

Volume 27: Number 2 > Summer 2010

The Quarterly Journal of the Florida Native Plant Society

Palmetto



Everglades Tree Islands • *Schizaea pennula* • Pricing the Priceless



Historical and Current Occurrence of Endangered *Schizaea pennula*

at Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida

1



2

by *Diane LaRue and Gayle Martin*

Schizaea pennula Sw. (ray fern) is state listed as endangered by Florida Department of Agriculture and Consumer Services and listed as critically imperilled by Florida Natural Areas Inventory. This study was performed in March – April of 2009 to ascertain if *S. pennula* is still in existence on tree-islands at Arthur R. Marshall Loxahatchee National Wildlife Refuge, and to assess its vulnerability to the invasive plant management program currently being conducted at the Refuge.

Historically, the species, also known as *Actinostachys pennula* (Sw.) Hook (spike ray fern), *Actinostachys germanii* Fée and *Schizaea germanii* (Fée) Prantl (tropical curly-grass fern), was noted in Florida in low hammocks near the headwaters of the Miami River in 1904 and in 1914 at Royal Palm Hammock, Dade County (Small 1918, p. 7). It was found in 1952 from Pinellas County (Beckner 1953) and in 1972 at Arthur R. Marshall Loxahatchee National Wildlife Refuge, Palm Beach County in organic soils of tree-islands (Alexander 1974). Although it is considered extirpated from Dade and Pinellas Counties, it has recently been found associated with *Serenoa repens* (W. Bartram) Small (saw palmetto) in sandy soils of mesic pine flatwoods at Big Cypress National Preserve, Collier County and at Prairie Pines Preserve, Lee County in similar circumstances (Woodmansee and Sadle 2005).

Small describes the fern as epiphytic, of small stature (5 - 15 cm tall) with from one to several erect leaves arising from a bristly tuber usually buried in rotten wood. Because of its small size and its sheltered habitat, it is easily overlooked (Small 1918). Alexander noted that the plants at the Refuge grow on the small tree-islands characterized by ferns on the margins and with open interior under the tree canopy. These islands are dominated by *Ilex cassine* L. (dahoon holly), and what he called *Persea borbonia* (L.) Spreng. (red bay), which is now known to be *Persea palustris* (Raf.) Sarg. (swamp bay). Alexander gave the fern's habitat as old rotting *Persea* stumps and trunks on these islands (Alexander 1974).

According to Refuge reports, staff interest in *S. pennula* has varied over the years at the Refuge. A "Management Plan", which included a technical description along with habitat and management considerations, was



Figure 1: Tree-islands in the A.R.M. Loxahatchee National Wildlife Refuge. Photo by Diane LaRue. **Figure 2:** *Schizaea pennula*; (previously published in *Ferns of Florida*, by Gil Nelson; Pineapple Press). Photo by Gil Nelson. **Figure 3:** *Schizaea pennula*. Photo by Gil Nelson. **Figure 4:** Tree-island vegetation in the Loxahatchee National Wildlife Refuge. Photo by Diane LaRue.

completed in 1981. This document stated that it had not been found on islands burned in the 1960s, nor was it found on islands subjected to much human use. Recommended management suggestions included maintaining a normal flood-drought periodicity, prevention of prolonged drying (with accompanying fire risk), prevention of prolonged flooding, protection from human disturbance and denial of requests for collection.

While areas were being posted for a proposed deer hunt in 1982, new locations were found, although the precise locations were not specified. Occasionally permission was given to collect specimens for organizations concerned with rare native plants. Nauman, a fern expert, viewed the fern at the Refuge and published a description of it (Nauman 1987). It was generally accepted at that time that the only extant population in the continental U. S. was on these small tree-islands at the Refuge, always associated with rotting *Persea* stumps and mounds.

By 2000, the Refuge's tree-islands were heavily infested with *Melaleuca quinquenervia* (Cav.) S.T. Blake (*Melaleuca*) and *Lygodium microphyllum* (Cav.) R. Br. (*Lygodium*). The latter is considered by many to be in the same plant family (*Schizaeaceae*) as *S. pennula*. As control efforts on the invasive exotics increased, permission was granted in 2000 to collect *S. pennula* in order to test it for the non-indigenous *Cataglyphis camptozonale* (Hampson) (Australian pyralid moth), a candidate biological control agent for *Lygodium*. In 2000, Marian Bailey, Wildlife Biologist at the Refuge, reviewed

the current knowledge of *S. pennula* (Bailey, 2000a) and carried out substantial work on it. She found the fern growing consistently on *Osmunda cinnamomea* L. (cinnamon fern) tussocks on large strand islands, south of the 1987 and 1991 locations (Bailey, 2000 b, c). At that time, there was speculation that the apparent change of habitat from rotting *Persea* stumps to *O. cinnamomea* tussocks may have been a response to changes in water level.

By 2009, a massive and costly control program for invasive exotics was underway in the interior of the Refuge. This has included aerial spraying with herbicides as well as on-ground cutting and spraying of tree-islands heavily infested with Old World climbing fern or *Melaleuca*. This program may threaten the *S. pennula* populations through contact with the herbicide, particularly since we observed newly germinated spores of the Old World climbing fern on the same tussocks as the *S. pennula*. Since it is so easily overlooked, *S. pennula* is also at risk from trampling by workers.

Field Studies

In order to prepare for field work, a search through the Refuge's Annual Narratives, as well as the electronic files and correspondence found in the Refuge's files was conducted. Although *S. pennula* has been noted as present on tree-islands several times since the late 70s, few accounts actually provide coordinates of the locations. Some documents referred to 'on a tree-island near the Research Natural Area', 'located in north-central section

Continued on next page

Historical and Current Occurrence of Endangered *Schizaea pennula* (continued)

of the refuge' (1982 Narrative, p.36), 'presence reconfirmed on three tree-islands while the Research Natural Area and deer hunt boundaries were being posted' (1983 Narrative p.50), 'in late November eight tree-islands scattered around central and southeast central part of the refuge were investigated ...found on seven of the eight...' (1983 Narrative, p.50), '... found in two more locations in addition to the eight tree-islands discovered last year' (1984 Narrative, p.52), '...new location on tree island west of the western portion of the canoe trail...' (1985 Narrative, p.54). It is possible that the coordinates were not stated in the publicly available Narratives (for fear of poaching),

and that documents providing the coordinates were destroyed in the 2004 and 2005 hurricanes which ravaged the Refuge.

Of the documents read, a total of 11 coordinates (determined by GPS) were found for *S. pennula* locations. These included the 5 coordinates from the large amount of field work conducted by Bailey in 2000, plus coordinates recorded in 2002-2003 by botanists with The Institute for Regional Conservation (IRC), when they were performing studies related to *Lygodium* control on tree-islands in the Refuge. Some of the recorded coordinates are located on the same strand island. We also found Loran coordinates from 1987 and 1991 correspondence in the Refuge's biology files.

TABLE 1 – Summary of *Schizaea pennula* Field Findings

Description	Original Date	Island Type	Island Size (ha)	No. Locations	No. Stems	Habitat/ Associated Vegetation	
Confirmation of Former Sightings							
Island 1	2002-2003	Strand	24	None found		Did not search entire island	
Island 2	2002-2003	Strand	19	4	10	Cinnamon fern tussocks, sphagnum moss	
Island 3	2002-2003	Strand	21	10	>50	Cinnamon fern tussocks, royal fern, dahoon holly stump, lichens	
Island 4	2002-2003	Strand	44	2	18	Cinnamon fern tussock, sphagnum moss	
Island 5	2002-2003	Strand	13	3	24	Cinnamon fern tussocks; rotting dahoon holly stump	
Island 6	2000	Strand	13	Found		No data taken	
Island 7	2002-2003	Strand	6	4	11	Cinnamon fern tussocks	
Island 8	1987			Not found			
Island 9	1987	Bayhead	0.0526	6	19	Base of live bay trunk; old bay mounds, swamp fern	
Island 10	1991	Bayhead		None found		Has good habitat	
Island 11	1991	Bayhead	0.0659	2	22	Old bay mounds	
New Sightings							
Island 12	Near Island 5	2009	Bayhead	0.1133	1	> 5	Center of island, open, mass of rotting stumps, mosses, leaf litter
Island 13	Small mammal studies	2009	Bayhead	0.0688	4	12	Swamp ferns, old bay stumps, live swamp bay
Island 14	Small mammal studies	2009	Bayhead	0.0801	3	> 5	Live swamp bay trunk, cinnamon fern tussock, rotting swamp bay
Island 15	Small mammal studies	2009	Bayhead	0.0688	4	17	Dahoon holly mound, live & stumps, swamp fern Swamp bay mound - rotting, live
Island 16	Small mammal studies	2009	Bayhead	0.089	None found		Has potential habitat
Island 17	Small mammal studies	2009	Bayhead	0.1295	None found		Has potential habitat
Island 18	New area west of ne cut	2009	Bayhead	0.109	None found		Not good habitat
Island 19	New area west of ne cut	2009	Bayhead	0.0668	None found		Small good habitat
Island 20	New area west of ne cut	2009	Bayhead	0.0585	None found		Not good habitat
Island 21	New area west of ne cut	2009	Bayhead	0.058	None found		Several sites good habitat
Island 22t	New area west of ne cut	2009	Bayhead	0.0827	None found		Good habitat
Island 23	New area west of ne cut	2009	Bayhead	0.045	None found		Small good habitat
Island 24	New area west of ne cut	2009	Bayhead	0.1269	None found		Good habitat
Island 25	Near 'Research Natural Area'	2009	Bayhead	0.0933	>5	21	Live swamp bays, old stump, swamp fern
Island 26	Near 'Research Natural Area'	2009	Bayhead	0.0616	5	>20	Dahoon holly mound, rotting stumps, swamp fern tussock, leaf litter
Island 27	Near 'Research Natural Area'	2009	Bayhead	0.118	None found		Lygodium treated island with live and dead Lygodium
Island 28	Near 'Research Natural Area'	2009	Bayhead	0.055	None found		Good habitat with dahoon holly, swamp bay
Island 29	Near 'Research Natural Area'	2009	Bayhead	0.037	1	8	Live swamp bay mounds
Island 30	Near 'Research Natural Area'	2009	Bayhead	0.0623	None found		Too enclosed for good habitat
Island 31	Near 'Research Natural Area'	2009	Bayhead	0.0382	1	9	Rotting leaf litter in open
Island 32	Near 'Research Natural Area'	2009	Bayhead	0.1013	1	9	Base of live swamp bay, in rotting leaf litter
Island 33		2009	Strand	20	4	10	Cinnamon & swamp fern tussocks, swamp bay mound, dahoon holly mound
Island 34		2009	Bayhead	0.0462	3	6	Bases of live swamp bay trunks
Island 35		2009	Cypress is.	None found			Not good habitat

Several field trips to both bayhead and strand tree-islands were undertaken in March and April (2009) to confirm if these formerly located populations still existed. We also visited islands in areas where there had been anecdotal sightings, as well as tree-islands that had been investigated for small mammal and tree growth studies. In addition, we looked on islands in the vicinity of the above searches that appeared to have suitable habitat. We also searched several bayhead islands to the northeast of any known sightings, west of the northeast cut airboat trail.

Table 1 summarizes the findings. Of the 35 islands searched we found live, healthy stems of *S. pennula* on 19 islands. Of the 11 islands previously noted to have *S. pennula* present, we were unable to locate one of the 1987 islands. Of the remaining 10, we found none on one of the 1991 bayhead islands and none on one of the strand islands. The latter was a 24 ha strand island and only a small portion was searched, so the fern might have been present on the island without our locating it. Of the 24 islands which were newly searched for *S. pennula*, plants were found on 11 islands. Of islands without *S. pennula*, 7 were located west of the northeast cut airboat trail in an area of the Refuge that had previously never been reported to have *S. pennula*, although several had what appeared to be potential habitat. One was a cypress island which provided a different vegetation community and was searched on the off chance *S. pennula* might be found there. Of the other islands where we did not find *S. pennula*, 3 appeared to have good habitat, 2 did not and 1 had been treated with herbicide for *Lygodium* control. Since the fern is of small stature and easily overlooked, our not finding it does not mean it is not there.

On the smaller bayhead or “popup” islands, the entire island was searched. On the larger strand islands we aimed for the coordinate we had and searched from there. Once *S. pennula* had been sighted, we looked in the nearby area to locate additional plants. When additional plants were found we recorded these as separate locations. On some bayheads, as on larger strand islands, there were several locations per island. We made rough notes on habitat and associated vegetation and became familiar with the fern’s typical habitat. Photos were taken at the entrance of each island and of most of the sightings. The coordinates of each sighting were taken with a GPS unit. The stems at a given site numbered from one to 12 although there were many locations with only one stem and very few had more than 2 or 3. Since plants were not dug up, it is not known how many stems could be from one root system. None of the strand islands were searched completely, so there may well be other locations on each of them.

Although this study was limited, the most outstanding conclusion from the field studies is that *Schizaea pennula* is living on many tree-islands in several regions of the Refuge and in a wider variety of habitats than previously reported. We found it in on both strand and bayhead islands, on mounds of live and rotting *P. palustris*, on mounds of live and rotting *I. cassine*, on *Blechnum serrulatum* L. C. Richard tussocks that are often growing out of *P. palustris* stumps, *O. cinnamomea* tussocks, along the base of large healthy *P. palustris* trunks, and rooted in decomposing leaf

litter in open areas on a bit higher portion of an island. Additional associated vegetation consisted of *Myrica cerifera* L. (wax myrtle), *Cephalanthus occidentalis* L. (buttonbush), *Osmunda regalis* L. (royal fern), *Chrysobalanus icaco* L. (coco plum) and the exotic invasive, *Lygodium* on some islands.

Other habitat observations include: *S. pennula* may or not be living associated obviously with bryophytes and lichens. It can be rooted in rotting bark and in rotting leaf litter. It is usually found in partially shaded, protected locations. Where the location is more open and exposed, it is found at micro sites protected by a stump or other vegetation. It is usually found on the inner portion of the island, but on some islands it was close to the edge of the island.

As has often been noted, and we heartily confirm, it is easily overlooked. Without further investigation, it is not known what the total Refuge population is, whether or not the Refuge population of *S. pennula* is increasing or decreasing and it is not known if each plant is long lived or if new plants are being produced. Further life history and demography studies are needed.

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ACKNOWLEDGEMENTS

The authors acknowledge the A. R. M. Loxahatchee National Wildlife Refuge for providing logistical and airboat support for this project and access to their electronic and hard copy files.

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The Palmetto

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