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LAKESHORES IN THE TUSKET RIVER VALLEY, NOVA SCOTIA: DISTRIBUTION AND STATUS OF SOME RARE SPECIES, INCLUDING *COREOPSIS ROSEA* NUTT. AND *SABATIA KENNEDYANA* FERN.

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ABSTRACT

The Tusket River valley in southwestern Nova Scotia has many rare Atlantic coastal plain plant species. Sixteen lakes were examined for some specific rare shoreline plants: seven lakes through which the Tusket River flows and nine similar-sized lakes adjacent to or discharging into the Tusket River. The seven Tusket River lakes had significantly more rare species ($P = 0.01$): the richest shoreline floras occurred lowest in the watershed ($P < 0.02$). Two environmental factors which could produce these distributions are water level fluctuations associated with the Tusket River and presence of different glacial tills. Shoreline species such as *Coreopsis rosea* and *Sabatia kennedyana* are threatened by the disruptive effects of cottage development and all-terrain vehicle use.

Key Words: Conservation, rare plants, *Coreopsis rosea*, *Sabatia kennedyana*, shorelines, wetlands, Tusket River, Nova Scotia

INTRODUCTION

The southwestern portions of Nova Scotia have long been known to support a rich flora disjunct from the Atlantic coastal plain of the eastern United States (Fernald 1921, 1922; Roland and Smith, 1969). Many of these species are considered rare and/or threatened in Nova Scotia and Canada (Maher et al., 1978). Some, such as *Coreopsis rosea* Nutt. (Compositae) and *Sabatia kennedyana* Fern. (Gentianaceae) are restricted to only a few lakeshores in Yarmouth County, apparently those specifically associated with the Tusket River.

The within-lake distributions of shoreline species in this river valley are the subject of ongoing ecological studies (Keddy, 1984 a, b). The distribution among lakes, however, was known only from scattered herbarium collections. It was important to locate concentrations of these species for future ecological studies and for conservation planning; the objective of this study was, therefore, to describe the distributions of these rare shoreline species in more detail.

METHODS

Field work was conducted during August 10–20, 1982, while canoeing from South Wallace Lake to Gavels Lake (*see* map, Figure 1). Since it was not possible in the time available to inventory fully the flora of each lake, two observers searched for two groups of target species: (i) some coastal plain species considered by Maher et al. (1978) to be rare or threatened in Nova Scotia, and (ii) typical shoreline species with wide distributions in eastern Canada (Table 1).

Where possible, the entire perimeter of each lake was examined using a canoe. When a lake was explored on foot instead, at least a kilometer of shoreline was carefully explored, paying particular care to visit both sheltered and exposed shorelines. Although species may have been missed, in those lakes which were fully inventoried, the first kilometer of shoreline usually revealed the presence or absence of all target species in that lake.

On lakes where *Coreopsis rosea* or *Sabatia kennedyana* were found, the entire shoreline was examined. Population size was estimated by counting the number of flowering stalks. Since both species had vigorous vegetative reproduction, and since many shoots in each population were not flowering, these data were only a crude measure of population size. It does, however, quantify the geographical distribution more accurately than simply presence or absence on a particular lake.

Species nomenclature follows Roland and Smith (1969). Statistical tests were carried out according to Siegel (1956).

RESULTS

Table 1 compares the shoreline floras of the lakes examined. There were significantly more rare Atlantic coastal plain species (Table 1, $P = 0.01$) on the Tusket River lakes. The other shoreline species occurred on all lakes. Within the Tusket River lakes, the number of rare species decreased with distance upstream (Spearman rank correlation coefficient corrected for ties, $n = 7$, $r_s = 0.93$, $p < 0.02$). Wilson's Lake had the richest shoreline flora and was the only lake with *Hydrocotyle umbellata* (*see also* Roland, 1980).

Figures 1 and 2 show the known Canadian distributions of *Sabatia kennedyana* and *Coreopsis rosea*. Both are largely restricted to the lower portions of the Tusket River basin. In addition, these maps show two populations (Fanning Lake, Salmon Lake) which

are outside the Tusket River system; they were located later but are included here for completeness.

Figures 3 and 4 show the previously known distributions of these species based on herbarium specimens. Both once occurred on the shores of the lower lakes of the Tusket River, but apparently were eliminated when these lakes were turned into reservoirs for the Tusket Falls hydroelectric generating station. The specimen of *S. kennedyana* from Canoe Lake (Figure 3) was surprising since there appeared to be little suitable habitat there. The area which seemed most similar to other shorelines with *S. kennedyana* has several cottages adjacent to it; no *S. kennedyana* was found there.

DISCUSSION

It is difficult to explain the distribution of shoreline species in this region of Yarmouth County. The origin of Atlantic coastal plain species in southwestern Nova Scotia has been discussed by Roland and Smith (1969) and Holland (1981), but environmental factors influencing their present distributions have received less attention. Fluctuating water levels and glacial till may both be important.

Lakes in the Tusket River system have wide fluctuations in water level both within and among years, as shown by fluctuations in the water levels of the Tusket River (Figure 5). Occasional high water periods may eliminate shrubs which would otherwise dominate the shoreline. Shrubs have a major effect on the distribution of shoreline plants (Keddy, 1983), and more than a century ago Thoreau (1854) described how high water periods kill woody plants and produce open habitat on lakeshores in New England. Lakes without water level fluctuations often have little open habitat between shrubs and water line. The lakes associated with the Tusket River all had broad littoral zones. Keddy and Reznicek (1982) have found that water level fluctuations were associated with the presence of coastal plain species on Ontario lakes.

Southwestern Nova Scotia has a complex glacial history (Grant, 1977, 1980), and at least two till types can be found on lakeshores. One till has many large angular boulders of the surrounding greywacke of the Goldenville formation. The other till has rounded stones and gravels from the Caledonian igneous complex of New Brunswick. This latter till produces gently-sloping sand and gravel shorelines. *Coreopsis rosea, Hydrocotyle umbellata* and *Sabatia*

Table 1a. Shoreline species found on lakes associated with the Tusket River in Yarmouth County, Nova Scotia.

		Lakes Visited[1]						
		Tusket River						
Species		Bennetts	Wilsons	Gillfillan	Third	Pearl	Travis	South Wallace
(i)[2]	*Hydrocotyle*[3] *umbellata*		√					
	Coreopsis rosea[3]	√	√					
	Habenaria flava	√	√	√				
	Eupatorium dubium	√	√	√				
	Sabatia kennedyana[4]	√	√	√	√	√	√	
	Panicum longifolium	√	√	√	√	√	√	
(ii)[5]	*Nymphoides cordata*	√	√	√	√	√	√	√
	Eriocaulon septangulare	√	√	√	√	√	√	√
	Lobelia dortmanna	√	√	√	√	√	√	√
	Lysimachia terrestris	√	√	√	√	√	√	√

[1]Lowermost to uppermost within watershed (left to right) within each group (see maps); lakes below Bennett's are hydroelectric reservoirs with very little shoreline vegetation and are therefore not included.

[2]Atlantic coastal plain species rare in Nova Scotia (Maher et al., 1978); Mann-Whitney U Test (Siegel, 1956), one-tailed, $n_1 = 7$, $n_2 = 9$, $U = 9$, $P = 0.01$.

[3]Endangered in Canada

[4]Threatened in Canada

[5]Some widespread shoreline species

Table 1b. Shoreline species found on lakes associated with the Tusket River in Yarmouth County, Nova Scotia.

		Lakes Visited[1]								
					Other					
	Species	Clear-water	Mill	Kege-shook	Canoe	Rushy	Kempt Snare	Beaver-house	Sun-day	Chur-chills
(i)[2]	*Hydrocotyle*[3] *umbellata*									
	Coreopsis rosea[3]									
	Habenaria flava			√						
	Eupatorium dubium			√						
	Sabatia kennedyana[4]			√						
	Panicum longifolium			√				√		
(ii)[5]	*Nymphoides cordata*	√	√	√	√	√	√	√	√	√
	Eriocaulon septangulare	√	√	√	√	√	√	√	√	√
	Lobelia dortmanna	√	√	√	√	√	√	√	√	√
	Lysimachia terrestris	√	√	√	√	√	√	√	√	√

kennedyana are all most abundant on, and largely restricted to, sand and gravel shorelines.

The anomalous rich flora in Kegeshook Lake is consistent with both of the above proposals since this lake had (1) broad littoral zones, suggesting past water level fluctuations, and (2) extensive sand and gravel shorelines.

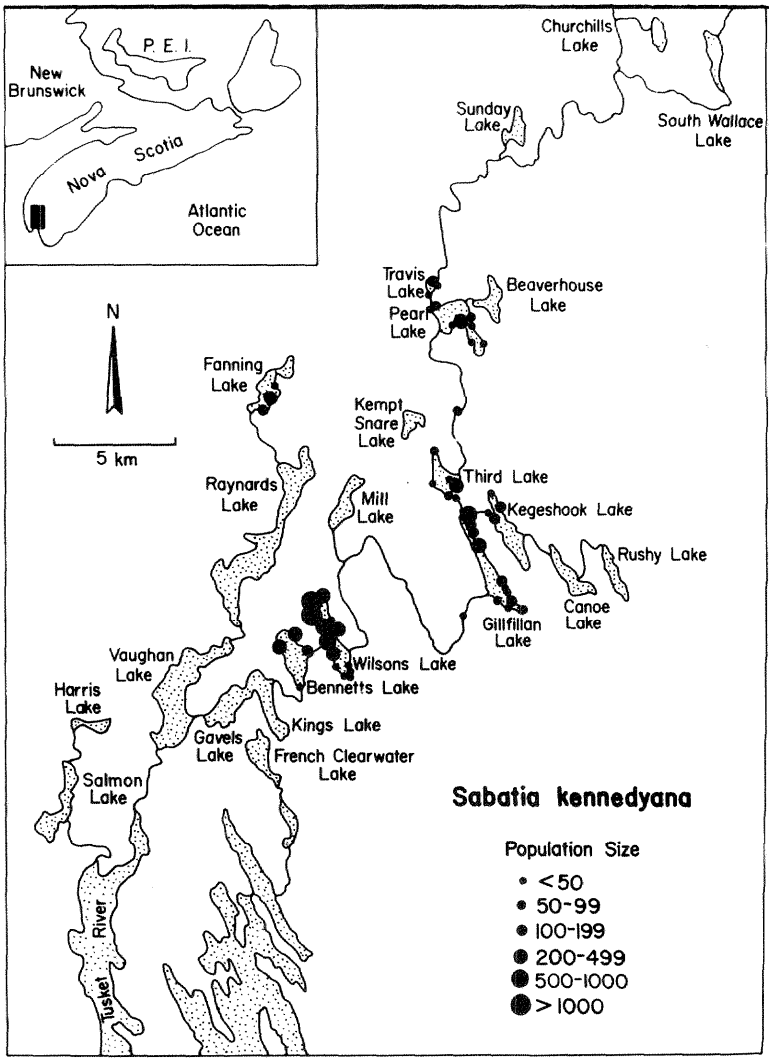

Figure 1. *Sabatia kennedyana* populations in Canada. Lake names follow Tusket 1:50,000 topographic map, Canada Department of Energy, Mines and Resources, 1976. The lowest two water bodies shown are brackish or salt water.

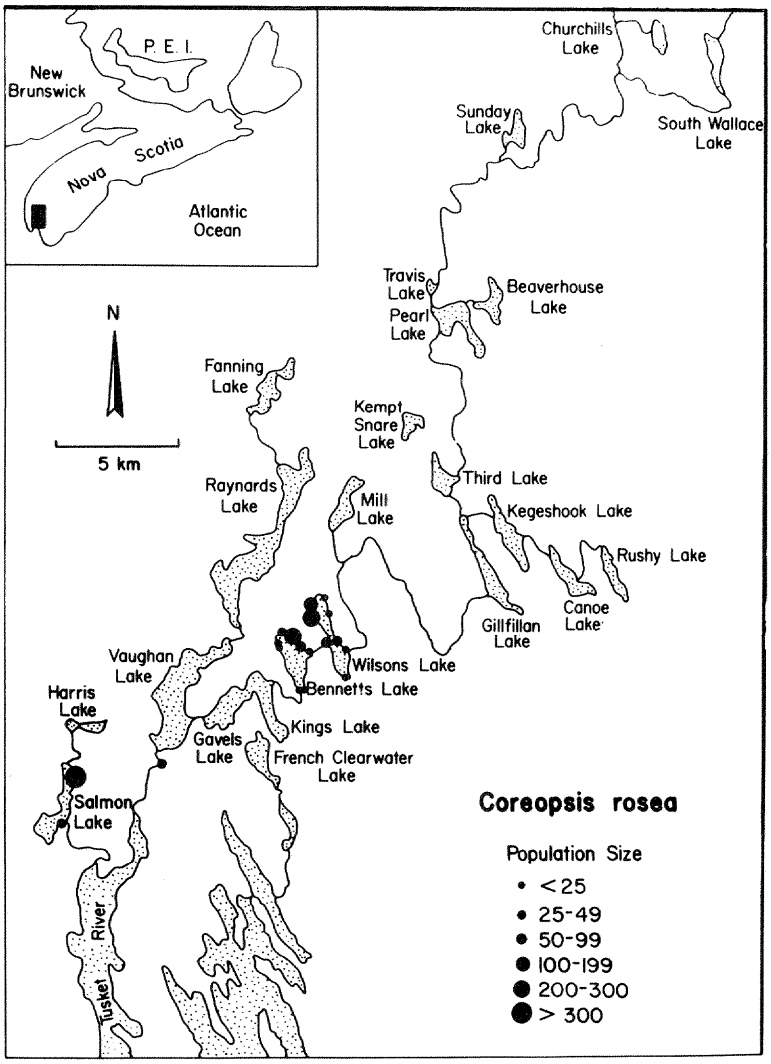

Figure 2. *Coreopsis rosea* populations in Canada.

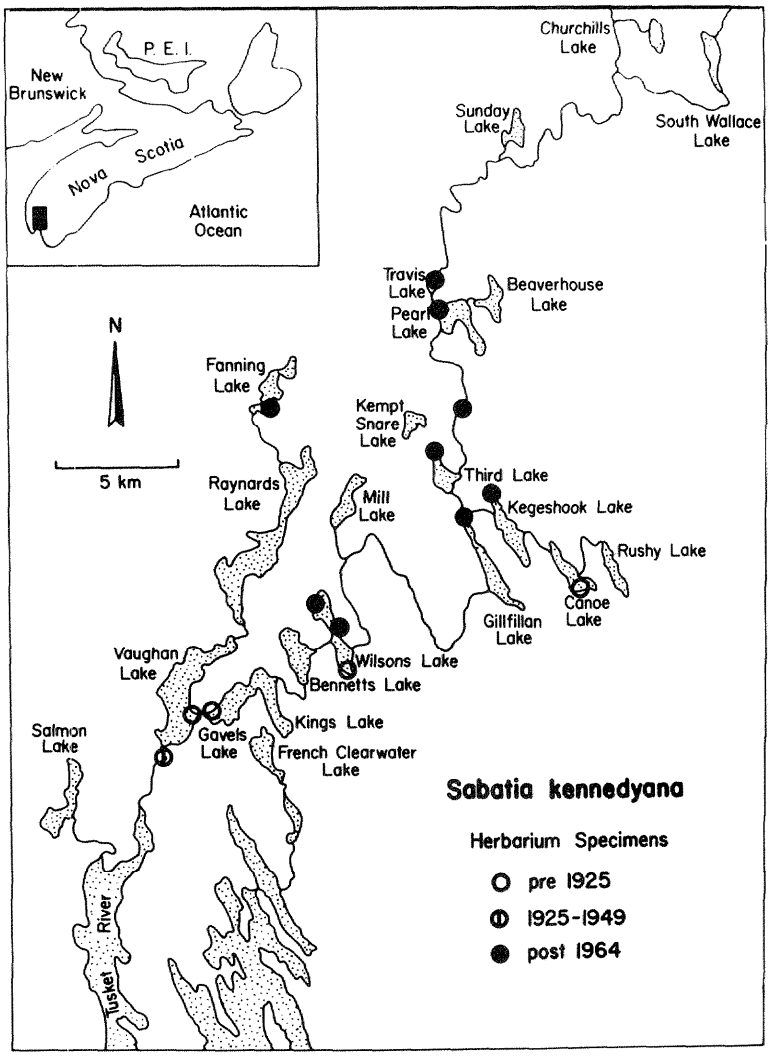

Figure 3. Past and present distribution of *Sabatia kennedyana* based on herbarium specimens (Courtesy of C. J. Keddy; herbaria consulted were ACAD, CAN, DAL, DAO, GH, NSAC, NSPM, TRT, US).

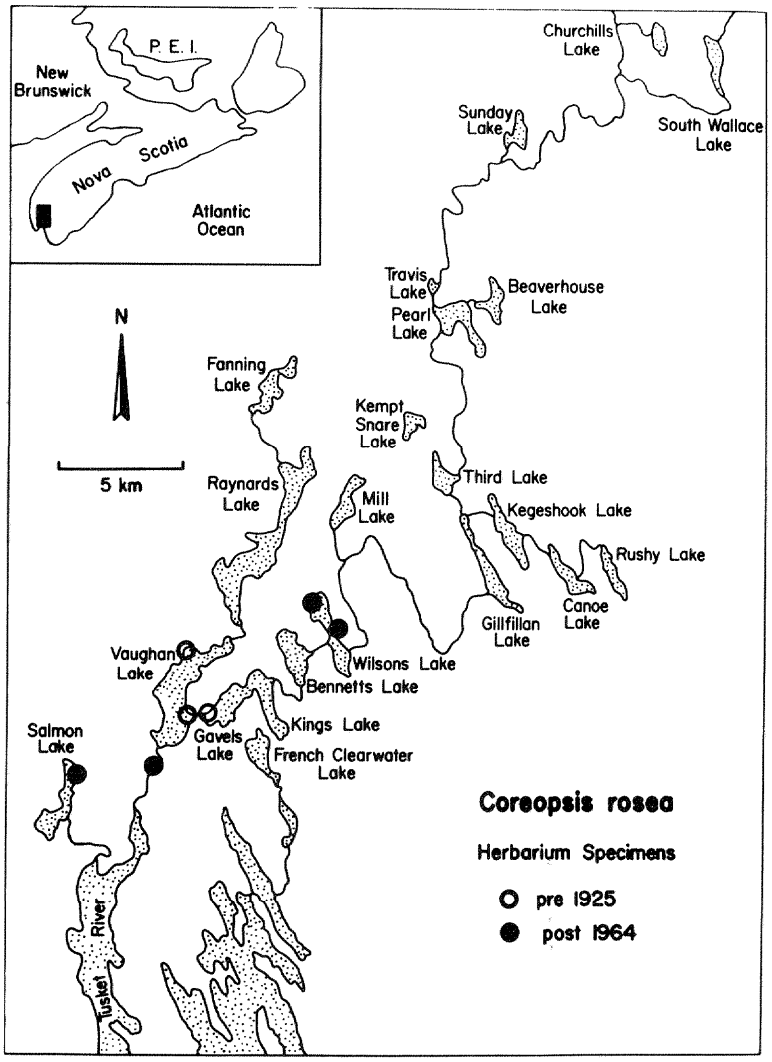

Figure 4. Past and present distribution of *Coreopsis rosea* based on herbarium specimens (Courtesy of C. J. Keddy; herbaria as in Figure 3).

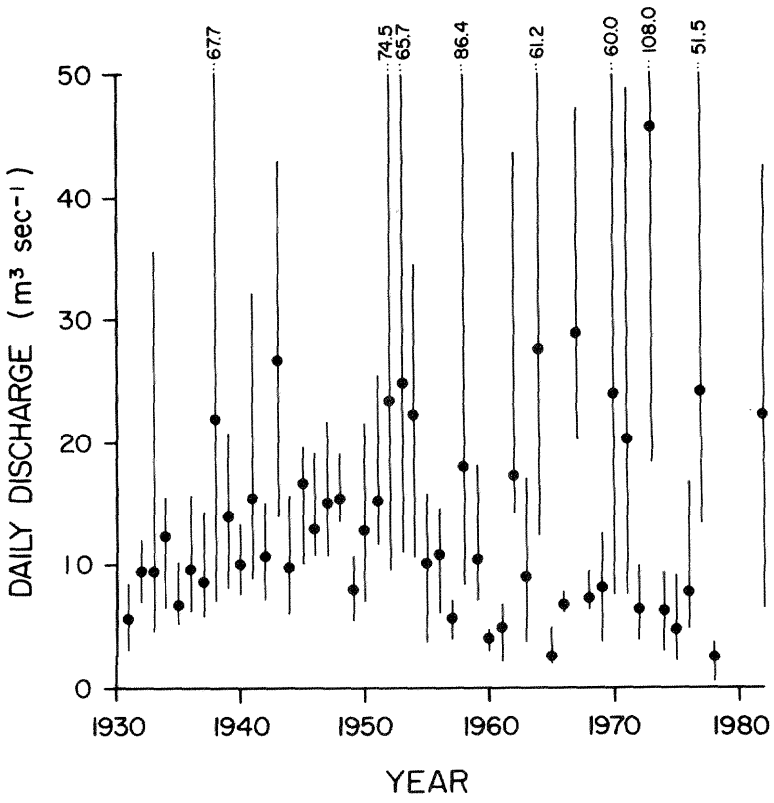

Figure 5. Water levels in the Tusket River measured just upstream from Wilson's Lake (means and range for August by year). Note fluctuations within and among years. (Data from station no. 01EA003 courtesy of the Inland Waters Directorate, Environment Canada).

STATUS OF FLORA

Older records (Fernald, 1921, 1922; Roland and Smith, 1969) indicate that these species were always rare in Nova Scotia, but habitat loss from human activity is now a growing threat. Raynards, Vaughan, Gavels and Kings Lake are now hydroelectric reservoirs, and species such as *Sabatia kennedyana* and *Coreopsis rosea* have apparently disappeared from them. Bennetts, Wilsons, Gillfillan,

Kegeshook and Pearl Lakes are all being developed for cottages. Cottages not only lead to trampling, but vegetation is sometimes deliberately eliminated to provide swimming areas. All-terrain vehicles are causing increasing damage, and several *S. kennedyana* populations seen in 1982 were heavily damaged by 1984. Table 1 shows that Wilsons Lake should receive the highest priority in protecting a representative example of coastal plain vegetation in Nova Scotia. The Gillfillan-Kegeshook area also deserves consideration; although *C. rosea* and *Hydrocotyle umbellata* do not occur here, a wide range of vegetation types with other coastal plain species is represented.

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