

THE FLORA OF PENIKESE ISLAND, MASSACHUSETTS:
THE FIFTH SURVEY(1998–1999), WITH EMPHASIS ON
THE WOODY VEGETATION

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ABSTRACT. Five vascular plant surveys have been made between 1873 and 1999 on Penikese, one of the Elizabeth Islands (Massachusetts). The five surveys have noted a total of 326 species, the most recent survey, 218 species. Almost half of the species noted are alien on all five survey lists. Four rare (state-listed) native species were found in 1998–1999. The most significant change in the island's vegetation over 125 years is the great increase in woody vines and shrubs following cessation of the farming that stripped the island of its presettlement forest. Fifteen woody species, some of them recent introductions, are thought to be increasing. Two of the island's ponds—Tubs and South—are brackish, supratidal pools without vascular plants. Four ponds—North, Leper, Tern, and Typha—are fresh, shallow, and usually dry up annually, at which time their bottoms support a dense, diverse flora. Salt marsh species and numbers are fewer than formerly. There is evidence that the island as plant habitat is drier than in the past, perhaps as a result of the increase in woody vegetation. For instance, ferns, once common on Penikese, are now almost wholly absent. Certain species common on nearby islands are missing; for instance, no blueberries or other ericads are found on Penikese. In the absence of further disturbance, it is possible that Penikese will again become forested with red cedar (*Juniperus virginiana*) as a presettlement account of

1602 describes it, but island-wide burns are suggested for destroying invasive woody plants and encouraging native grasses. Such burns might also restore former tern-nesting sites to usefulness.

Key Words: alien species, *Juniperus virginiana*, Penikese Island, prescribed burns, rare species, red cedar, woody vegetation

The first botanical survey of Penikese was made in 1873 by David Starr Jordan, who spent the summer on the island as a student of Louis Agassiz at the latter's Anderson School of Natural History (Jordan 1874). Jordan preserved no specimens of vascular plants, but listed 114 species using the fifth (1867) edition of Gray's Manual (Fogg 1930). Six species were restricted to the little satellite, Gull Island, which now, at high tide, shows only as a heap of rocks. Bartholomew Gosnold had visited Penikese in 1602 when it was "full of cedars" (Archer 1625 as quoted in Quinn and Quinn 1983), but after many decades of cultivation and grazing, it was, in 1873, "absolutely treeless and nearly shrubless . . . about as barren looking a pile of rock and stone as one could well imagine" (Jordan 1874). Settlers had cut trees and grazed sheep there as early as 1675 (Buckley 1997). Early history of the island is also given by Howland (1964).

The second botanical survey was made from Woods Hole in 1923 by the Marine Biological Laboratory (MBL) and the Fisheries Biological Station of the U.S. Bureau of Fisheries on the 50th anniversary of the founding of the Anderson School (Lewis 1924). The island had served the Commonwealth of Massachusetts as a leper colony from 1905 to 1921, during which period gardening was encouraged (Buckley 1997). The leper colony kept sheep for some of its years, but grazing was likely reduced or intermittent from about 1865 or 1870 to about 1915, when it ceased altogether. Lewis (1924) said of the second survey that "one day was devoted to collection, July 24, and casual visits in August added a few observations." Four people observed the vegetation, eight others collected vascular plants. The final list of the latter was provided by John M. Fogg, Jr., then at work on his Ph.D. dissertation on the flora of the Elizabeth Islands under M. L. Fernald. One hundred fifty-nine species of vascular plants were listed. Specimens were deposited in the herbarium at the MBL (SPWH). When Fogg published his thesis (Fogg 1930), 19 additional species were noted for Penikese. Altogether, 90 species not

seen in 1873 were recorded, while 40 species seen in that year went unreported.

The third survey was conducted from the MBL in 1947. The list of vascular plants was prepared by Edwin T. Moul (1948). He and five colleagues collected on July 6, July 31, and August 3. Specimens were deposited in SPWH. Moul noted that the asters recorded in earlier surveys were missing or “were overlooked because of their late summer flowering.” Moul listed 156 plant species, 24 of which had not been reported earlier, while about 90 seen previously were not found. Moul (1961) records a return visit to the island.

During much of the interval between the second and third surveys (1923–1947), the Commonwealth had used the island as a game farm and wildlife refuge. Annual reports (Massachusetts Division of Fisheries and Game 1925–1939) mention much that is relevant to the natural history of the island. The following were noted (by common names, as given here) as having been planted for wildlife food or cover: arbor vitae, bayberry, beach plum, blueberry, buckthorn, Carolina poplar, inkberry, Japanese barberry, laurel, mulberry, Norway spruce, privet, rose (native), sago pondweed, Scotch pine, sumac, viburnum, and widgeon grass.

The fourth survey was made in 1973 by botanists from Smith College as a part of the M.A. thesis research of Scott D. Lauer-mann under C. J. Burk (Lauermann 1974; Lauermann and Burk 1976). Some or all of five people collected on June 12, July 14 and 15, August 8, 9 and 13, and September 20. By 1973, the island had been uninhabited for about 40 years and ungrazed for at least 50. Twenty-nine species not reported earlier were noted, while 109 species listed earlier were not found. Specimens were placed in the Smith College Herbarium (SCHN). Also in 1973, the Penikese Island School was established on the island, bringing new gardeners with new plants. Altogether, it is clear from Penikese’s history that there have been waves of plant introduction and extirpation as land use has changed.

SITE DESCRIPTION

Penikese Island (41°27’N, 70°55’W) lies 19 km from Woods Hole, Massachusetts at the southern extremity of Buzzards Bay in the Town of Gosnold, Dukes County. The island consists of a fragment of the now partly submerged Buzzards Bay Moraine of

Wisconsinan glaciation (Zinn and Kahn 1972). Save for Penikese, the Elizabeth Islands lie in a straight northeast-southwest string from Woods Hole, with Cuttyhunk at the southwest end. Penikese is out of line with this string, being one mile north of Cuttyhunk, the land nearest to it.

Penikese, totalling about 185 hectares (75 acres), consists of two hilly parts connected by a narrow, flat strip of land called "the Isthmus" or, in the past, the "Neck" or "Causeway" (Figure 1). The maximum elevation, 25 m, is found on the greater part; the smaller portion, known as Tubs Point, is a few meters lower. The Isthmus is formed from the coalescing upper parts of two back-to-back beaches that head embayments indenting the eastern part of the island—a shallow indentation from the north, a deep one from the south. The beach on the south side of the Isthmus is wide and sandy, and there are sandy stretches of shore south along the east side of the island almost to its southern extremity, South Point; otherwise the perimeter of the island is a jumble of cobbles and boulders. The New England hurricane of 1938 is estimated to have reduced the island by about 25 hectares (10 acres; Massachusetts Division of Fisheries and Game, Annual Report for 1938).

The "Soil Survey of Dukes County, Massachusetts" (Fletcher and Roffinoli 1986) describes the Elizabeth Islands as having "very deep . . . well drained, sandy and loamy soils formed in reworked glacial outwash or in glacial till." Most Penikese soil is of the Eastchop-Montauk complex (EnC) or the Plymouth-Montauk complex (PtC and PtD). These soil-map units are described as rolling or hilly, very or extremely bouldery, and consist of loamy sands or sandy loams. Soil permeability is mostly moderate to rapid, and available water capacity is moderate to very low. Nothing appears to have been published regarding the island's soil chemistry.

Edgartown, Martha's Vineyard, about 32 km to the east-southeast of Penikese, is thought to have a climate similar to the latter's. Climatic averages for Edgartown for the period 1961–1990 are as follows: annual rainfall, 45.25 inches; wettest month, November, 4.45 inches; driest month, July, 2.92 inches; annual temperature, 49.7°F; coldest month, January, 29.2°F; warmest month, July, 69.8°F (Northeast Regional Climate Center, 1123 Bradfield Hall, Cornell University, Ithaca, NY).

The island is the nesting site for gulls and terns. In 1999, there

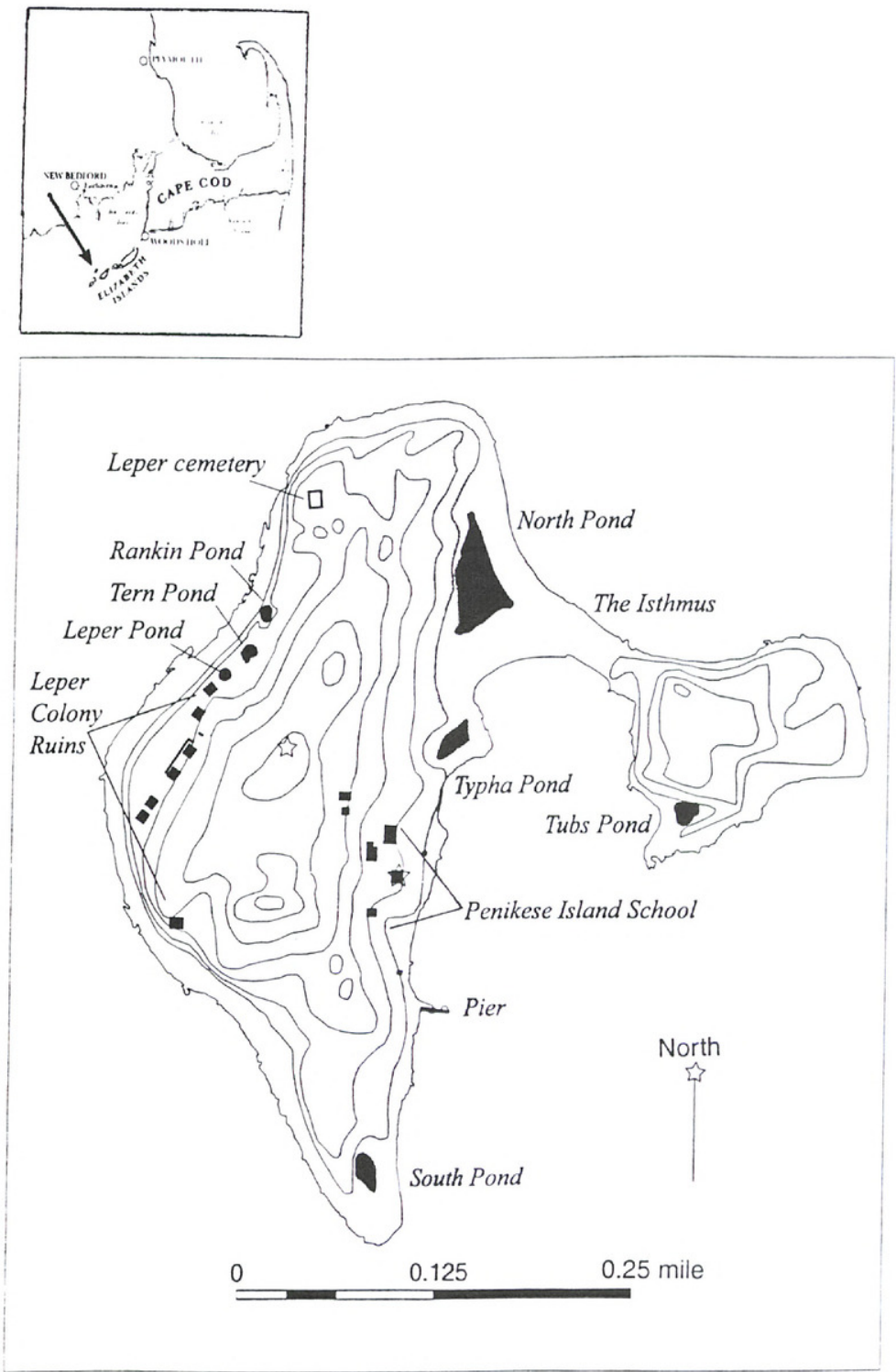


Figure 1. Penikese Island; insert showing its location off the Massachusetts coast; from Buckley (1997).

were about 1000 gull nests on the main part of the island (about 87% herring gull, *Larus argentatus*, and 13% great black-backed gull, *L. marinus*) and a tenth that number of tern nests (almost wholly common tern, *Sterna hirundo*, with a few arctic terns, *S. paradisaea*) divided among three spots—on the Isthmus, on the south shore of Tubs Point, and at South Point (Blodget 1999). Most of the food of these birds comes from the surrounding sea or from places remote from Penikese, with much excretion and egestion occurring on the island. Thus, since there is little export of organic material, Penikese would seem to be accruing an ever-larger supply of plant nutrients.

Penikese is streamless, but has several shallow ponds. Except for a few planted trees and gardens near existing buildings and the vegetation at the shore and around the ponds, the rolling island is best thought of as long-abandoned pasture and cropland covered with grasses or grasses mixed with low shrubs or vines. Here and there are individual tall shrubs or patches of the same, some of the patches being of many square meters (Figure 2).

MATERIALS AND METHODS

Plants were collected on Penikese in 1999 by R. H. Backus, T. O. Hendrickson, P. T. Polloni, B. L. Reid, and Jessica Schultz. One to three of this group worked on April 28, May 14–17, June 11–13, July 9–12, August 20–23, September 18–21, and October 15–17. The whole island was walked over repeatedly. Estimates of plant cover are visual ones based on these explorations, and statements of abundance are subjective. About 430 specimens were pressed, then studied in the herbarium at the MBL (SPWH), where R.H.B. and P.T.P. prepared and deposited about 230 sheets. Much of the 1999 material was identified by the last two, although B.L.R. identified most of the grasses, graminoids, and goldenrods. Paul Somers made some identifications and verified others. Paul and Lois Somers and Jeanne Livingston collected on the northern two-thirds of the island on June 24–26, 1998. Among the 95 specimens collected by the Somers party were three species not found in 1999—*Amaranthus blitoides*, *Scleranthus annuus*, and *Agrostis hyemalis*; these are included on the list for 1999. A few observations were made by R.H.B. on July 8–11, 2000 and P.T.P. made a few on February 7, 2001. Plant names have been brought into conformance with Sorrie and Somers (1999).



Figure 2. Looking east-southeast to Tubs Point from the northeast slope of the main part of Penikese Island.

RESULTS

The vascular plant species found at Penikese in 1998 and 1999 are listed in the Appendix together with the results of the earlier surveys. Certain groups of garden plants observed in 1998–1999 are not listed. One group, just north of the Schoolhouse, contained three apple trees of cultivated varieties, three trees of a *Prunus* sp., probably a plum, and one white spruce, *Picea glauca*. These plants were overgrown to varying degrees with Asian bittersweet, sumac, and Japanese honeysuckle. A catalpa stood nearby at the southeast corner of the Schoolhouse. Another group, called the Lower Garden, was about 300 yards north of the House (the residence and principal building of the Penikese Island School). It was planted with nursery stock and contained the following in July 2000: two apples, one pear, four blueberries, four grapevines, one nectarine, one peach or nectarine, one cherry, one plum or cherry, one Rose-of-Sharon, and eight of a horticultural variety of *Juniperus virginiana*. No annual flowers or vegetables in gardens near the House have been listed, although the weeds of these gardens have been included.

DISCUSSION

Alien species. The five surveys together report 326 species, one of which is represented by two varieties, for a total of 327 taxa. Of the species on the composite list for the five surveys, 48% are alien (155), the same ratio as in the most recent survey (105 of 218 species). The percentage of alien species for each of the earlier four surveys between 1873 and 1973 are 44, 48, 43, and 48, respectively. Although the percentage of aliens on Penikese is close to that reported by Sorrie and Somers (1999) for the entire Commonwealth of Massachusetts (45% of 2814 species), Massachusetts itself is high in aliens in comparison with New England as a whole and with the other New England states for which numbers are available. A recent summary (Mehrhoff 2000) shows that 31% of New England's 2882 species are alien, for Connecticut 35% of 2625 species, for Maine 30% of 2103 species, and for Rhode Island 24% of 1618 species. The following smaller New England areas for which floral lists have recently been prepared can be compared with Penikese with respect to percentage of alien species (arranged in order of diminishing size of flora):

Berkshire County, Mass.	27% alien of 1675 taxa (up from 17% of 1586 taxa in 1922; Weatherbee 1996)
Southeastern Connecticut	25% of 1550 species (Tucker 1995 as cited in Hill 1996)
Nantucket, Mass.	39% of 1265 taxa (Dunwiddie and Sorrie 1996)
Caledonia County, Vt.	24% of 1180 species (Gilman 1999)
Worcester, Mass.	32% of 1154 species (Bertin 2000)
Dukes County, Mass.	28% of 1082 taxa (calculated from Sorrie and Somers 1999)
A part of Stonington, Conn. ...	36% of 385 species (Hill 1996)
Cuttyhunk Island, Mass.	31% of 263 species (O'Neill 1981)

Monomoy Islands, Mass.	ca. 16% of ca. 263 species (calculated from Lortie et al. 1991)
Flood plain forest communities in Massachusetts	17% of 214 species (Kearsley 1999)

In reporting the Penikese survey for 1973, Lauermann and Burk (1976) noted that the percentage of aliens on Penikese is “strikingly higher than [for] adjacent coastal areas.” This large proportion must result from the fact that for much of its recent (say, 250-year) history most or all of the island has been used for farming and gardening.

Rare species. The following rare (state-listed) native species (Massachusetts Division of Fisheries and Wildlife 1998, 2001) were found during the 1998–1999 survey: Threatened: *Diplachne maritima*; Watch list: *Angelica lucida*, *Cuscuta polygonorum*, and *Polygonum glaucum*. A few other rare species have been found on Penikese in the past. They are: Endangered: *Juncus debilis* and *Myriophyllum verticillatum*; Watch list: *Cirsium horridulum* and *Myriophyllum pinnatum*.

The increase in woody vegetation. The principal change in Penikese’s vegetation over the 125-year record has been the increase in the number of woody species and the space occupied by them judging from the published accounts of the several surveys. Forty-five woody species have been recorded by at least one of the five surveys, 31 by the survey in 1998–1999. Of the 31 woody species currently present, 15 are abundant or conspicuous as individual plants and are known or thought to be spreading. Of these 15, of which nine are native, only one was recorded in 1873, nine were first found in 1923, two first found in 1947, and three first found in 1999. Collectively, we estimate the 15 to be present on 80–90% of the island’s surface, although they are often mingled with grasses and other herbs. A brief history of these spreading species shows their increase.

Rubus flagellaris is the sole woody species noticed by all five surveys (1873 to present), and annotations suggest that it was always common: “Common locally, in patches” (Lewis 1924); “Large areas covered in upland grassland” (Moul 1948); “covering large areas in the upland grasslands of the larger section”

(Lauermann 1974). At present, this blackberry is widely distributed on both the main island and on Tubs Point and is probably Penikese's most abundant woody plant. It fruits but sparingly.

The nine spreading woody species noticed by all surveys except the first are *Lonicera japonica*, *Myrica pensylvanica*, *Populus alba*, *Prunus serotina*, *Rhus hirta*, *Rosa rugosa*, *Rubus laciniatus*, *R. pensilvanicus*, and *Sambucus canadensis*. *Rosa rugosa* exemplifies the spread of these species between 1923 and the present. Lewis (1924) said, "(Escaped.) Occasional." Moul (1948) said, "Large patches in grassland, eastern shore." Lauermann and Burk (1976) said, "... reported previously only on the east side of the main portion of the island near the dock, [it] is now well established over the main portion and borders South, Typha, and Leper Ponds and the marsh." In 1999, beach rose was found as described by Lauermann and Burk (1976), but also on the near side of Tubs Point. An along-shore patch just south of the pier measured about 35×45 m.

The two spreading woody species first noted on Penikese proper in 1947 were *Toxicodendron radicans* and *Rhus copallinum*, although Jordan (1874) had found poison ivy on Gull Island. Of poison ivy, Moul (1948) said, "Occasionally on grasslands. Not common."; Lauermann and Burk (1976) said, "... occurs in dense patches in the upper grasslands on the main portion of the island." In 1999, we found poison ivy to be generally distributed over the main part of the island with a lesser amount on Tubs Point. One patch northwest of the House on the path to Plow Rock was about 30×30 m. Moul (1961) called attention to the spread of *R. copallinum* between 1947 and 1960.

The three woody species first noted in 1999 and thought to be spreading are: *Celastrus orbiculatus*, *Rosa multiflora*, and *Juniperus virginiana*. Asian bittersweet is growing vigorously and fruiting both on the main part of the island and on Tubs. About 100 m northwest of South Pond, for example, are two conspicuous patches—one approximately 5×15 m, the other approximately 5 m in diameter. There are scattered clumps of multiflora rose along the path between the pier and the buildings of the Penikese Island School and at a few other places. These are growing vigorously and fruiting, and the spread of this species seems assured.

About 10 *Juniperus virginiana* are conspicuous because they stand as isolated specimens a little taller than most of the island's

shrubby growth. According to David Masch (Associate Director, Penikese Island School, pers. comm.) at least some of these scattered small trees (1–2 m high) antedate the Lower Garden, which was planted about a decade ago and where there are fruiting specimens of this species. Two of the largest of the naturally planted trees bore immature cones early in 2001. Since this species grows well on abandoned southern New England farmland, and since the Penikese trees seem little, if at all, disfigured by the wind, the continued increase of red cedar on the island seems certain.

Tree growth. The annual report of the Massachusetts Division of Fisheries and Game for 1935 said, “. . . it is almost impossible to get any trees to grow on the island,” and the adverse conditions for tree growth there are well illustrated by a row of five specimens of *Acer pseudoplatanus* just south of the Schoolhouse. These are the tallest trees (up to about 8 m) of which the island can boast. This maple, a vigorous weed on the nearby mainland, probably was planted in leper-colony days. The trees are partly protected from the southwest wind, summer’s prevailing one, by a hill immediately to windward and more or less conform to the contour of that hill. Though multi-stemmed and gnarled, the most protected trees are taller and thicker than the less protected, which have been severely wind-pruned. Some inferior-looking fruit is produced by the stronger trees, but no seedlings have been observed.

The growth and occurrence of *Prunus serotina* is also illustrative. Lewis (1924) said, “South end of island,” and Moul (1948) said “Grassland n. of Typha Pond. Suckers only, 4 feet tall. Dead twigs also only that high. (Not reported from south end of island as formerly.)” In 1999, there were a dozen or so small specimens of black cherry scattered about the island. Like many of the island’s shrubs these trees grow vigorously, but suffer much winterkill and disfigurement by the wind. Most of them have recumbent trunks and wider-than-high silhouettes. One tree about 2 m tall was about 15 cm in diameter at the ground and had divided into five stems about 30 cm above the ground. The length of the previous summer’s twigs averaged about 43 cm, of which about 10 cm at the top of the tree had been winterkilled, somewhat less at the sides. There is a tall tree (DBH 33.1 cm), probably planted and with flavorsome fruit, in a protected spot near the School-

house that may have been the seed source for these small trees. The latter have not been observed to flower.

Penikese ponds in 1999. Penikese ponds (Figure 1) are South, Tubs, North, Typha, Leper, Tern, Rankin, and (formerly) Dry. Considerable confusion exists in the island's biological literature with respect to their names. We follow the designations on Lewis's (1924) map, except that what he called "swamp area" (and was later called "Marsh Pond") is now called North Pond and his two "Tub Ponds" are now but one, called by us "Tubs Pond." Rankin Pond has been recognized since Lewis wrote. It is likely that the loss of the second pond at Tubs Point and of salt marsh here and at South Point was due to the erosion by the 1938 hurricane noted earlier.

South and Tubs Ponds are only a few inches above sea level and close to the southern extremities of the greater and lesser parts of the island, respectively. They are turbid pools a few feet deep, holding water the year round. According to Zinn and Rankin (1952), salinity in South Pond was 23‰ in August 1923 and 13.2‰ in August 1947; in Tubs Pond salinity was 9‰ in August 1923 and 34.4‰ in August 1947, the last being close to the salinity of the adjacent bay. When we measured salinity on July 10, 2000, it was 10‰ in South Pond and 28‰ in Tubs Pond. These ponds, which supported no submersed or emergent vascular plants in 1999, probably should be thought of as supratidal pools with fluctuating salinity. Both seem to have had shallow connections to salt water at one time, but in 1999 were narrowly separated from the adjacent bay by low piles of cobbles such as those moved by storm surges. Tubs Pond still supported some vegetation characteristic of brackish habitats around its edges, being completely encircled by a narrow band of *Bassia hirsuta*, mixed in a few spots with *Suaeda* sp. Along the north edge of the pond were narrow patches of *Spartina patens* and *Distichlis spicata*. Just south of the ridge of cobbles that separated the pond from the bay lay a flat beach of cobbles that was submerged by high tides. Here there was a 2 × 3 m patch of *Salicornia maritima* surrounded by a few outlying plants, the only occurrence of this species on the island.

No plants characteristic of brackish habitats were found at South Pond in 1999, although such plants have been found there in the past. For instance, Fogg (1930) listed for South Pond the

characteristic salt marsh plants *Juncus gerardii* (Fogg 1094) and *Distichlis spicata* (Fogg 1092). Also, the label of a specimen of *Scirpus pungens* from the 1947 survey (Erskine & Hulbert s.n., SPWH 90), reads “Salt marsh pocket by South Pond,” and a specimen of *Bassia hirsuta* from the 1947 survey (Erskine & Hulbert s.n., SPWH 1454) reads, “Mud around South Pond.” *Juncus gerardii* was not found on Penikese in 1999, but past collections have come not only from around South Pond, but from North Pond as well. Two other characteristic salt marsh species not found on the island in 1999 were *Iva frutescens* and *Spartina alterniflora*.

Leper Pond lay on the west side of the island only 20 m or so north of the ruins of the leper colony laundry. It was about 8×16 m with a single specimen of *Salix atrocinerea* growing at its western margin. The pond had a maximum depth of about 15 cm on May 15, but had been 30 cm higher. The pond is said to dry every year and was so at the time of our visit on June 13. Later, the pond bottom and edges were rife with *Bidens connata*, *Cyperus erythrorhizos*, *Gnaphalium uliginosum*, *Hypericum mutilum*, *Lycopus americanus*, *L. uniflorus*, *Mentha arvensis*, *Polygonum lapathifolium*, and *P. pensylvanicum*. A few flowering individuals of *Viola lanceolata* were found there in May.

Tern Pond, about 12×15 m, lay a little north-northeast of Leper Pond. It is said to dry every year and had only a small puddle left in its middle by May 15, 1999. This was gone two days later. In May, the drying pond was much frequented by Canada geese, which had grazed almost to the ground a sizeable patch of *Phalaris arundinacea* at the pond's southern edge. In June, the pond was half-surrounded by blooming *Iris versicolor*. Later, there were rich growths of *Chenopodium ambrosioides*, *Cuscuta polygonorum*, *Cyperus erythrorhizos*, *Gnaphalium uliginosum*, *Juncus effusus* var. *pyllei*, *Lycopus* spp., *Polygonum* spp., *Rorippa palustris*, and other herbs.

Rankin Pond, just north-northeast of Tern Pond, was larger than the latter, though its boundaries were ill-defined. The first botanical survey to mention this pond was the one by Lauermann and Burk (1976), who said that it held water in June 1973, which had “fallen markedly” by July 14, and that it was completely dry by August 8. In 1999, the pond showed no sign of having held water in the recent past, perhaps not for years, and in 1999 could scarcely be called a pond. In May, it was wholly covered

with tall plants, including *Calystegia sepium*, *Galium tinctorium*, *Juncus effusus* var. *pylaei*, and *Panicum virgatum*.

Dry Pond, shown by Lewis (1924) as being near the leper cemetery, was described in 1923 as having held water in the spring as "its surface was cracked mud" when visited in July (Lewis 1924). Moul (1948) made little mention of Dry Pond, noting only that *Cuscuta polygonorum* was growing there on *Polygonum punctatum* and that *Rubus pensilvanicus* was growing around it. Lauermann and Burk (1976) said for 1973 that "Dry Pond supports large stands of various grasses, *Polygonum persicaria*, *Rubus [pensilvanicus]*, *Sambucus canadensis* and *Solidago rugosa*." In 1999 we were unable to decide where Dry Pond once had been.

Typha Pond, 20 × 50 m, lay near the west edge of the southern embayment at the east side of the island. Although low and narrowly separated from the bay, it was somewhat protected from the east by Tubs Point and seemed to maintain its freshwater integrity. There was a large stand of *Typha latifolia* at its eastern edge. Found at Typha Pond by the 1923 and 1947 surveys, cattail was not found there when particularly sought by the 1973 survey (Lauermann and Burk 1976; C. J. Burk, pers. comm.). In May 1999, the pond held a little water, but was dry at our June 12 visit. On July 9, a considerable piece of the pond bottom was covered with young plants of *Portulaca oleracea*. Some other plants of the pond bottom and edges were *Gnaphalium uliginosum*, *Hibiscus moscheutos*, *Hypericum mutilum*, *Impatiens capensis*, *Iris versicolor*, *Juncus effusus* var. *pylaei*, *Ludwigia palustris*, *Mentha arvensis*, *Myrica pensylvanica*, *Panicum virgatum*, *Polygonum* spp. (including *P. persicaria*), *Rosa rugosa*, *Scirpus pungens*, *Solanum dulcamara*, and *Xanthium strumarium*.

North Pond lay near the western extremity of the Isthmus. It was the largest pond on Penikese, about 90 × 150 m. The pond held a little water in May and June, 1999, but by our visit on July 10 it "was dry, save for a tiny puddle" at its western edge "although kneeling on its plant-covered bottom dampened the knees" (field notes). According to David Masch (pers. comm.), North Pond dries completely about once every five years. Portions of the most recently dried pond bottom were covered by a "garden of miniatures" whose plants were well on their way to making seed. The smallest species were *Eleocharis parvula* and *Limosella subulata*. Described as "a giant" among them was

Chenopodium glaucum, only 8–10 cm high. Another diminutive species was *Rumex maritimus* var. *fueginus*. The parts of pond bottom that had been dry longer held taller species dominated by *Pluchea odorata*. By our visit on August 20, much of the pond was pink-purple with the last, and it and other tall species had succeeded the tiny flora noted in July. By our September 18 visit, the pond again held a few centimeters of water in its center. Conspicuous among the pond-bottom flora then were *Cyperus diandrus*, *C. erythrorhizos*, and *C. filicinus*.

Other conspicuous species in or at the edges of North Pond were *Angelica lucida*, *Aster novi-belgii*, *A. subulatus*, *Bidens con-nata*, *Carex lurida* and other *Carex* spp., *Cuscuta polygonorum*, *Gnaphalium uliginosum*, *Hibiscus moscheutos*, *Hypericum mutil-um*, *Impatiens capensis*, *Iris versicolor*, *Juncus effusus* var. *pylpei*, *Lycopus americanus*, *L. uniflorus*, *Mentha arvensis*, *Polygonum pennsylvanicum*, *P. lapathifolium*, *P. punctatum*, *Scutellaria gal-ericulata*, *Scirpus pungens*, *S. tabernaemontani*, *Sparganium eu-rycarpum*, *Spartina patens*, and *Xanthium strumarium*.

Beach plants. In 1999, common species of the rocky shore were *Achillea millefolium*, *Anagallis arvensis*, *Bromus tectorum*, *Lathyrus japonicus*, *Leucanthemum vulgare*, *Oenothera biennis*, *Raphanus raphanistrum*, *Rumex crispus*, *Solanum dulcamara*, *Solidago sempervirens*, and *Verbascum thapsus*. Common species of the sandy shore, where they grow particularly strongly in piles of decaying *Zostera*, were *Ambrosia artemisiifolia*, *Atriplex* spp., *Chenopodium macrocalycium*, *Datura stramonium*, and *Erechtites hieraciifolia*. *Glaucium flavum* was very conspicuous in the wrack on the Isthmus and at South Point when it was in flower in June.

The loss of ferns. Ferns, once common on Penikese, were very rare in 1999. *Dennstaedtia punctilobula*, the only fern reported by Jordan (1874), was included by Lewis (1924) in a list of “the more common plants of the grassland area.” Lewis also listed *Athyrium filix-femina*, the only Penikese survey to do so, (“South end of island”) and *Thelypteris palustris* (“Low wet places, Typha and Tub Ponds”). Moul (1948) said for *Dennstaed-tia*, “Grassy hillside, n.w. of the reservoir,” then said that in 1960 both this species and *T. palustris* “are no longer growing at their former sites” (Moul 1961). With the 1973 survey by Lauermaun

and Burk (1976) *T. palustris* dropped from the list of Penikese plants, and they noted but “a single specimen” of hay-scented fern. In 1999, we noted only a single poorly growing plant of the latter species, curiously, at the mouth of a petrel burrow in the rock retaining wall near the House. The only other fern reported from Penikese is *Onoclea sensibilis*, found in 1999 in a tangle of other plants at the north end of North Pond. It may have been a recent arrival on Penikese or, judging by the difficulty we had in re-locating the few fronds we had found earlier, simply overlooked by the other surveys.

Why have ferns been lost to Penikese? Is it simple competition with species that are spreading such as the woody species noted earlier, or is the island drying a little superficially, perhaps also attributable to the spread of (deeper-rooted) woody species and a consequent increase in evapotranspiration? The label of a sheet of *Thelypteris palustris* collected in 1923 (Fogg 460, SPWH) says, “Low wet places. All parts of is.” With the exception of the ponds, there were, in 1999, no places on the island that could be called low and wet. The total disappearance of Dry Pond and the dryness of Rankin Pond lend additional support to the notion that Penikese as plant habitat was somewhat drier in 1999 than formerly.

Plants not found. Conspicuous among woody shrubs and vines common on the Elizabeth Islands as a whole (Cherau 1998; Fogg 1930), but missing on Penikese in all surveys, were members of the family Ericaceae. Aside from the planted blueberries in the Lower Garden (growing very poorly), we know of but a single ericaceous plant on the island in 1999—an old and overgrown specimen of *Vaccinium corymbosum* on the west bank of Typha Pond, perhaps a survivor of blueberries planted by the Commonwealth about 1930. Moul (1948) listed *V. fuscatum* saying, “Rare” and *Kalmia angustifolia*, “One colony in grassland.” These, too, were probably survivors of plantings made around 1930. These are the only records of ericads for Penikese. We suppose that edaphic factors explain the lack of these plants.

Penikese and Cuttyhunk compared. O'Neill (1981) described the vascular flora of Cuttyhunk for 1974 and compared it to the one described by Lauermann and Burk (1976) for nearby Penikese for 1973. O'Neill calculated the Simpson Index of Re-

semblance, $100c/n_1$ (where c is the number of species common to the two floras and n_1 is the number of species in the smaller flora), to be 67.6, Penikese (163 species) and Cuttyhunk (264 species) having 110 species in common. The more diverse Cuttyhunk flora was attributed to the island's greater size and consequent greater diversity of its plant communities. O'Neill reported an increase in the number of species of shrubs from the eight given for Cuttyhunk by Fogg (1930) to 40 for 1974 and also found a recent general increase in the island's shrubby vegetation.

The floral future on Penikese. Earlier writers on the Penikese flora have usually speculated as to whether the island will regain the forest that once covered it, but often with ill-founded assumptions about what that presettlement forest was like. Jordan (1874), without citing any authority, said, "When Penikese was first known it was covered with a growth of trees said to be similar to those now found on Martha's Vineyard and Naushon. Among these may be mentioned the red cedar, pitch pine, red maple, shag bark etc." Lewis (1924) said, "The original vegetation, like that of neighboring islands, is said by Jordan to have been of a forest type, with pitch pine, red cedar, red maple, shag-bark etc." and "As the early records of the island mention trees belonging to forests of an advanced type, it is possible that such a forest may again develop." Moul (1948) said, "the original climax of forest mentioned by Dr. Jordan may return," but the same author (1961) said, "In 1948, I expressed the belief that the original tree cover, mentioned by Gosnold's naturalists in 1602, might return, but today the evidence indicates that a grass 'sub-climax' may persist into the future."

Fogg's (1930) consideration of the question is more thoughtful. He argued that the post-glacial forest of the Elizabeth Islands (including Penikese) developed when sea level was much lower than at present so that the shoreline was then many miles south of what are now the islands. Thus, the current regrowth of the islands' forests must occur under a much harsher set of conditions than those prevailing during their original growth and "it would seem futile to hope that the devastated areas can ever regain their former wooded luxuriance" (Fogg 1930).

Gabriel Archer's and John Brereton's (1625 and 1602, respectively, as cited in Quinn and Quinn 1983) descriptions of a di-

verse oak-hickory forest (including cedars) for Cuttyhunk, where the Gosnold party camped, must ultimately be the source of Jordan's remarks about nearby Penikese's presettlement forest. But the forest on Penikese was different from the one on Cuttyhunk as indicated by the facts that the Gosnold party, which visited Penikese several times, described the latter as "full of Cedars" and came there especially to cut a cargo of that tree for taking back to England ("Captain Gosnoll fell downe with the ship to the little Ilet of Cedars etc."; Archer 1625 as quoted in Quinn and Quinn 1983). This seems to indicate that the pre-settlement forest on Penikese was dominated by red cedar. (We take "cedar" to be *Juniperus virginiana*. Both "cedar" and "cypresse" are mentioned in accounts of the voyage, although only "cedar" is attributed to Penikese. We take "cypresse" to be *Chamaecyparis thyoides*.)

By 1930 *Juniperus virginiana* was rare in the Elizabeth Islands. Fogg (1930) recorded it only for Naushon, where it was "Plentiful in the woods near the East Gutter." But seven decades later, Cherau (1998) found many "in all parts of Naushon." Probably the species is generally increasing in the Elizabeth Islands.

Thus, while two arborescent species, *Prunus serotina*, black cherry, and *Juniperus virginiana*, red cedar, seemed to be slowly increasing on Penikese in 1999 as noted above, we subscribe to Fogg's (1930) argument as to the difficulty of reforestation of the island and believe that a hardwood forest such as has been described for presettlement Cuttyhunk and assumed for presettlement Penikese will not come about. A regrowth of the red cedar that the Gosnold party found in 1602 is quite possible, as this species' increase on Penikese suggests. Why red cedar, an early successional species, might have dominated on Penikese when Gosnold visited remains an interesting question. We can only suggest that this dominance may have resulted from deliberate or accidental burns by the aboriginal Pokanokets who, according to the Gosnold reporters, were seen on Penikese, but did not have a settlement there.

Management. A beautiful place, Penikese is disfigured, when viewed at close hand, by the winterkilled sticks of elderberry, white poplar, and sumac; by the dead canes of blackberries; and by weedy species such as poison ivy, Japanese honeysuckle, and Asian bittersweet. These woody plants together with herba-

ceous weeds such as *Cynanchum louiseae*, black swallowwort, first noticed for Penikese in 1999, will increasingly affect the island adversely. The handsomest parts of Penikese's uplands (becoming more and more restricted) are the grasslands that are free of woody plants. Since fire probably can encourage these grasslands at the expense of aggressive woody plants, we suggest repeated prescribed burns for Penikese on an island-wide scale. The island, wholly under the control of the Commonwealth, is isolated, and burning there does not endanger other places. Restricted parts of the island (including its buildings) not wanted to be burned are or can be protected readily. The destruction of woody weeds and the increase of grasses by burning might at the same time restore certain parts of the island to their former utility as nesting grounds for terns, although the birds at present are not limited by a lack of the brush-free nesting grounds that they prefer. In the past, these birds have used different and more extensive parts of the island than they do at present as is shown, for instance, by the map in Lewis (1924).

ACKNOWLEDGMENTS. We thank Dr. Thomas W. French, Assistant Director, Massachusetts Division of Fisheries and Wildlife, for permission to make a plant inventory and to collect specimens on Penikese. We are much indebted to staff of the Penikese Island School, who carried us to and from the island and gave us beds, meals, and good company after we got there. We especially thank Director Toby Lineaweaver and J. C. Burke, Pam Brighton, Omer Gagnon, Jim Gammans, Ken Hepburn, Michelle Manfredi, Greg Meier, Tom Quatrimoni, Bill Rogers, and Ginny Root. David Masch, a founder of the School, has shared his knowledge of both Penikese's social and natural history. We thank Dr. George Argus, who identified specimens of *Salix*, and Bruce Sorrie for identifying specimens of *Atriplex*. Professor C. John Burk checked specimens in SCHN from the 1973 survey and shared unpublished information from the same. We are grateful to Professor Burk, Mario DiGregorio, David Masch, Donald Schall, Bruce Sorrie, and two anonymous reviewers, who read versions of the manuscript, corrected some errors, and made useful suggestions. We also thank Carolyn Mostello and Christina Sulzman, the "bird ladies," who studied tern nesting in 1999 for the Penikese Island Ternery Restoration Project, but were not blind to plants. Dick Norris provided the map. Tom Buckley, Teresa Nor-

ris, and Chris Polloni helped in various ways. Once-director John Burris of the Marine Biological Laboratory gave moral and physical support to the Laboratory's herbarium and financial support to the 1999 survey for which we are grateful. Finally, we thank officers and members of the Botanical Club of Cape Cod and the Islands under whose auspices and with whose support the work in 1999 was carried out.

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APPENDIX

PENIKESE VASCULAR PLANTS, 1873–1999

Species indicated by Sorrie and Somers (1999) as introduced to the north-eastern United States are marked with an asterisk (*). Species noted in the works recording them for Penikese as “escaped,” or are known or thought to have been deliberately planted on Penikese, are marked +. The 1999 status of all woody species ever reported from Penikese is noted. The dates showing the occurrence of species refer to Jordan (1874), Lewis (1924), Fogg (1930), Moul (1948), Lauermaun and Burk (1976), and the current survey (1999). Voucher specimens from the 1999 survey are followed by the senior author’s collection numbers. Three exceptions are specimens, collected by P.S. in

1998, of species not found in 1999; these are listed with SPWH accession numbers. All 1998/1999 vouchers have been deposited in SPWH.

POLYPODIOPHYTA

DENNSTAEDTIACEAE

Dennstaedtia punctilobula (Michx.) T. Moore – 1874, 1924, 1948, 1976, 1999 (RHBP 2279)

DRYOPTERIDACEAE

Athyrium filix-femina (L.) Roth – 1924
Onoclea sensibilis L. – 1999 (RHBP 2355)

THELYPTERIDACEAE

Thelypteris palustris Schott var. *pubescens* (G. Lawson) Fernald – 1924, 1948

CONIFEROPHYTA

CUPRESSACEAE

Juniperus virginiana L. – 1999 (RHBP 2600); scattered trees and presumed increasing

PINACEAE

*+*Pinus sylvestris* L. – 1924, 1948; extirpated

MAGNOLIOPHYTA

MAGNOLIOPSIDA

ACERACEAE

*+*Acer platanoides* L. – 1924; extirpated
*+*Acer pseudoplatanus* L. – 1930, 1948, 1976, 1999 (RHBP 2275); a few old trees

AMARANTHACEAE

**Amaranthus blitoides* S. Watson – 1999 (Somers s.n., SPWH 8545)
**Amaranthus blitum* L. – 1999 (RHBP 2443)
**Amaranthus retroflexus* L. – 1874, 1930, 1976, 1999 (RHBP 2400)

ANACARDIACEAE

Rhus copallinum L. – 1948, 1976, 1999 (RHBP 2405); abundant and widespread on both parts of the island
Rhus hirta (L.) Sudw. – 1924, 1948, 1976, 1999 (RHBP 2282); mostly shrub-like and widely distributed, though relatively little on Tubs Point
Toxicodendron radicans (L.) Kuntze – 1874 (Gull Island only), 1948, 1976, 1999 (RHBP 2434); in large patches

APIACEAE

Angelica lucida L. – 1874, 1976, 1999 (RHBP 2378)

**Daucus carota* L. – 1924, 1948, 1976, 1999 (RHBP 2285)

Ligusticum scoticum L. – 1924, 1948, 1976

AQUIFOLIACEAE

Ilex verticillata (L.) A. Gray – 1999 (RHBP 2456); a single old plant

ARALIACEAE

*+*Hedera helix* L. – 1976; extirpated

ASCLEPIADACEAE

Asclepias incarnata L. subsp. *pulchra* (Ehrh. ex Willd.) Woodson – 1874, 1976

Asclepias syriaca L. – 1924, 1999 (RHBP 2322)

**Cynanchum louiseae* Kartesz & Gandhi – 1999 (RHBP 2189)

ASTERACEAE

Achillea millefolium L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2221)

Ambrosia artemisiifolia L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2383)

**Anthemis cotula* L. – 1874, 1924, 1976

**Artemisia stelleriana* Besser – 1999 (RHBP 2261)

Aster ericoides L. – 1930

Aster novi-belgii L. – 1976, 1999 (RHBP 2453)

Aster pilosus Willd. var. *pringlei* (A. Gray) S. F. Blake – 1924

Aster subulatus Michx. – 1976, 1999 (RHBP 2492)

Aster undulatus L. – 1924

Bidens connata Muhl. ex Willd. – 1924, 1948, 1976, 1999 (RHBP 2504)

**Cirsium arvense* (L.) Scop. – 1874, 1924, 1948, 1976, 1999 (RHBP 2291)

Cirsium horridulum Michx. – 1976

**Cirsium vulgare* (Savi) Ten. – 1874, 1924, 1948, 1976, 1999 (RHBP 2292)

Conyza canadensis (L.) Cronquist – 1874, 1924, 1948, 1976, 1999 (RHBP 2403)

*+*Coreopsis lanceolata* L. – 1924, 1948

Erechtites hieraciifolia (L.) Raf. – 1874, 1924, 1948, 1976, 1999 (RHBP 2416)

Erigeron strigosus Muhl. ex Willd. – 1948, 1976

Euthamia graminifolia (L.) Nutt. – 1948, 1976, 1999 (RHBP 2467)

Euthamia tenuifolia (Pursh) Nutt. – 1924, 1948, 1976, 1999 (RHBP 2412)

**Galinsoga quadriradiata* Ruiz & Pavón – 1999 (RHBP 2537)

Gnaphalium obtusifolium L. – 1924, 1948, 1976, 1999 (RHBP 2437)

Gnaphalium uliginosum L. – 1874, 1976, 1999 (RHBP 2349)

*+*Helianthus annuus* L. – 1924, 1976

**Hieracium piloselloides* Vill. – 1999 (RHBP 2226)

**Hypochaeris radicata* L. – 1999 (RHBP 2250)

Iva frutescens L. subsp. *oraria* (Bartlett) R. C. Jackson – 1874; extirpated

- Lactuca biennis* (Moench) Fernald – 1999 (RHBP 2468)
Lactuca canadensis L. – 1976, 1999 (RHBP 2417)
**Lactuca serriola* L. – 1999 (RHBP 2458)
**Leontodon autumnalis* L. – 1924
**Leucanthemum vulgare* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2204)
**Matricaria discoidea* Alph. de Candolle – 1976, 1999 (RHBP 2198)
Pluchea odorata (L.) Cass. var. *succulenta* (Fernald) Cronquist – 1976, 1999 (RHBP 2392)
**Rudbeckia hirta* L. var. *pulcherrima* Farw. – 1924
Solidago canadensis L. – 1924, 1999 (RHBP 2490)
Solidago juncea Aiton – 1924, 1976
Solidago nemoralis Aiton – 1924
Solidago rugosa Mill. – 1924, 1948, 1976, 1999 (RHBP 2436)
Solidago sempervirens L. – 1874 (Gull Island only), 1924, 1948, 1976, 1999 (RHBP 2469)
**Sonchus arvensis* L. – 1924
**Sonchus asper* (L.) Hill – 1924, 1948, 1976, 1999 (RHBP 2498)
**Sonchus oleraceus* L. – 1924, 1948, 1999 (RHBP 2462)
**Tanacetum vulgare* L. – 1930
**Taraxacum officinale* Weber ex F. H. Wigg. – 1874, 1924, 1976, 1999 (RHBP 2155)
Xanthium strumarium L. – 1874, 1930, 1999 (RHBP 2382)

BALSAMINACEAE

- Impatiens capensis* Meerb. – 1999 (RHBP 2332)

BERBERIDACEAE

- *+*Berberis thunbergii* Alph. de Candolle – 1999 (RHBP 2428); a single old plant

BETULACEAE

- Betula populifolia* Marshall – 1874; extirpated

BORAGINACEAE

- *+*Symphytum officinale* L. – 1999 (RHBP 2257)

BRASSICACEAE

- *+*Armoracia rusticana* G. Gaertn., B. Mey. & Scherb. – 1948, 1976
**Barbarea vulgaris* R. Br. – 1948, 1999 (RHBP 2200)
**Brassica juncea* (L.) Czernj. – 1924, 1948
**Brassica nigra* (L.) W. J. D. Koch – 1874
Cakile edentula (Bigelow) Hook. – 1874, 1924, 1948, 1976, 1999 (RHBP 2320)
**Capsella bursa-pastoris* (L.) Medik. – 1874, 1924, 1976, 1999 (RHBP 2191)
**Coronopus didymus* (L.) J. E. Smith – 1999 (RHBP 2328)
**Lepidium campestre* (L.) Aiton f. – 1999 (RHBP 2371)

- Lepidium virginicum* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2241)
**Raphanus raphanistrum* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2188)
*+*Raphanus sativus* L. – 1924
Rorippa palustris (L.) Besser – 1976, 1999 (RHBP 2345)
**Sinapis arvensis* L. – 1874, 1948
**Sisymbrium altissimum* L. – 1924, 1948, 1976
**Sisymbrium officinale* (L.) Scop. – 1874, 1924, 1948, 1976, 1999 (RHBP 2424)

CALLITRICHACEAE

- Callitriche heterophylla* Pursh – 1924, 1948, 1976

CAMPANULACEAE

- Triodanis perfoliata* (L.) Nieuwl. – 1948

CAPRIFOLIACEAE

- **Lonicera japonica* Thunb. – 1924, 1948, 1976, 1999 (RHBP 2206); found almost everywhere and after *Rubus flagellaris*, the island's most abundant woody plant
**Lonicera morrowii* A. Gray – 1999 (RHBP 2455); a single old plant
Sambucus canadensis L. – 1924, 1948, 1976, 1999 (RHBP 2277); patches are scattered on both Tubs Point and the main part of the island with large thickets at the north end of the latter.
Viburnum dentatum L. – 1976, 1999 (RHBP 2259); a few scattered plants
+*Viburnum nudum* L. var. *cassinoides* (L.) Torr. & A. Gray – 1999 (RHBP 2395); a single old plant

CARYOPHYLLACEAE

- **Cerastium fontanum* Baumg. subsp. *vulgare* (Hartm.) Greuter & Burdet – 1924, 1948, 1976, 1999 (RHBP 2158)
**Cerastium glomeratum* Thuill. – 1874
*+*Dianthus barbatus* L. – 1924
*+*Gypsophila paniculata* L. – 1924
Honckenya peploides (L.) Ehrh. – 1874, 1924, 1976
**Sagina procumbens* L. – 1874, 1924, 1948, 1976
**Scleranthus annuus* L. – 1999 (Somers s.n., SPWH 8544)
**Silene latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet – 1924, 1948, 1976, 1999 (RHBP 2167)
**Spergula arvensis* L. – 1874
Spergularia rubra (L.) J. & C. Presl – 1924, 1948, 1976, 1999 (RHBP 2156)
Spergularia salina J. & C. Presl – 1874, 1924, 1976
**Stellaria graminea* L. – 1924, 1948, 1976, 1999 (RHBP 2185)
**Stellaria media* (L.) Vill. – 1874, 1924, 1948, 1976, 1999 (RHBP 2177)

CELASTRACEAE

- **Celastrus orbiculatus* Thunb. – 1999 (RHBP 2429); well established

CHENOPODIACEAE

Atriplex littoralis L. – 1999 (RHBP 2566)

Atriplex pentandra (Jacq.) Standl. – 1874

Atriplex prostrata Boucher ex Alph. de Candolle – 1874, 1924, 1948, 1976, 1999 (RHBP 2569)

**Bassia hirsuta* (L.) Asch. – 1948, 1999 (RHBP 2474)

**Chenopodium album* L. – 1874, 1976, 1999 (RHBP 2540)

**Chenopodium ambrosioides* L. – 1976, 1999 (RHBP 2404)

**Chenopodium glaucum* L. – 1999 (RHBP 2365)

Chenopodium macrocalycium Aellen – 1924, 1948, 1999 (RHBP 2459); Fogg 1401, Moul 3070, and Moul 3091 are treated as *C. macrocalycium*, not *C. album* as labeled, although none hold mature fruit, making identification uncertain.

**Chenopodium pumilio* R. Br. – 1976, 1999 (RHBP 2353)

Chenopodium rubrum L. – 1999 (RHBP 2358)

Salicornia maritima S. L. Wolff & Jefferies – 1874, 1999 (RHBP 2473)

Salsola kali L. – 1874, 1948, 1976, 1999 (RHBP 2318)

Suaeda sp. – 1874, 1999 (RHBP 2418); we defer identifying the Penikese plants to species until material with mature seeds can be collected. Jordan's *S. maritima* may or may not have been that species as the edition of Gray's Manual that he used offered no alternatives.

CLUSIACEAE

Hypericum mutilum L. – 1874, 1948, 1999 (RHBP 2389)

**Hypericum perforatum* L. – 1924, 1948, 1976, 1999 (RHBP 2283)

CONVOLVULACEAE

Calystegia sepium (L.) R. Br. – 1874, 1924, 1948, 1976, 1999 (RHBP 2217)

**Convolvulus arvensis* L. – 1924

CUCURBITACEAE

*+*Cucumis melo* L. – 1976

*+*Cucurbita maxima* Duchesne – 1924

CUSCUTACEAE

**Cuscuta polygonorum* Engelm. – 1948, 1976, 1999 (RHBP 2406); possibly native; in 1999 on *Aster subulatus*, *Bidens connata*, *Lactuca* sp., *Lycopus americanus*, and *Polygonum punctatum*

ELAEAGNACEAE

**Elaeagnus umbellata* Thunb. – 1999 (RHBP 2315); a single plant found in 1999 was not present in 2000

ERICACEAE

+*Kalmia angustifolia* L. – 1948; extirpated

+*Vaccinium corymbosum* L. – 1999 (RHBP 2234); a single old plant found

+*Vaccinium fuscatum* Aiton – 1948; extirpated

EUPHORBIACEAE

Chamaesyce maculata L. – 1874, 1948, 1976, 1999 (RHBP 2295)

Chamaesyce polygonifolia L. – 1874, 1948, 1999 (RHBP 2380)

FABACEAE

Lathyrus japonicus Willd. – 1874 (Gull Island only), 1924, 1948, 1976, 1999 (RHBP 2216)

Trifolium arvense L. – 1874, 1924

**Trifolium aureum* Pollich – 1924, 1999 (RHBP 2260)

**Trifolium dubium* Sibth. – 1874, 1999 (RHBP 2236)

**Trifolium hybridum* L. – 1930, 1948, 1999 (RHBP 2190)

**Trifolium pratense* L. – 1924, 1948, 1999 (RHBP 2193)

**Trifolium repens* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2196)

**Vicia cracca* L. – 1924, 1976, 1999 (RHBP 2244)

**Vicia sativa* L. – 1948, 1999 (RHBP 2587)

**Vicia tetrasperma* (L.) Schreb. – 1924, 1948, 1999 (RHBP 2230)

FAGACEAE

+*Quercus rubra* L. – 1924, 1948; extirpated

GERANIACEAE

**Erodium cicutarium* (L.) L'Her. ex Aiton – 1976, 1999 (RHBP 2157)

Geranium carolinianum L. – 1924

Geranium robertianum L. – 1976

HALORAGACEAE

Myriophyllum pinnatum (Walter) Britton, Sterns & Poggenb. – 1874, 1924, 1948, 1976

Myriophyllum verticillatum L. – 1976

LAMIACEAE

**Glechoma hederacea* L. – 1948, 1976, 1999 (RHBP 2154)

**Leonurus cardiaca* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2293)

Lycopus americanus Muhl. ex W. Bartram – 1924, 1948, 1976, 1999 (RHBP 2350); Moul 3403, called *L. uniflorus* by him, has been re-identified as *L. americanus*, as has Lauermann and Burk's *L. rubellus* in SCHN.

**Lycopus europaeus* L. – 1874; the edition of Gray's Manual that Jordan used lists only *L. virginicus* and *L. europaeus*. Since the latter is uncommon in North America, the best thing to be said of this record, perhaps, is "not *virginicus*."

Lycopus uniflorus Michx. – 1924, 1976, 1999 (RHBP 2514)

**Mentha arvensis* L. – 1948, 1976, 1999 (RHBP 2323)

**Nepeta cataria* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2325)

*+*Origanum vulgare* L. – 1999 (RHBP 2199)

Scutellaria galericulata L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2359)

Teucrium canadense L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2317)

MALVACEAE

Hibiscus moscheutos L. – 1999 (RHBP 2386)

**Malva neglecta* Wallr. – 1874, 1924, 1999 (RHBP 2239); the 5th edition of Gray's Manual does not offer *M. neglecta* as an alternative to *M. rotundifolia*, the name that Jordan gave to the plant that he observed. Fogg 1442, called by him *M. rotundifolia*, has been re-identified as *M. neglecta*.

MOLLUGINACEAE

**Mollugo verticillata* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2299)

MORACEAE

*+*Morus alba* L. – 1948, 1976, 1999 (RHBP 2233); a few trees in three widely separated places

MYRICACEAE

Myrica pensylvanica Loisel. – 1924, 1948, 1976, 1999 (RHBP 2237); found in numerous small to medium-sized patches, mostly near the shore

OLEACEAE

*+*Ligustrum ovalifolium* Hassk. – 1924, 1948, 1976, 1999 (RHBP 2286); a few old plants; all of the privets on the island, about two dozen, were examined while in flower and are *L. ovalifolium* save for a single *L. vulgare*, the smallest and poorest-growing plant in the middle of a row of privets planted by the Penikese Island School about 1975. Fogg's *L. vulgare* (1451) has been re-identified as *L. ovalifolium*, as have Lauer-mann and Burk's specimens in SCHN. Moul's *L. vulgare* (3100), with immature flowers, has glabrous twigs and is assumed to be *L. ovalifolium*.

*+*Ligustrum vulgare* L. – 1999 (RHBP 2601); one plant as noted above

ONAGRACEAE

Epilobium coloratum Biehler – 1999 (RHBP 2407)

Ludwigia palustris (L.) Elliott – 1874, 1924, 1948, 1976, 1999 (RHBP 2333)

Oenothera biennis L. – 1924, 1948, 1976, 1999 (RHBP 2477)

*+*Oenothera glazioviana* Micheli – 1924

OXALIDACEAE

**Oxalis corniculata* L. – 1976

Oxalis dillenii Jacq. – 1874, 1924, 1948, 1976, 1999 (RHBP 2298); Fogg

1439 and Moul 3147, labeled *O. stricta*, have been re-identified as *O. dillenii*, and we suppose that Jordan's observations pertain to this species also.

PAPAVERACEAE

**Glaucium flavum* Crantz – 1976, 1999 (RHBP 2215)

PHYTOLACCACEAE

Phytolacca americana L. – 1948, 1976, 1999 (RHBP 2213)

PLANTAGINACEAE

**Plantago lanceolata* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2161)

**Plantago major* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2280)

PLUMBAGINACEAE

Limonium carolinianum (Walter) Britton – 1874 (Gull Island only)

POLYGONACEAE

**Polygonum aviculare* L. – 1874, 1924, 1999 (RHBP 2484)

**Polygonum convolvulus* L. – 1924

Polygonum glaucum Nutt. – 1874, 1999 (RHBP 2290)

Polygonum hydropiper L. – 1874

Polygonum lapathifolium L. – 1999 (RHBP 2390)

Polygonum pensylvanicum L. – 1976, 1999 (RHBP 2388)

**Polygonum persicaria* L. – 1874, 1924, 1976, 1999 (RHBP 2327)

Polygonum punctatum Elliott – 1924, 1948, 1976, 1999 (RHBP 2326)

*+*Rheum rhaponticum* L. – 1948

**Rumex acetosella* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2163)

**Rumex crispus* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2278)

Rumex maritimus (L.) var. *fueginus* (Phil.) Dusen – 1924, 1948, 1976, 1999 (RHBP 2398)

**Rumex obtusifolius* L. – 1874, 1976, 1999 (RHBP 2421)

PORTULACACEAE

**Portulaca oleracea* L. – 1874, 1976, 1999 (RHBP 2324)

PRIMULACEAE

**Anagallis arvensis* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2192)

RANUNCULACEAE

**Ranunculus acris* L. – 1924, 1948, 1976, 1999 (RHBP 2232)

**Ranunculus bulbosus* L. – 1976, 1999 (RHBP 2160)

Ranunculus cymbalaria Pursh – 1874, 1924, 1948

Ranunculus flabellaris Raf. – 1924

ROSACEAE

- Amelanchier arborea* (Michx. f.) Fernald – 1924; extirpated
Argentina egedii subsp. *egedii* (Wormsk.) Rydb. – 1948
*+*Fragaria vesca* L. – 1874
Fragaria virginiana Duchesne – 1874, 1924, 1948
**Malus pumila* Mill. – 1999 (RHBP 2483); a single old plant
**Potentilla argentea* L. – 1874, 1924, 1948
Potentilla canadensis L. – 1924
Potentilla norvegica L. – 1924
Prunus serotina Ehrh. – 1924, 1948, 1976, 1999 (RHBP 2509); scattered small trees and slowly increasing
**Rosa multiflora* Thunb. ex Murray – 1999 (RHBP 2228); well established
Rosa palustris Marshall – 1930; extirpated
*+*Rosa rugosa* Thunb. – 1924, 1948, 1976, 1999 (RHBP 2169); abundant and spreading
Rubus flagellaris Willd. – 1874, 1924, 1948, 1976, 1999 (RHBP 2201); abundant and spreading
*+*Rubus laciniatus* Willd. – 1924, 1948, 1976, 1999 (RHBP 2202A & B); heavily fruiting in three patches tens of meters in diameter west of the reservoir hill
Rubus pensilvanicus Poir. – 1924, 1948, 1976, 1999 (RHBP 2203); this sparsely fruiting, least abundant blackberry grows on both the main part (especially the north end) and on Tubs Point. We may be putting more than one species under this name as individuals with irregular, arching canes and ones with vertical, straight canes were both observed.

RUBIACEAE

- Galium tinctorium* (L.) Scop. – 1930, 1948, 1976, 1999 (RHBP 2344)

SALICACEAE

- *+*Populus alba* L. – 1924, 1948, 1976, 1999 (RHBP 2431); several patches tens of meters in diameter of plants 1–2 m tall grow on the east side of the island, but have not been seen to flower. Fernald (1950) said, “. . . spreading by suckers (especially after destruction of parent trunk),” and so we suppose it to be increasing on Penikese.
*+*Populus deltoides* Bartram ex Marshall – 1924, 1948; extirpated
**Salix atrocinerea* Brot. – 1999 (RHBP 2445); two small trees; this species was called *S. cinerea* by Sorrie and Somers (1999).
Salix discolor Muhl. – 1874; extirpated
*+*Salix pentandra* L. – 1924, 1948; extirpated
*+*Salix ×rubens* Schrank – 1924, 1948, 1976, 1999 (RHBP 2584); one old, small tree

SCROPHULARIACEAE

- *+*Digitalis purpurea* L. – 1924
Limosella australis R. Br. – 1948, 1999 (RHBP 2362)
**Linaria vulgaris* Mill. – 1924

Lindernia dubia (L.) Pennell – 1924, 1948, 1976, 1999 (RHBP 2335)
Nuttallanthus canadensis (L.) D. A. Sutton – 1874, 1924, 1948, 1976, 1999
(RHBP 2247)

**Verbascum thapsus* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2220)

**Veronica arvensis* L. – 1976, 1999 (RHBP 2182)

SOLANACEAE

**Datura stramonium* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2316)

**Lycopersicon esculentum* Mill. – 1976

**Solanum dulcamara* L. – 1976, 1999 (RHBP 2218)

**Solanum nigrum* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2336)

**Solanum physalifolium* Rusby – 1976

VIOLACEAE

Viola lanceolata L. – 1976, 1999 (RHBP 2178)

Viola sagittata Aiton – 1874, 1924

VITACEAE

Parthenocissus quinquefolia (L.) Planch. – 1924, 1948, 1999 (RHBP 2180); a few plants

*+*Parthenocissus tricuspidata* (Siebold & Zucc.) Planch. – 1930, 1948;
extirpated

LILIOPSIDA

COMMELINACEAE

**Commelina communis* L. – 1999 (RHBP 2425)

CYPERACEAE

Carex annectens E. P. Bicknell – 1999 (RHBP 2243)

**Carex contigua* Hoppe – 1924, 1948, 1976, 1999 (RHBP 2166)

Carex longii Mack. – 1924, 1948, 1976, 1999 (RHBP 2305)

Carex lurida Wahlenb. – 1999 (RHBP 2225)

Carex muhlenbergii Schkuhr ex Willd. – 1948

Carex scoparia Schkuhr ex Willd. – 1874

Carex silicea Olney – 1930, 1948

Carex stipata Muhl. ex Willd. – 1999 (RHBP 2263)

Carex straminea Willd. ex Schkuhr – 1874, 1930, 1999 (RHBP 2356)

Cyperus diandrus Torr. – 1999 (RHBP 2507)

Cyperus erythrorhizos Muhl. – 1976, 1999 (RHBP 2444)

Cyperus filicinus Vahl – 1999 (RHBP 2526)

Cyperus lupulinus (Spreng.) Marcks subsp. *macilentus* (Fernald) Marcks –
1874, 1948, 1999 (RHBP 2544)

Eleocharis acicularis (L.) Roem. & Schult. – 1874

Eleocharis palustris (L.) Roem. & Schult. – 1874, 1924, 1948

Eleocharis parvula (Roem. & Schult.) Link ex Bluff, Nees & Schauer –
1948, 1999 (RHBP 2361)

Scirpus maritimus L. – 1874, 1924, 1948

Scirpus pungens Vahl – 1874, 1924, 1948, 1999 (RHBP 2341); Fogg 486 and Moul 3339 are this species, although reported as *S. americanus* Pers. in keeping with the nomenclature of their days. Jordan listed *S. pungens* Vahl, the accepted name for this species then as it is now.

Scirpus tabernaemontani K. C. Gmelin – 1924, 1948, 1999 (RHBP 2369)

IRIDACEAE

*+*Iris* × *germanica* L. – 1948, 1976

Iris versicolor L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2205)

Sisyrinchium angustifolium Mill. – 1874, 1924, 1948, 1999 (RHBP 2329)

Sisyrinchium atlanticum E. P. Bicknell – 1976

JUNCACEAE

Juncus acuminatus Michx. – 1924, 1948, 1976, 1999 (RHBP 2457)

Juncus articulatus L. – 1930

Juncus bufonius L. – 1948

Juncus debilis A. Gray – 1924

Juncus dichotomus Elliott – 1930, 1948

Juncus effusus L. var. *pylaei* (Laharpe) Fernald & Wiegand – 1924, 1948, 1976, 1999 (RHBP 2338)

Juncus gerardii Loisel. – 1874, 1930, 1948, 1976

Juncus greenei Oakes & Tuck. – 1924, 1976, 1999 (RHBP 2287)

Juncus pelocarpus E. Mey. – 1874, 1999 (RHBP 2334)

Juncus tenuis Willd. – 1874, 1924, 1948, 1976, 1999 (RHBP 2337)

LILIACEAE

**Allium vineale* L. – 1999 (RHBP 2186)

*+*Asparagus officinalis* L. – 1924, 1948, 1976, 1999 (RHBP 2211)

*+*Lilium lancifolium* Thunb. – 1924

*+*Narcissus pseudonarcissus* L. – 1999 (RHBP 2153)

POACEAE

**Agrostis capillaris* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2312)

Agrostis hyemalis (Walter) Britton, Sterns & Poggenb. – 1999 (*Somers s.n.*, SPWH 8543)

Agrostis perennans (Walter) Tuck. – 1999 (RHBP 2301)

Agrostis stolonifera L. var. *palustris* (Huds.) Farw. – 1874, 1930, 1948, 1976, 1999 (RHBP 2308)

Ammophila breviligulata Fernald – 1874, 1930, 1948, 1976, 1999 (RHBP 2377)

Andropogon virginicus L. – 1999 (RHBP 2543)

**Anthoxanthum odoratum* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2164)

**Arrhenatherum elatius* (L.) J. & C. Presl – 1999 (RHBP 2231)

**Avena sativa* L. – 1924, 1948

**Bromus commutatus* Schrad. – 1948

**Bromus hordeaceus* L. – 1930

- **Bromus secalinus* L. – 1924
- **Bromus tectorum* L. – 1999 (RHBP 2159)
- **Dactylis glomerata* L. – 1924, 1948, 1976, 1999 (RHBP 2197)
- Danthonia spicata* (L.) F. Beauv. ex Roem. & Schult. – 1924, 1948, 1976, 1999 (RHBP 2246)
- Dichanthelium acuminatum* (Sw.) Gould & C. A. Clark var. *fasciculatum* (Torr.) Freckmann – 1924, 1948, 1976, 1999 (RHBP 2466)
- Dichanthelium acuminatum* (Sw.) Gould & C. A. Clark var. *lindheimeri* (Nash) Gould & C. A. Clark – 1999 (RHBP 2548)
- Dichanthelium clandestinum* L. – 1976
- Dichanthelium columbianum* (Scribn.) Freckman – 1924, 1948
- Dichanthelium dichotomum* (L.) Gould – 1874
- Dichanthelium meridionale* (Nash) Freckmann – 1930
- **Digitaria ischaemum* (Schreber) Muhl. – 1999 (RHBP 2541)
- **Digitaria sanguinalis* (L.) Scop. – 1874, 1976, 1999 (RHBP 2538)
- Diplachne maritima* E. Bicknell – 1999 (RHBP 2410)
- Distichlis spicata* (L.) Greene – 1930, 1976, 1999 (RHBP 2464)
- **Echinochloa crusgalli* (L.) P. Beauv. – 1874, 1930
- Elymus virginicus* L. – 1874 (Gull Island only), 1924, 1948, 1976, 1999 (RHBP 2381)
- **Elytrigia pungens* (Pers.) Tutin – 1999 (RHBP 2207)
- Elytrigia repens* (L.) Desv. ex B. D. Jackson – 1874, 1924, 1948, 1976, 1999 (RHBP 2254)
- **Festuca filiformis* Pourr. – 1976
- **Festuca ovina* L. – 1874, 1948, 1976, 1999 (RHBP 2174)
- **Festuca pratensis* Huds. – 1874, 1924
- Festuca rubra* L. – 1924, 1948, 1976, 1999 (RHBP 2214)
- **Holcus lanatus* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2235)
- **Lolium perenne* L. – 1999 (RHBP 2340)
- Panicum dichotomiflorum* Michx. – 1976, 1999 (RHBP 2449)
- Panicum virgatum* L. var. *spissum* Linder – 1930, 1948, 1976, 1999 (RHBP 2294)
- Paspalum setaceum* Michx. – 1948
- Phalaris arundinacea* L. – 1999 (RHBP 2270)
- **Phleum pratense* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2256)
- **Poa annua* L. – 1874, 1976, 1999 (RHBP 2314)
- Poa palustris* L. – 1874, 1999 (RHBP 2357)
- **Poa pratensis* L. – 1874, 1924, 1948, 1976, 1999 (RHBP 2173)
- **Poa trivialis* L. – 1999 (RHBP 2209)
- Puccinellia maritima* (Huds.) Parl. – 1874
- Schizachyrium scoparium* (Michx.) Nash – 1948, 1999 (RHBP 2555)
- **Setaria glauca* (L.) P. Beauv. – 1874, 1976
- **Setaria viridis* (L.) P. Beauv. – 1874
- Spartina alterniflora* Loisel. – 1874, 1924, 1948, 1976
- Spartina patens* (Aiton) Muhl. – 1874, 1924, 1948, 1999 (RHBP 2373)

RUPPIACEAE

- Ruppia maritima* L. – 1874, 1948

SMILACACEAE

Smilax rotundifolia L. – 1924, 1999 (*RHBP* 2394); one patch 2–3 m in diameter, perhaps a single plant; not seen to flower

SPARGANIACEAE

Sparganium eurycarpum Engelm. *ex* A. Gray – 1999 (*RHBP* 2482)

TYPHACEAE

Typha latifolia L. – 1924, 1948, 1976, 1999 (*RHBP* 2330)

ZOSTERACEAE

Zostera marina L. – 1874, 1924, 1948, 1976, 1999 (*RHBP* 2274)



Backus, Richard H. et al. 2002. "The flora of Penikese Island, Massachusetts: The fifth survey (1998-1999), with emphasis on the woody vegetation." *Rhodora* 104, 219–252.

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