private land. The only two known secure coastal populations are about 500 m apart. They are on Hawk Trap Hill at Hawley Nature Reserve (HNR) and at a Latrobe Council Reserve (LCR) at Lot 9 Summerhill Drive.

Caged plant 78 being measured by Peter Lawrence and recorded by Philip Milner at Hawley Nature Reserve on 20 August 2016. Clearly visible is the difference between the cage-protected plant and the surrounding habitat that is heavily grazed.

Spyridium obcordatum in full flower.

By 2011, the *S. obcordatum* at Hawk Trap Hill had declined significantly over 20-25 years since Dr Fiona Coates completed her PhD on this and related species. Various causes for the decline were proposed, the leading contenders being drought and grazing. To distinguish between these two possibilities, we identified 19 pairs of similar S. obcordatum plants and caged one of each pair while leaving the other uncaged. If grazing were the primary cause of the decline, then caged plants should be protected, while if drought were the cause, all plants should be affected equally. We obviously could not organise a drought during our experiment, but we were fortunate with the timing of the el niño drought in 2015-16, before our last monitoring in spring 2016.

Initially, we proposed a two-year experiment (an initial establishment visit followed by two annual visits), but this was extended to five years and six visits following a review in 2013. In this article, we review the experiment, the results and potential future actions.

Left: six tagged *Spyridium* plants were damaged by a fallen sheoak *Allocasuarina verticillata*.
Top right: close-up of two crushed cages; bottom right: final stages of restoring crushed cages.

Sole surviving uncaged plant 6 at the Latrobe Council Reserve in open sheoak habitat, 20 August 2016.

Experimental method in retrospect

Overall, the caged-uncaged method worked well with a few provisos. Some of the flagging tape that we used in 2011 during the set up did not survive until 2012, and we were unable to reconcile some of the 2011 and 2012 data. To remedy this, in 2012 we installed aluminium tags etched with unique numbers at all plants. While annoying at the time, this turned out to be a minor glitch given the circumstances that were about to unfold.

Because our cages were made of chicken netting, they were not strong enough to withstand all eventualities. One cage that was installed in a narrow gap was damaged twice probably by collisions with animals passing by. A collection of cages in sheoak woodland suffered a major branch fall, which squashed them quite badly. In all cases, the plants inside the cages were not seriously affected, and we repaired all cages as soon as we noticed the damage.

The most distressing finding was of a bandicoot skeleton in one of our cages. We could not identify the cause of death, in principle a bandicoot that can get into a cage can also get out, but it is a reminder that risks need to be considered in any field experiment. After deploying hundreds of similar cages at our own property for ten years, we have never seen a dead animal in a cage.

Results

All the annual reports from this experiment, including the final report, are available on the Disjunct Naturalist web site. These contain summaries of the data year by year, various charts and indications of statistical significance. For this article, I will highlight some of the major findings mostly from the final report.

Some of the *Spyridium* plants grow amongst the natural protection of sticky swordsedge, *Lepidosperma viscidum*, tussocks, and we dis-

Part of the line count of the population of Spyridium plants at HNR upper rock plate on 2 October 2016.


Dead and dying tussocks of sticky swordsedge *Lepidosperma viscidum* and drooping sheoak *Allocasuarina verticillata* on 30 August 2014, showing the rock plate at Hawley Nature Reserve (left) and Latrobe Council Reserve (right).

cuss these separately from those growing either on open rock plate or in drooping sheoak, *Allocasuarina verticillata*, open woodland. Of the 26 plants growing in the open (13 caged and 13 uncaged), only one uncaged plant is still alive, compared to 11 caged plants still living. Furthermore, the caged plants are typically large and cage-limited, with massed flowering in spring. The only living uncaged plant is heavily grazed with woody branches and few leaves.

Of the 12 plants growing in tussocks (six caged and six uncaged), four uncaged plants and all six caged plants are still alive. Once again, the caged plants are typically larger with more flowers.

The evidence strongly supports grazing as the primary cause of the decline in *Spyridium* plants. The caged plants are generally more luxuriant than any seen in a natural setting at Hawk Trap Hill (or elsewhere), which could have enhanced their sensitivity to drought. In fact, all caged plants were unaffected by the 2015-16 drought. A dry summer in 2014 was much more damaging, particularly to the sheoak woodland on the edge of the rock plates, and it probably killed one of our caged plants on the edge of a rock plate. This result is reinforced by the results from the *Spyridium* plants that are naturally protected by tussocks. The larger caged plants did not suffer any ill-effects from the drought, despite their roots being embedded amongst the tussock roots.

Habitat of the new population of *Spyridium obcordatum* plants discovered by Philip Milner at Narawntapu NP on 27 September 2014.

Immature *Spyridium obcordatum* seen on 29 August 2011 at Hawley NR. No similar immature plants have been seen in recent years.

Population counts

As an extension of the caged-uncaged experiment, we conducted population counts at both experimental sites in 2011, 2013 and 2016. Adult plants are relatively easy to detect, while seedling plants are difficult on the rock plate and impossible amongst sheoak needles and swordsedge tussocks. A "police line" method was used for population counts, where individuals were responsible for counting plants in their swath of a site as we all walked forward slowly in line.

At Hawley Nature Reserve, we counted 159 adult plants in 2011, but only 13 plants in 2016. At the Latrobe Council property, equivalent counts were 620 plants in 2011 and 110 plants in 2016. Seedling plants were only counted on the rock plates at Hawley Nature Reserve, and 176 seedlings were discovered in 2016, up from 32 in 2011, but less than the 336 seedlings in 2013.

Recent discoveries

The known extent of the coastal sub-population of *S. obcordatum* has been extended in recent years. In 2014, Philip Milner discovered a compact, but heavily grazed, population at Narawntapu National Park on the Badger Head track. A year or two later, Philip was part of a group that re-discovered a previously known nearby population that was first recorded by Fiona Coates in 1990. This population is comprised of scattered leggy plants in the shelter of larger shrubs; the extent of this population will be difficult to pin down given these characteristics.

Summary

Apart from the very welcome discoveries at Narawntapu National Park, the news from this experiment is mostly grim. Adult *Spyridium* plants at Hawk Trap Hill are in real trouble apart from the few that we have caged, and on the open rock plate they are virtually extinct. This is a dramatic decline in 5 short years, and completely unexpected when our experiment started. The only glimmer of light is the continued presence of a respectable number of seedling plants in 2016. Rather predictably, given the overall results, the seedling plants evident in 2013 have not resulted in any recruitment of immature or adult plants, and probably the same fate awaits the 2016 seedlings, unless something is done.

Follow up

Our five-year experiment has concluded, with clear scientific results. The question remains of what to do with the results. By spring 2016, the only (healthy) adult plants remaining are those that we caged for experimental purposes in 2011. This was not the aim of the experiment, of course. It seems clear that if we remove the cages, the plants would be rapidly grazed, so we have left the cages in place, with permission from the landowners. These caged plants are flowering well, and are currently providing a potential seed resource, which would otherwise be largely absent at Hawley.

We also have a crop of seedling plants at Hawley Nature Reserve, and it would be nice to give these a chance to survive and grow. The "obvious" answer is to provide animal-proof cages around the relatively small areas of known populations. These would probably not only benefit the *Spyridium* plants, but likely other plants that are attempting to grow in the same open habitat. However, this requires resourcing, and there are any number of half broken down cages around the countryside left over from similar efforts in the past. A more conservative approach would be an experimental cage matched with an uncaged control site to establish whether a larger cage would be beneficial. However, this would continue to sacrifice the control site, with the result probably being self-evident. A third idea is to cover the open areas with dead branches, to impede access by grazing mammals, while not leaving a permanent scar on the landscape. I think the very best option is to find some neighbours who will take a regular interest in the populations and be willing to monitor cages or other devices that protect precious populations over a longer period. Unfortunately, this idea currently belongs in dreamtime.

After some considerable discussion and consultation, a team of CNFN members have covered the rock plates at Hawley Nature Reserve with dead branches. We await results of whether this will help to recover the population of *Spyridium* plants.

Acknowledgments

This has been a wonderful collaborative project conducted by Central North Field Naturalists and the wider Field Naturalists in Tasmania. During the five years of the project, there have been several field trips and small-group monitoring trips annually to Hawk Trap Hill. I thank all participants for their interest and enthusiasm. All images are by Robin Garnett or Phil Collier.

CNFN Walks Program June to September 2017

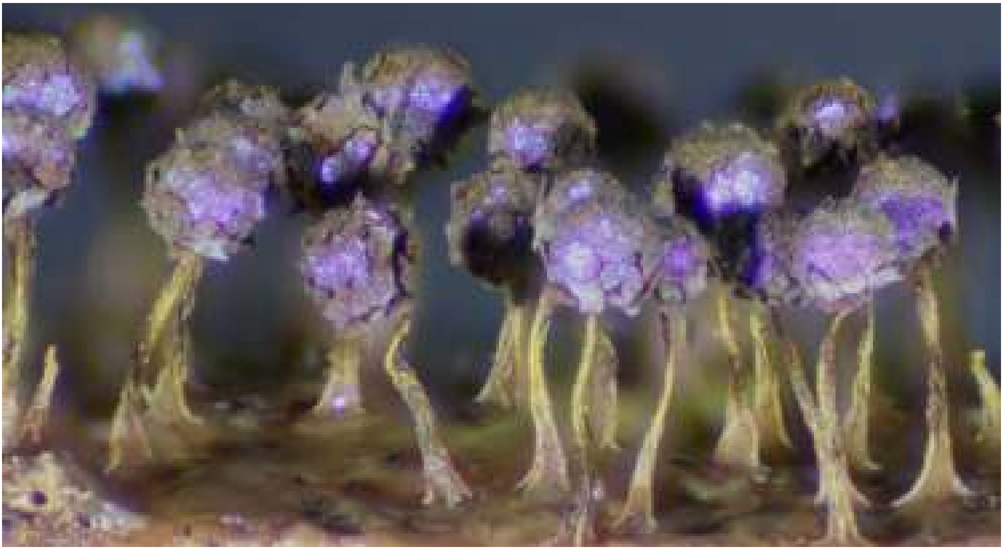
Bring lunch, water and clothes for all weather

Sun 4th June: Black Sugarloaf, Birralee. Meet at 10.00 am at the end of Denmans Road, off Priestley's Road, Birralee, for a leisurely walk along the track to Sarah and Ron's place.

Sun 2nd July: Walk to Anniversary Bay, Rocky Cape National Park. Start at 10:00am from the Boat Ramp at the western end of Sisters Beach. Follow the signs to "Boat Ramp", where we shall meet in the large car park. The walk takes at least 2.5 hours, in a circuit past Wet Cave, up through high coastal heath, down to a sand and cobble beach, then back up along the grassy headlands. If the weather is inclement, it can be quite exposed, so come prepared. Reasonable fitness to climb some steepish hills and walk 7km on variable surfaces is required. If the weather is fine we should see a range of coastal vegetation, heath, grassland and coastal birds, and some delightful coastal scenery. (Leader: Ian Ferris)

Sun 6th Aug: AGM and winter social at Jim Nelson's, 68 Dynan's Bridge Rd, Weegena. The AGM will start at 10.30 am and will be followed by lunch – please bring food to share.

Sun 3rd Sep: The Tasmanian Arboretum, 46 Old Tramway Road, Eugenana. Meet at 10.00 am in the carpark for a walk through the plant collections of the Arboretum and on to the trail alongside the Don River where we hope to observe wet forest birds. Eugenana is approximately 10 km south of Devonport on the C146. (leader: Philip Milner)



The iridescent peridium of *Physarum flavicomum* fragments as soon as the sporangia mature. The active yellow plasmodium is visible on the substrate.

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