

The Story of Tom Darling and Bear Lake

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Introduction

Bear Lake is a glacial lake at an elevation of one thousand eight hundred and ninety one feet above sea level in Lackawana County, Pennsylvania. Beginning in 1930 a number of plants from the eastern U.S., especially Pennsylvania, were introduced to the North Cove Bog at Bear Lake by Thomas Darling. The results of these introductions after sixty-nine years are discussed.

Discussion

The Bear Lake Association was formed in the late 1800's as part of a ninety-nine year lease from the state of Pennsylvania for a summer resort. This is where young Tom Darling spent many summers roaming and exploring the Pocono woods and developing his interest in botany. These explorations in Mr. Darling's youth led to a lifelong love of botany and a willingness to try experimental plant transplants at Bear Lake. Additionally Tom Darling discovered many rare ferns in Florida and published several papers on these rarities in the early 1960's.

Having visited many unique areas in Pennsylvania and the southeastern United States, Tom Darling decided to attempt the introduction of a variety of plant species to the North Cove Bog at Bear Lake. Prior to this decision the North Cove Bog was a rather botanically mediocre glacial sphagnum bog with the following species: *Caltha palustris* L. (Water Arum), *Chamaedaphne acalyculata* (L.) Moench (Leather Leaf), *Decodon verticillata* (L.) Ell. (Swamp Loosetrite), *Drosera intermedia* Hayne (Spathulate leaved Sundew), *D. rotundifolia* L. (Round Leaved Sundew), *Dulichium arundinaceum* L. Britton (Three Way Sedge), *Gaultheria hispidula* L. Muhl. (Creeping Snowberry), *Eleocharis acicularis* (L.) R. & S. (Needle Spike Rush), *Eriophorum virginicum* L. (Virginia Cotton Grass), *Kalmia angustifolia* L. (Sheep Laurel), *Myrica gale* L. (Sweet Gale), *Osmunda cinnamomea* L. (Cinnamon Fern), *Rhododendron canadense* (L.) Torr. (Rhodora), *Rhynchospora alba* (L.) Vahl. (White Beak Rush), *Sagittaria latifolia* Willd. (Arrowhead), *Sarracenia purpurea* L. (Purple Pitcher Plant), *Thelypteris simulata* (Davenp.) Nieuwl. (Massachusetts Fern), *Utricularia purpurea* Walter (Purple Bladderwort), *Vaccinium macrocarpon* Ait. and *V. oxycoccos* L. (Large and Small Cranberry respectively). The area surrounding the bog harbored hemlock, white pine and mountain laurel. Other plants found at North Cove Bog are detailed by Darling and Shetler in a 1972 Castanea paper. (Darling and Shetler, 1972).

Below is a list of those species introduced to North Cove Bog at Bear Lake by Thomas Darling starting in approximately 1931. Also listed are the original collection areas.

#	Species	Location
1.	<i>Andromeda glaucophylla</i> Link. (Bog Rosemary)	Lehigh Pond, Pa.
2.	<i>Arethusa bulbosa</i> L. (Bog Rose or Swamp Pink)	Mt. Lake, N.J.
3.	<i>Calopogon pulchellus</i> (Salisbury) R. Brown. (Grass Pink)	Lehigh Pond, Pa. Atherton's Pond, Pa. Tannersville Bog, Pa.

4. *Cypripedium candidum*
Small
(Small White Ladyslipper) New York State.
Bergen Swamp.
5. *Cypripedium calceolus* L.
(Yellow Ladyslipper) Commercial source.
6. *Cypripedium reginae* Walter.
(Showy Ladyslipper) New York State.
7. *Dionaea muscipula* L.
(Venus Flytrap) Wilmington, N.C.
8. *Drosera filiformis* Raf.
(Thread Leaved Sundew) Pine Barrens, N.J.
9. *Habenaria blephariglottis*
(Willd.) Hooker.
(White Fringed Orchid) Stillwater Bog, Pa.
Lehigh Pond, Pa.
10. *Habenaria ciliaris*
(L.) R. Brown.
(Yellow Fringed Orchid) Windgap, Pa.
11. *Habenaria cristata*
(Michaux) R. Brown.
(Crested Yellow Orchid) Pine Barrens, N.J.
12. *Habenaria fimbriata*
(Ait.) R. Brown.
(Purple Fringed Orchid) Commercial source.
13. *Habenaria integra*
(Nuttall) Sprengel.
(Yellow Fringeless Orchid) Pine Barrens, N.J.
14. *Habenaria nivea*
(Nuttall) Sprengel.
(Snowy Orchid) Cape May, N.J.
15. *Kalmia polifolia* Wang.
(Bog Laurel) Lehigh Pond, Pa.
16. *Ledum groenlandicum* Oeder.
(Labrador Tea) Lehigh Pond, Pa.
17. *Linnaea borealis* L.
(Twinflower) Mt. Lake, N.J.
18. *Lygodium palmatum*
(Bernh.) Swartz.
(Climbing Fern) Sand Spring Run, Pa.
19. *Menyanthes trifoliata* L.
(Buckbean) Lehigh Pond, Pa.
20. *Pogonia ophioglossoides*
(L.) Ker.
(Rose Pink) Lehigh Pond, Pa.
Atherton's Pond, Pa.
Tannersville Bog, Pa.
21. *Rhexia virginica* L.
(Meadow Beauty) Grassy Lake, Pa.

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| 22. <i>Sarracenia flava</i> L.
(Yellow Pitcher Plant) | Wilmington, N.C. |
| 23. <i>Sarracenia rubra</i> Walt.
(Sweet or Red Pitcher Plant) | Wilmington, N.C. |
| 24. <i>Woodwardia virginica</i>
(L.) Smith.
(Virginia Chain Fern) | Peat Bog near Pocono
Manor, Pa. |
| 25. <i>Woodwardia areolata</i>
(L.) Moore.
(New-Veined Chain Fern) | Coastal area. |

The results of these introductions have been mixed. Some of the species were able to survive and flourish, others perished early, and some have spread very little or barely maintained their original planting.

The most successful in order of colonization were *Menyanthes trifoliata*, *Woodwardia virginica*, *Rhoxia virginica*, *Pogonia ophioglossoides* and *Habenaria blephariglotis*. In the sixty-nine years since these plants have been introduced they have filled all available habitat. The Virginia Chain Fern, Meadow Beauty and Buckbean have spread by means of thick runner roots, seeds or spores. The orchids have spread by budding and seeds to sphagnum hummocks and open grassy patches.

Early casualties were *Andromeda glaucophylla*, *Arethusa bulbosa*, *Calopogon pulchellus*, *Cypripedium candidum*, *C. calceolus*, *C. reginae*, *Drosera filiformis*, *Habenaria ciliaris*, *H. cristata*, *H. fimbriata*, *H. integra*, *H. nivea*, *Linnaea borealis*, *Lygodium palmatum* and *Woodwardia areolata*. Reasons are not clear for their demise but apparently they were not able to compete in the succession of this bog. Darling (Darling, 1989) states that "there was a large area of open sphagnum (with hummocks) between the original *S. flava* colony and extending south to ... several all-green leaved *S. purpurea*. Here it was that I planted literally dozens of *Arethusa* from Mt. Lake Bog in N.J. (near Del. Water Gap), *Pogonias* and *Calopogons*. ... all now covered with dense shrubbery." Thus in less than sixty years the open sphagnum bog habitat required by some bog species has disappeared at North Cove Bog. Subtle microhabitat differences may also have excluded many of these plants thousands of years ago from establishing themselves at this site. Today *Linnaea borealis* and *Calopogon pulchellus* can be found in suitable sites approximately twenty miles from Bear Lake. Some species, such as *Drosera filiformis*, prefer open moist sand habitats to survive and flourish. This type of habitat was lacking in the peat bog at Bear Lake. Deer and rabbits were also responsible for eating the flower stalks of pitcher plants and many orchids. (Darling, 1943). This may have prevented some of the introduced plants from seeding and becoming established.

Succession in North Cove Bog at Bear Lake is further illustrated by the disappearance of the native bog species *Carex baileyi* Britton, *Drosera intermedia* and *Gaultheria hispidula*. Herbarium collections were made of *D. intermedia* by Tom Darling in the early 1900's at Bear Lake.

The Labrador Tea (*Ledum groenlandicum*) has managed to survive and spread several times. Only one new colony, however, was able to survive. Without human intervention the original colony of Labrador Tea would be in poor health today. Tom Darling has had to prune invading shrubs which threaten to overtake this shrub. Strong competition probably explains the natural lack of this species in North Cove Bog. The Labrador Tea is found in abundance sixteen miles away at Lehigh Pond where it is flourishing in an expansive kettle hole bog. The species seems to require open bog for survival. Labrador Tea apparently cannot compete well with other shrubs. The same applies to *Kalmia polifolia* (Bog Laurel), which is struggling for survival at North Cove Bog but is not uncommon at Lehigh Pond.

The transplant of *Dionaea muscipula* lasted for nineteen years. Of four plants one survived the first few years and continued to flower and produce vigorous leaves. No seedling activity was observed and the plant finally succumbed in 1960 to one of the more severe winters. The winter of 1960 was one of the coldest on record with lows of 24 degrees below zero. Snowfall was within one inch of an all time record and snow covered the ground until the first of May. My impression is that the *Dionaea* probably rotted out due to the extended snow cover. Snow would be an effective protection in winter but protracted cover without growth could result in the plant rotting out. This indeed was a remarkable survival record for this southern herb.

S. rubra has continued to flower over the years but has only spread once. This new colony failed to survive. Hybridization with *S. purpurea* has also been limited by the later flowers of *S. rubra* and the tendency of deer to eat the tender flower stalks. No hybrids have been found between either *S. flava* or *S. purpurea* with *S. rubra*.

S. flava has been the most successful of the southeastern pitcher plants in the bog. The original planting is now seventy inches long and a foot wide! Three other clumps of *S. flava* managed to become established within fifty feet of the original planting but only one has survived. One of the limiting factors in the spread of *S. flava* is the early flowering time of this species. Although this favors hybridization with *S. purpurea* it also exposes the flowers to frost damage. Late frosts and lack of suitable soils, as well as other environmental factors, have probably limited the spread of *S. flava* to other parts of the bog.

Over the forty nine years that *S. flava* has been at Bear Lake a number of hybrids have occurred with *S. purpurea*. Below follows a list of the occurrence of the hybrid *S. x catesbaei* Elliott at Bear Lake.

1. 1961. Found near the original colony of *S. flava* and survived without flowering until 1966. Hybrid station 1. Discovered by Dr. and Mrs. A. Gerard DeVoe, Chappaqua, N.Y., who called it to the attention of Tom Darling. Tom Darling confirmed its identity with botanists at the National Herbarium of the Smithsonian Institution.

2. 1965. Found 200 meters across the cove from the original *S. flava* with a barrier of 100 meters of open water. Survived one season without flowering. Hybrid station 2. Discovered by Dr. and Mrs. A. Gerard DeVoe.

3. 1969. Found 3 meters east of the original *S. flava* colony. Survived till 1970. Hybrid station 1A. Discovered by T. Darling.

4. 1970. Found 15 meters east of the original *S. flava* colony growing between *S. purpurea* and a new clump of *S. flava*. Survived till 1986. Hybrid station 3. (See figure 1.) Discovered by T. Darling.

5. 7/15/86. "A group of botanists from Morris Arboretum, Philadelphia, under the supervision of Dr. Ann Rhoads, discovered a thriving colony of *S. x catesbaei* near the water's edge on the N.W. side of N. Cove, about 100 meters due east of the original colony of *S. flava*. There were no flowers at this time. However, just one year later, on 7/18/87, I discovered 4 flowering stalks in evidence amidst many leaves. In 1988 there were no flowers, but the number of leaves had increased to about 27 and the plant was evidently thriving. This is hybrid station 4." (Darling, 1989). (See Figure 2.)

6. "On 8/15/87 a 5th location for the hybrid [*S. x catesbaei*] was found by Philip Sheridan of Arlington Co., VA. There were only 2 leaves and no flowers. (About 5 meters S. of station 4. This is hybrid station 5." (Darling, 1989).

7. "On 8/6/88 Phil Sheridan discovered still another hybrid [*S. x catesbaei*] several meters northwest of the original *S. flava* colony. Two leaves and no flowers. This is hybrid station 6." (Darling, 1989). This hybrid was growing on the side of a small hummock in the midst of the original *S. rubra* colony.

8. 8/6/88. A small clump of the hybrid [*S. x catesbaei*] was found by me about 15 meters north west of the original *S. flava* colony and approximately five meters west of the original *S. rubra* station. This is hybrid station 7 which did not survive to 1989.



Figure 1: *S. x catesbaei*. Hybrid station 3. Photo by Tom Darling

Thus since 1961 there have been eight occurrences of *S. x catesbaei*. One clump has flowered and the longest period of survival for the hybrid is sixteen years for station 3.

S. x catesbaei seems to be more successful in colonization than either *S. flava* or *S. rubra*. There have only been three new stations for *S. flava*, one for *S. rubra*, but eight for *S. x catesbaei*! This greater survival and colonization of the hybrid is probably due to the fact that *S. x catesbaei* possesses enough of the characteristics of the native *S. purpurea* to give it a competitive edge over the introduced *S. flava*. Since it is an intermediate, it is able to exploit an ecological niche which neither of the parent species are able to capitalize on. Stations four, five and six continue to survive through 1989.

Conclusion

Twenty five plant species were introduced to North Cove Bog at Bear Lake starting in 1930. Sixteen species were unable to survive due to succession, competition, lack of suitable soils, severe weather, animal predation or unknown causes. Nine species were able to survive. Of the nine surviving species *Menyanthes trifoliata*, *Woodwardia virginica*, *Rhoxia virginica*, *Pogonia ophioglossoides* and *Habenaria blephariglottis* have spread and flourished, *Sarracenia flava* has spread and maintained one colonization and *Sarracenia rubra*, *Ledum groenlandicum* and *Kalmia polifolia* have spread once but not maintained their settlement.

The hybrid *S. x catesbaei* has occurred eight times and survives in three stations. The hybrid flowered once in 1987.



Figure 2: *S. x catesbaei*. Hybrid station 4. Photo by Phil Sheridan.

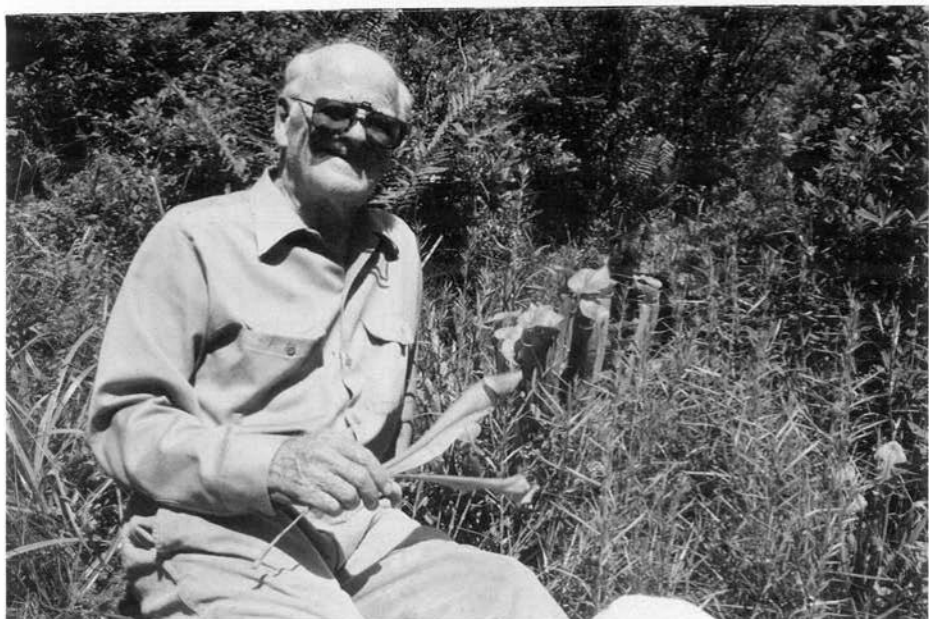


Figure 3: Thomas Darling sitting near original colony of *S. flava*. In his hand is a leaf of the hybrid *S. x catesbaei*. Photo by Phil Sheridan.

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CP Alive in the Fuqua Conservatory

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CPN readers will recall our article in the September, 1988 issue describing the building of the Fuqua Conservatory in the Atlanta Botanical Garden, including a photo of work in progress (CPN 17:73-75). Well, they finished on time, and what a beauty it is.



Figure 1. Fuqua Conservatory from front. All photos by author.