Investigations of the Marine Algae of Nova Scotia. X. Distribution of *Fucus Serratus* L. and Some Other Species of *Fucus* in The Maritime Provinces*

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Abstract

The distribution of *Fucus serratus* in the Maritime Provinces has changed markedly during the past century. It is now common in the Northumberland Strait, eastern Prince Edward Island, Cape Breton I. and the Tusket I. area. The most common and abundant species of *Fucus* in the Maritime Provinces is *F. vesiculosus* which is found in a wide variety of habitats. Other species of *Fucus* found in this area are *F. edentatus*, *F. distichus* ssp. *distichus* and ssp. *evanescens* and *F. spiralis*. These species are widely distributed but only locally abundant and usually restricted to specific habitats.

Seven species of Fucus have been recorded from the east coast of North America as occurring in the Atlantic Provinces (Taylor 1957, South and Cardinal 1970). None of these species is endemic to the western Atlantic. Powell (1957) has suggested that *F. edentatus* Pyl., *F. evanescens* C. Ag. and *F. filiformis* Gmel. are subspecies of *F. distichus* L., and this has been generally accepted (Parke and Dixon 1968, South and Cardinal 1970). The validity of *F. miclonensis* Pyl. is doubtful, and it was recently merged with *F. distichus* ssp. *distichus* (Lee 1968). Distributional records for the Maritime Provinces were provided by Bell and MacFarlane (1933*a*, *b*), MacFarlane and Bell (1933) and MacFarlane (1952). Colinvaux (1970) recorded the species of *Fucus* in New Brunswick along the shores of both the Northumberland Strait and the Bay of Fundy. General floristic accounts inclusive of species of *Fucus* are available for Halifax Co. (Edelstein and McLachlan 1966), the Digby Neck area (Edelstein *et al.* 1970) and Newfoundland (Lee 1968).

During the past several years we have made extensive collections throughout the Maritime Provinces (Fig. 1 and Table I), and it is now possible to present updated distributional records for the species of *Fucus*. We have been especially interested in *F. serratus* which has a very restricted distribution. *F. vesiculosus* is certainly the most common and widely distributed species in our area whereas

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*F. edentatus** is more restricted although locally abundant. *F. spiralis*, *F. distichus* ssp. *distichus* and ssp. *evanescens* are confined to specific, isolated habitats.

Fucus serratus L.

In Europe, *F. serratus* is a common and abundant alga. In North America, it is found only in the Maritime Provinces, especially in Nova Scotia and Prince Edward Island. This is the only species of *Fucus* for which there are records of major changes in distribution. Robinson (1903) postulated that *F. serratus* was introduced from Europe in ballast, possibly around the turn of the 19th century, although it was not recorded by Harvey during his visit to the Maritimes in 1850. The first collections were made at Pictou on the Northumberland Strait in 1869 (Hay and MacKay 1887), and by 1886 plants were common around Pictou and Pictou Island (near Site 11, Fig. 1).

Robinson's extensive survey of *F. serratus* in 1903 revealed a dense population which extended from Pugwash Harbour (Site 8) eastward for 250 miles to Eastern Harbour (Cheticamp, Site 27) Cape Breton I. The plants penetrated the Strait of Canso as far as Mulgrave, but were apparently absent from the Cape Breton shore of the Strait. Robinson failed to locate any specimens along the New Brunswick coast of the Northumberland Strait, and found only an isolated population in Prince Edward Island, at Murray Harbour (near Site 109). He concluded that *F. serratus* was absent from the Bay of Fundy and the Atlantic coast of Nova Scotia. In 1907, Robinson also reported *F. serratus* as absent around Canso (Site 65).

Bell and MacFarlane (1933) completed their survey of the Maritime Provinces in 1931 which revealed that the distribution of *F. serratus* had extended considerably beyond that reported earlier by Robinson (1903, 1907). The reported range in 1931 included the entire mainland shore of the Northumberland Strait to Miramichi Bay, the west shore of Cape Breton I. to Cape St. Lawrence (near Site 29), and an isolated population on the Atlantic coast just south of Ingonish (Site 36); it was apparently absent in Chedabucto Bay. They also reported this species as relatively abundant all around Prince Edward Island (see their map 5, p. 277). Roscoe (1931) did not record *F. serratus* in her survey of St. Paul's I. In 1948 MacFarlane (1952) noted this species in a limited area in the Tusket Islands, Yarmouth Co. (Site 92), and in 1954 she found the alga near Canso in eastern Guysborough Co. (MacFarlane and Milligan 1966).

Our recent observations show that changes in the distribution of *F. serratus* have occurred during the past several decades. Contrary to the report of Bell and MacFarlane (1933), we have not encountered *F. serratus* along the New Brunswick shore of the Northumberland Strait except for a few scattered plants at Cadman Point (Site 4); proceeding eastward an extensive population was first noted around Coldspring Head (Site 7). Our observations are confirmed by those of Colinvaux (1970) and A.R.A. Taylor (private communication). Possibly the sandy to muddy substrata together with the considerable outflow of freshwater, render this area unfavourable for *F. serratus*. This species has

*We refer herein to this taxon as a separate species based on other considerations (Edelstein and McLachlan, unpublished).

also been reported from the Gaspé and Bay of Chaleur (Gauvreau 1956) but not by Cardinal (1967) who considers the previous identifications to be in error.*

In agreement with previous reports, including more recent observations by MacFarlane (1965), we found *F. serratus* continuously along the Northumberland Strait in Nova Scotia and the west shore of Cape Breton I. The known range can now be extended around Cape North and along the eastern shore of the Island to White Point (Site 32). At this locality the alga was replaced by dense beds of *F. distichus* ssp. *evanescens*. *F. serratus* reappeared around Ingonish and extended southward to Whelan Point (Site 47). Thereafter the density of this species was much less and only a single specimen was found amongst dense beds of ssp. *evanescens* at Mira Bay (Site 50). The Atlantic coast of Cape Breton I. is not only extremely exposed, but subject to erosion by ice throughout the winter. Moreover, the shore is often steep and the littoral zone narrow. Beds of *F. serratus* in this area were usually confined to the sublittoral and ranged from just below low water to 4 to 5 m. Between sites 36 and 40 (Table I) the shore is of rolling stones, and the population of *F. serratus* was some distance offshore. Previously we recorded this species in Bras d'Or Lake from the entrance of Great Bras d'Or Channel to a point near Baddeck (McLachlan and Edelstein 1971).

F. serratus presently occurs along both shores of the Strait of Canso and is relatively abundant throughout Chedabucto Bay. We have not observed the alga along the Atlantic coast of Nova Scotia beyond the Canso area, and conclude that little westward movement has taken place during the past 2 decades. We noted a large luxuriant population of *F. serratus* in St. Peter's Bay, but failed to locate the alga from a point near L'Ardoise (Site 55) eastward to Mira Bay. Thus *F. serratus* has spread along the Atlantic shore of Cape Breton I. both southward from Cape North and eastward from the Strait of Canso. The population may eventually become continuous around Cape Breton I.

We have been unable to confirm the report of Bell and MacFarlane (1933*a*) that *F. serratus* encircles Prince Edward Island. We did find a contiguous population from Cable Head (Site 115) to East Point (Site 111) and thence westward to Cape Egmont (Site 128). There was no evidence of the alga along the north shore west of Cable Head to North Point (Site 123) and southward to Egmont Bay (Sites 127 to 128). Extensive underwater surveys in this area have been made by D.J. Scarratt and his associates who confirm our observations (private communication). In addition A.R.A. Taylor and L.A. Hanic have studied sublittoral communities within this region and they too have failed to record *F. serratus* (private communications). We are unable to offer a satisfactory explanation for the apparent disappearance of *F. serratus* from the western portion of the province where it had been reported as relatively abundant (Bell and MacFarlane 1933*a*). Freshwater run-off in this area is negligible and the substratum is generally firm and supports commercial quantities of *Chondrus crispus* Stackh.

*A report by O.A. Doiron and R. Branch [Final report on northern New Brunswick Irish moss survey. Project No. 402-72. Dept. of Fisheries and Environment. Fisheries Development Branch, Caraquet, N.B. 1972. (mimeographed),] circulated after this paper was submitted for publication, states that *F. serratus* is present off Miscou I., Caraquet I., and Blue Cove in the Bay of Chaleur.

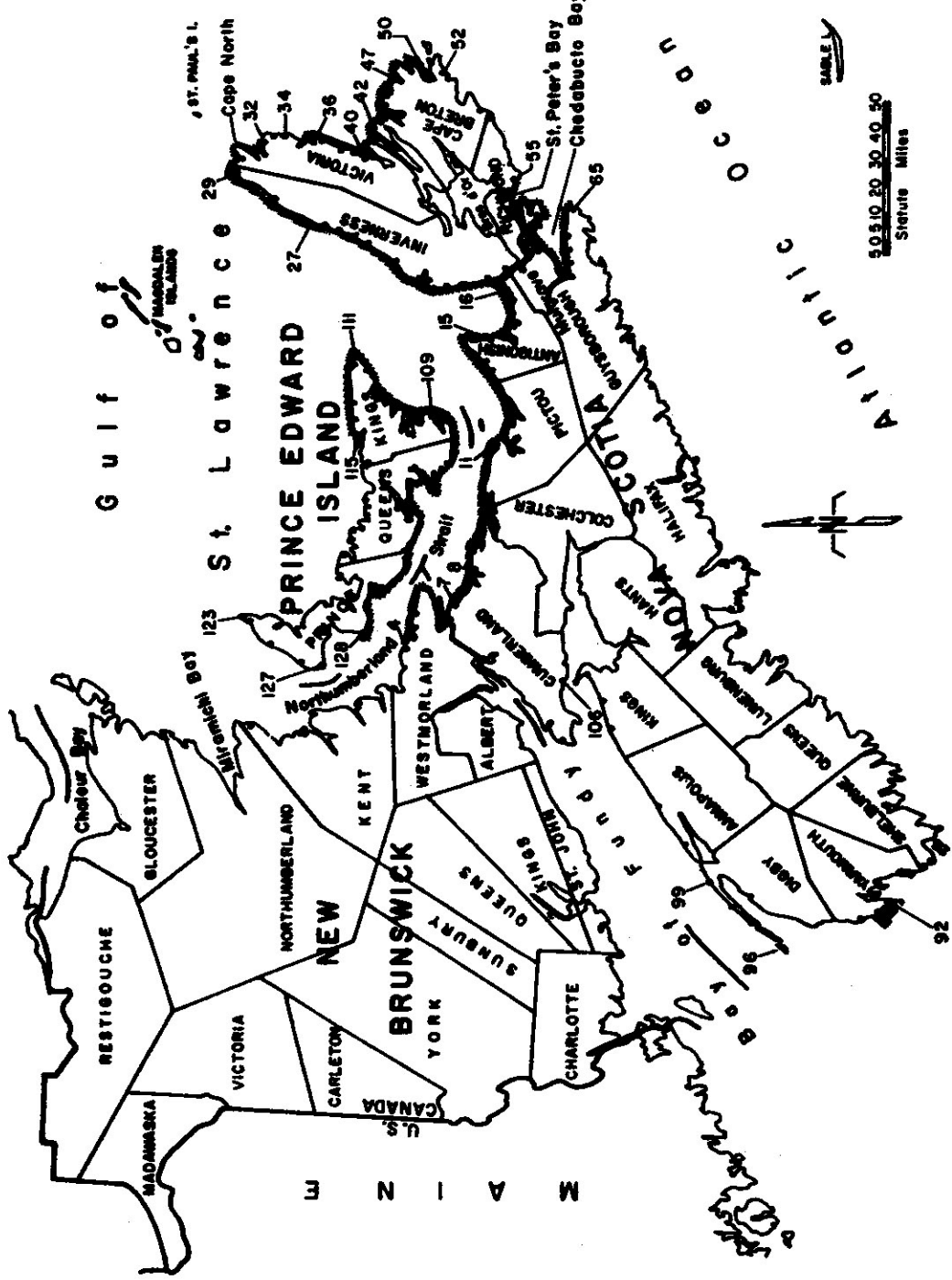

Fig. 1. Location of collecting sites in the Maritime Provinces as referred to in Table I. The present distribution of *F. serratus* is shown by stippling.

Table I
Locations of Collecting Sites

Northumberland Co., N.B.:
1. Point Sapin
2. Richibucto Head
3. Cocagne Head

Westmorland Co., N.B.:
4. Cadman Point
5. Murray Beach

Cumberland Co., N.S.:
6. Tidnish Dock
7. Coldspring Head
8. Pugwash
9. Malagash Point

Pictou Co., N.S.:
10. Cape John
11. Caribou Island
12. Merigomish Island

Antigonish Co., N.S.:
13. Arisaig
14. Georgeville
15. Lakevale
16. Cape Jack

Inverness Co., N.S.:
17. Troy Beach
18. Long Point
19. Ragged Point
20. Port Hood
21. Mabou Beach
22. Green Point
23. Inverness
24. Chimney Corner
25. Cap Le Moyne
26. Grand Etang
27. Cheticamp
28. Pleasant Bay
29. Meat Cove

Victoria Co., N.S.:
30. Bay St. Lawrence
31. South Harbour
32. White Point
33. New Haven
34. Black Brook
35. Ingonish, North Bay
36. Ingonish, South Bay
37. Wreck Cove
38. Little River Cove
39. North Shore
40. Indian Brook
41. Tablehead

Cape Breton Co., N.S.:
42. Point Aconi
43. Florence
44. Sydney Mines
45. New Victoria
46. Lingan
47. Whelan Point
48. MacDonald Point
49. Cow Bay
50. Mira Bay
51. Main à Dieu
52. Louisburg
53. Belfry Lake

Richmond Co., N.S.:
54. Fourchu
55. L'Ardoise
56. Rockdale
57. Bay of Rocks
58. Creighton Island
59. Janvrin Island

Guysborough Co., N.S.:
60. Cape Argos
61. Dort's Cove
62. Peas Brook
63. Queensport
64. Half Island Cove
65. Canso
66. Whitehead
67. Tor Bay
68. Country Harbour
69. Port Bickerton

Halifax Co., N.S.:
70. Moosehead
71. Owl's Head

72. Clam Bay
73. Martinique Beach
74. Lawrencetown
75. Cow Bay
76. Black Rock, Halifax Harbour
77. Herring Cove
78. Portuguese Cove
79. Gill Cove
80. Ketch Harbour
81. Fink Cove
82. Polly Cove
83. Peggy Cove
84. Paddy Head

Lunenburg Co., N.S.:
85. Bayswater
86. New Harbour
87. Lunenburg

Shelburne Co., N.S.:
88. Stoney Island
89. West Head
90. Lower Wood Harbour

Yarmouth Co., N.S.:
91. St. Ann Point
92. Tusket Island
93. Pinkney Point
94. Chebogue Point
95. Chegoggin Point

Digby Co., N.S.:
96. Pond Cove, Brier Island
97. Tommy Beach
98. Sandy Cove
99. Gulliver's Cove

Annapolis Co., N.S.:
100. Delap Cove
101. Port George

King's Co., N.S.:
102. Harbourville
103. Hall's Harbour
104. Scots Bay
105. Cape Split

Colchester Co., N.S.:
106. Ramshead River
107. Spicer's Cove

Kings Co., P.E.I.:
108. Guernsey Cove
109. Cody Point
110. Red Point
111. East Point
112. North Lake
113. Shipwreck Point
114. Swallow Point
115. Cable Head
116. Savage Harbour

Queens Co., P.E.I.:
117. Dalvay
118. Stanhope
119. Brackley
120. Rustico
121. Cavendish
122. Tryon Head

Prince Co., P.E.I.:
123. North Point
124. Nail Pond
125. Cape Gage
126. Cape Wolfe
127. West Point
128. Cape Egmont - Red Head
129. Sea Cow Head

Queens Co., P.E.I.:
130. Point Prim
131. Bell Point

In our survey of the Magdalen Islands, Gulf of St. Lawrence (unpublished results), we did not encounter *F. serratus*, despite an abundance of other species typical of the Gulf, including *C. crispus*. Cardinal (1966) also did not list *F. serratus* amongst the species he examined from these islands.

The apparent stability of the population of *F. serratus* in the Tusket I. area is one of the more surprising facts to arise from our investigation. The extent of *F. serratus* here was determined more than 20 years ago, and our obser-

vations suggest there has been relatively little subsequent migration. We do not know how *F. serratus* was introduced into southwestern Nova Scotia but it is reasonable to assume that it came from the Gulf of St. Lawrence.

Apart from the areas already mentioned, there is no evidence of the presence of *F. serratus* at other localities in eastern North America. It was reported once from Newburyport, Mass. during the last century (Farlow 1891). The specimens were either erroneously identified, or the population never became established.

Fucus vesiculosus L.

This is the most common species of *Fucus* in the Maritime Provinces and occurs in a wide variety of habitats, from exposed rocky shores to very protected muddy salt marshes (McLachlan and Edelstein 1971). The morphology of the plants is extremely variable, and well-developed vesiculate specimens were abundant only on the open, rocky coast. In general this species occupied the zone above *Ascophyllum nodosum* (L.) Le Jolis in protected sites and above *F. edentatus* in exposed areas where the latter was present. *F. vesiculosus* was always found associated with *F. serratus* although generally higher in the intertidal zone. On gently sloping shores the two species were frequently intermixed, especially in shallow tide pools. Specimens of *F. vesiculosus* in the Gulf of St. Lawrence were poorly developed and morphologically different from those along the Atlantic coast and the Bay of Fundy. At some sites along the west shore of Cape Breton I. only, we found a narrow form of *F. vesiculosus* somewhat similar to f. *limicola* Coll. described from muddy and salt-marsh habitats (Taylor 1957). In St. George's Bay (Sites 15 to 16), v. *sphaerocarpus* J. Ag. and v. *spiralis* Farl. were collected in addition to specimens similar to f. *gracillimum* Coll.

Fucus edentatus Pyl.

F. edentatus was common along the Atlantic Coast of Nova Scotia from Canso to Lunenburg Co. in the mid-littoral zone to about 3 m below low water. This species favoured an exposed rocky shore with a gentle slope, and disappeared whenever the rock gave way to sandy or muddy substrata. Well-developed populations were recorded in western Halifax Co. and plants up to 0.6 m in length have been noted (Edelstein and McLachlan 1966). In the Bay of Fundy a dense cover of this fucoid has been reported for Digby Neck (Sites 96 to 99) and New Brunswick (Edelstein *et al.* 1970, Colinvaux 1970). It was absent from protected, muddy areas, as around the head of the Bay. Even where a solid substratum was present, as along the Parrsboro shore (e.g. Site 106), this species was rare or seemingly absent, possibly because of the large amount of silt. Apart from a few doubtful specimens, we did not find *F. edentatus* either in the Northumberland Strait or around Cape Breton I. It was also apparently absent from the Yarmouth area where *F. serratus* was common. The different pattern of distribution may result from differences in exposure although competition cannot be excluded as a factor.

Fudus distichus L. ssp. **distichus**

This sub-species was confined to rock pools high in the littoral zone and therefore showed a rather discontinuous pattern of distribution. On the Atlantic coast well-developed populations were common in Halifax Co. (Table 1). We did not encounter the alga north of Louisburg (Site 52) although it was reported from St. Paul's I. (Roscoe 1931). Isolated, small groups of plants were found along Digby Neck (Edelstein *et al.* 1970). A detailed ecological study (Edelstein *et al.* unpublished) showed that morphological features of ssp. *distichus* were modified by depth of the pool, degree of exposure, etc. The apparent absence of this species along the Northumberland Strait may be due to lack of suitable habitats and to ice erosion.

Fucus distichus ssp. **evanescens** (C.Ag.) Powell

Our information on this subspecies is meagre. It has been recorded as abundant along the Atlantic coast of Nova Scotia (MacFarlane and Milligan 1966), but we have seldom encountered large populations except in Shelburne and Yarmouth Co. This subspecies does not seem to coexist with *F. serratus*. Ssp. *evanescens* was usually found in protected habitats and was locally common even in salt marshes. Lack of stable substrata is apparently not a limiting factor in distribution for sizeable plants were noted in sandy as well as muddy areas.

Fucus spiralis L.

This species was restricted to exposed, rocky shores; it was usually found in depressions that provided protection from direct surf action. *F. spiralis* occupied a narrow band in the extreme upper littoral zone above *F. vesiculosus*. It also occurred at sites with *F. serratus*, in which case the zonation was similar to that described for the British Isles (Burrows and Lodge 1953). In general *F. spiralis* was relatively uncommon, and even when present was represented by few specimens; in the Maritimes we noted the best-developed populations in Halifax Co. Under extreme conditions of surf action dwarf forms were found. Like *F. distichus* ssp. *distichus*, *F. spiralis* was absent in areas of gravel, sand and mud.

Summary

There has been an extensive spread of *F. serratus* throughout the Northumberland Strait, eastern Prince Edward Island and around Cape Breton I. since it was first noted at Pictou about a century ago. Significant changes in the distributional pattern have occurred in the last 40 years. These include not only the population of new areas, but ostensibly the disappearance of the species from extensive areas of western Prince Edward Island and the New Brunswick shore of the Gulf of St. Lawrence. The disappearnace of *F. serratus* from these areas is rather surprising and difficult to explain. According to Miss C.I. MacFarlane (private communication) there is no doubt that the 1933 distribution map (Bell and MacFarlane 1933*a*) was prepared accurately. The spread of

species along the Atlantic coast has been slow, and the population on the Tusket I. seems to be stable. Quite probably *F. serratus* will colonize areas presently unoccupied. Transplant experiments may help elucidate some of the problems of this species along the Atlantic coast has been slow, and the population in the Tusket I. area seems to be stable. Quite probably *F. serratus* will colonize areas presently unoccupied. Transplant experiments may help elucidate some of the problems of migration in this species. Remarks concerning other species of *Fucus* should be regarded as preliminary only. Our observations do however agree with corresponding observations made in the British Isles and elsewhere in Europe.

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