

# New population models help explain declines in the globally rare boreal felt lichen *Erioderma pedicellatum* in Newfoundland

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**Supplement.** Seasonal and annual parameter matrices for *Erioderma pedicellatum* in Newfoundland, Canada

Table S1. Parameter matrices ( $M = \emptyset \times P$ , where  $\emptyset$  and  $P$  are the estimated survival and transition rates, respectively, of life stages) for population models for fall to spring and spring to fall of life stage cohorts of *Erioderma pedicellatum* in the Lockyer's Waters study area, eastern Newfoundland, 2005 to 2009. Note that only one juvenile cohort could be ascertained in the first interval (see 'Materials and methods'). n: number of individual thalli

| Initial life stage cohort (n)  | Projected life stage cohort |        |          |                |                       |
|--------------------------------|-----------------------------|--------|----------|----------------|-----------------------|
|                                | Juvenile                    | Adult  | Necrotic | Necrotic loose | Necrotic regenerating |
| <b>Fall 2005 – Spring 2006</b> |                             |        |          |                |                       |
| Juvenile (11)                  | 0.6080                      | 0      | 0        | 0              | 0                     |
| Adult (68)                     | 0.0150                      | 0.6030 | 0.1620   | 0.1480         | 0.0450                |
| Necrotic (26)                  | 0                           | 0.1150 | 0.5000   | 0.3070         | 0                     |
| Necrotic loose (61)            | 0                           | 0.0160 | 0.0330   | 0.8690         | 0.0330                |
| Necrotic regenerating (30)     | 0.0670                      | 0.0330 | 0.0330   | 0.1670         | 0.5330                |
| <b>Spring 2006 – Fall 2006</b> |                             |        |          |                |                       |
| Juvenile (66)                  | 0.5760                      | 0.2120 | 0.0450   | 0.0310         | 0.0150                |
| Adult (60)                     | 0                           | 0.4830 | 0.2670   | 0.2500         | 0                     |
| Necrotic (36)                  | 0.0270                      | 0.0270 | 0.4990   | 0.3330         | 0.0560                |
| Necrotic loose (94)            | 0                           | 0.0100 | 0.0220   | 0.8510         | 0.0630                |
| Necrotic regenerating (24)     | 0.0410                      | 0.0830 | 0        | 0.2500         | 0.5830                |
| <b>Fall 2005 – Fall 2006</b>   |                             |        |          |                |                       |
| Juvenile (11)                  | 0.3502                      | 0.1289 | 0.0274   | 0.0188         | 0.0091                |
| Adult (68)                     | 0.0149                      | 0.3040 | 0.2458   | 0.3424         | 0.0449                |
| Necrotic (26)                  | 0.0135                      | 0.0721 | 0.2870   | 0.4565         | 0.0473                |
| Necrotic loose (61)            | 0.0022                      | 0.0200 | 0.0399   | 0.7628         | 0.0758                |
| Necrotic regenerating (30)     | 0.0613                      | 0.0769 | 0.0320   | 0.2967         | 0.3241                |

| Initial life stage cohort (n)  | Projected life stage cohort |            |        |          |                |                       |
|--------------------------------|-----------------------------|------------|--------|----------|----------------|-----------------------|
|                                | Juvenile 1                  | Juvenile 2 | Adult  | Necrotic | Necrotic loose | Necrotic regenerating |
| <b>Fall 2006 – Spring 2007</b> |                             |            |        |          |                |                       |
| Juvenile 1 (19)                | 0                           | 0.6860     | 0.0530 | 0        | 0              | 0                     |
| Juvenile 2 (43)                | 0                           | 0.3260     | 0.3260 | 0.1630   | 0.0700         | 0.0470                |
| Adult (53)                     | 0.0108                      | 0          | 0.4720 | 0.2260   | 0.2080         | 0.0380                |
| Necrotic (46)                  | 0.0093                      | 0          | 0.1090 | 0.3700   | 0.3700         | 0.0650                |
| Necrotic loose (129)           | 0.0262                      | 0.0090     | 0.0160 | 0.0310   | 0.7290         | 0.1090                |
| Necrotic regenerating (25)     | 0.0051                      | 0.0400     | 0.0800 | 0.0800   | 0.1600         | 0.6000                |
| <b>Spring 2007 – Fall 2007</b> |                             |            |        |          |                |                       |
| Juvenile 1 (21)                | 0                           | 0.2860     | 0.0320 | 0.0950   | 0.0320         | 0                     |
| Juvenile 2 (25)                | 0                           | 0.2820     | 0.2110 | 0.2820   | 0              | 0                     |
| Adult (53)                     | 0.0089                      | 0          | 0.3320 | 0.3490   | 0.1040         | 0.0700                |
| Necrotic (49)                  | 0.0082                      | 0          | 0      | 0.4780   | 0.1360         | 0.0850                |
| Necrotic loose (140)           | 0.0234                      | 0          | 0.0250 | 0.0550   | 0.5120         | 0.1550                |
| Necrotic regenerating (37)     | 0.0062                      | 0          | 0      | 0.0480   | 0.1450         | 0.6030                |
| <b>Fall 2006 – Fall 2007</b>   |                             |            |        |          |                |                       |
| Juvenile 1 (19)                | 0.0005                      | 0.1935     | 0.1623 | 0.2119   | 0.0055         | 0.0037                |
| Juvenile 2 (43)                | 0.0061                      | 0.0919     | 0.1788 | 0.2897   | 0.0987         | 0.0759                |
| Adult (53)                     | 0.0111                      | 0.0031     | 0.1622 | 0.2870   | 0.1922         | 0.1074                |
| Necrotic (46)                  | 0.0130                      | 0.0027     | 0.0457 | 0.2393   | 0.2608         | 0.1356                |
| Necrotic loose (129)           | 0.0181                      | 0.0100     | 0.0263 | 0.0708   | 0.3958         | 0.1825                |
| Necrotic regenerating (25)     | 0.0088                      | 0.0127     | 0.0392 | 0.1155   | 0.1883         | 0.3990                |
| <b>Fall 2007 – Spring 2008</b> |                             |            |        |          |                |                       |
| Juvenile 1 (10)                | 0                           | 0.1000     | 0.3000 | 0.1000   | 0              | 0                     |
| Juvenile 2 (21)                | 0                           | 0.4290     | 0.2860 | 0.0480   | 0.0480         | 0.0950                |
| Adult (34)                     | 0.0033                      | 0          | 0.6480 | 0.0880   | 0.0880         | 0                     |
| Necrotic (69)                  | 0.0067                      | 0          | 0.2610 | 0.4070   | 0.2320         | 0.0290                |
| Necrotic loose (106)           | 0.0103                      | 0.0090     | 0.1040 | 0.0940   | 0.6790         | 0.0480                |
| Necrotic regenerating (60)     | 0.0058                      | 0          | 0.1340 | 0.1000   | 0.3000         | 0.4500                |
| <b>Spring 2008 – Fall 2008</b> |                             |            |        |          |                |                       |
| Juvenile 1 (8)                 | 0                           | 0          | 0.5000 | 0        | 0.2500         | 0                     |
| Juvenile 2 (12)                | 0                           | 0.2220     | 0.4170 | 0.0830   | 0              | 0.0830                |
| Adult (84)                     | 0.0047                      | 0          | 0.3810 | 0.2500   | 0.2860         | 0.0360                |
| Necrotic (55)                  | 0.0031                      | 0          | 0.0380 | 0.4720   | 0.3780         | 0.1140                |
| Necrotic loose (126)           | 0.0070                      | 0          | 0.0480 | 0.1350   | 0.6670         | 0.0790                |
| Necrotic regenerating (35)     | 0.0019                      | 0          | 0.0290 | 0.0290   | 0.0860         | 0.8570                |
| <b>Fall 2007 – Fall 2008</b>   |                             |            |        |          |                |                       |
| Juvenile 1 (10)                | 0.0017                      | 0.0222     | 0.1598 | 0.1305   | 0.1236         | 0.0305                |
| Juvenile 2 (21)                | 0.0020                      | 0.0952     | 0.2947 | 0.1390   | 0.1401         | 0.1366                |
| Adult (34)                     | 0.0039                      | 0          | 0.2561 | 0.2154   | 0.2781         | 0.0403                |
| Necrotic (69)                  | 0.0041                      | 0          | 0.1302 | 0.2895   | 0.3874         | 0.0990                |
| Necrotic loose (106)           | 0.0056                      | 0.0020     | 0.0861 | 0.1642   | 0.5249         | 0.1100                |
| Necrotic regenerating (60)     | 0.0039                      | 0          | 0.0852 | 0.1343   | 0.3164         | 0.4256                |
| <b>Fall 2008 – Spring 2009</b> |                             |            |        |          |                |                       |
| Juvenile 1 (3)                 | 0                           | 0.4444     | 0      | 0        | 0              | 0                     |
| Juvenile 2 (4)                 | 0                           | 0.1875     | 0.3750 | 0        | 0              | 0                     |
| Adult (53)                     | 0.0089                      | 0          | 0.0342 | 0.5810   | 0.1196         | 0.0513                |
| Necrotic (71)                  | 0.0119                      | 0          | 0.0645 | 0.5287   | 0.1160         | 0.1289                |
| Necrotic loose (143)           | 0.0239                      | 0          | 0.0387 | 0.0775   | 0.5810         | 0.1549                |
| Necrotic regenerating (52)     | 0.0087                      | 0          | 0.0740 | 0.0185   | 0.0555         | 0.7766                |

| Initial life stage cohort (n)  | Projected life stage cohort |            |        |          |                |                       |
|--------------------------------|-----------------------------|------------|--------|----------|----------------|-----------------------|
|                                | Juvenile 1                  | Juvenile 2 | Adult  | Necrotic | Necrotic loose | Necrotic regenerating |
| <b>Spring 2009 – Fall 2009</b> |                             |            |        |          |                |                       |
| Juvenile 1 (17)                | 0                           | 0.5098     | 0      | 0        | 0              | 0                     |
| Juvenile 2 (5)                 | 0                           | 0.2500     | 0.5000 | 0        | 0              | 0                     |
| Adult (63)                     | 0.0017                      | 0          | 0.0371 | 0.6313   | 0.1300         | 0.0557                |
| Necrotic (68)                  | 0.0018                      | 0          | 0.0673 | 0.5520   | 0.1212         | 0.1346                |
| Necrotic loose (113)           | 0.0031                      | 0          | 0.0397 | 0.0795   | 0.5960         | 0.1589                |
| Necrotic regenerating (89)     | 0.0024                      | 0          | 0.0743 | 0.0186   | 0.0557         | 0.7805                |
| <b>Fall 2008 – Fall 2009</b>   |                             |            |        |          |                |                       |
| Juvenile 1 (3)                 | 0                           | 0.1111     | 0.2222 | 0        | 0              | 0                     |
| Juvenile 2 (4)                 | 0.0006                      | 0.0469     | 0.1077 | 0.2367   | 0.0488         | 0.0209                |
| Adult (53)                     | 0.0016                      | 0.0045     | 0.0489 | 0.3528   | 0.1490         | 0.1392                |
| Necrotic (71)                  | 0.0017                      | 0.0060     | 0.0522 | 0.3442   | 0.1488         | 0.1938                |
| Necrotic loose (143)           | 0.0024                      | 0.0122     | 0.0412 | 0.1163   | 0.3693         | 0.2258                |
| Necrotic regenerating (52)     | 0.0022                      | 0.0044     | 0.0639 | 0.0758   | 0.0882         | 0.6216                |

Table S2. Parameter matrix ( $M = \emptyset \times P$ , where  $\emptyset$  and  $P$  are the estimated survival and transition rates, respectively, of life stages) for population model for life stage cohorts of *Erioderma pedicellatum* in the Bay d'Espoir study area, south-central Newfoundland. n: number of individual thalli

| Initial life stage cohort (n)  | Projected life stage cohort |            |        |          |                |                       |
|--------------------------------|-----------------------------|------------|--------|----------|----------------|-----------------------|
|                                | Juvenile 1                  | Juvenile 2 | Adult  | Necrotic | Necrotic loose | Necrotic regenerating |
| <b>Spring 2007 – Fall 2007</b> |                             |            |        |          |                |                       |
| Juvenile 1 (17)                | 0                           | 0.5909     | 0.0909 | 0.0455   | 0.0455         | 0                     |
| Juvenile 2 (38)                | 0                           | 0.2632     | 0.3158 | 0.2632   | 0.1316         | 0.0263                |
| Adult (72)                     | 0.0104                      | 0          | 0.5135 | 0.2703   | 0.1216         | 0.0676                |
| Necrotic (127)                 | 0.0183                      | 0          | 0.0224 | 0.4701   | 0.3433         | 0.1119                |
| Necrotic loose (116)           | 0.0167                      | 0          | 0.0242 | 0.2016   | 0.5726         | 0.1371                |
| Necrotic regenerating (102)    | 0.0147                      | 0          | 0.0278 | 0.1943   | 0.3517         | 0.3609                |
| <b>Fall 2007 – Spring 2008</b> |                             |            |        |          |                |                       |
| Juvenile 1 (10)                | 0                           | 0.5897     | 0.0513 | 0.1026   | 0              | 0                     |
| Juvenile 2 (21)                | 0                           | 0.4318     | 0.2955 | 0.1136   | 0.0227         | 0                     |
| Adult (34)                     | 0.0006                      | 0          | 0.4949 | 0.2727   | 0.0808         | 0.0505                |
| Necrotic (69)                  | 0.0017                      | 0.0036     | 0.0468 | 0.6691   | 0.1223         | 0.0180                |
| Necrotic loose (106)           | 0.0016                      | 0          | 0.0190 | 0.2586   | 0.5399         | 0.0570                |
| Necrotic regenerating (60)     | 0.0007                      | 0          | 0.0198 | 0.3465   | 0.2178         | 0.3465                |
| <b>Spring 2008 – Fall 2008</b> |                             |            |        |          |                |                       |
| Juvenile 1 (8)                 | 0                           | 0.5000     | 0.1250 | 0        | 0              | 0                     |
| Juvenile 2 (12)                | 0                           | 0.5116     | 0.3023 | 0.0465   | 0.0698         | 0                     |
| Adult (84)                     | 0.0024                      | 0          | 0.7439 | 0.1341   | 0.0488         | 0                     |
| Necrotic (55)                  | 0.0095                      | 0.0092     | 0.1564 | 0.4969   | 0.2117         | 0.0644                |
| Necrotic loose (126)           | 0.0057                      | 0          | 0.0379 | 0.1185   | 0.6209         | 0.0758                |
| Necrotic regenerating (35)     | 0.0019                      | 0          | 0.1094 | 0.2500   | 0.2969         | 0.2969                |
| <b>Fall 2007 – Fall 2008</b>   |                             |            |        |          |                |                       |
| Juvenile 1 (10)                | 0.0011                      | 0.3026     | 0.2325 | 0.0853   | 0.0654         | 0.0066                |
| Juvenile 2 (21)                | 0.0019                      | 0.2220     | 0.3690 | 0.1188   | 0.0827         | 0.0090                |
| Adult (34)                     | 0.0043                      | 0.0028     | 0.4195 | 0.2241   | 0.1470         | 0.0387                |
| Necrotic (69)                  | 0.0072                      | 0.0088     | 0.1474 | 0.3579   | 0.2255         | 0.0577                |
| Necrotic loose (106)           | 0.0057                      | 0.0032     | 0.0815 | 0.2093   | 0.4078         | 0.0745                |
| Necrotic regenerating (60)     | 0.0053                      | 0.0035     | 0.1152 | 0.2873   | 0.3124         | 0.1417                |