Discussion of the Cumulative Mushroom Species Curve of Foray Newfoundland & Labrador

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FORAY NEWFOUNDLAND & LABRADOR has collected about 200 species of mushrooms in each of its four forays with a cumulative species list of 570. Each year almost half of the species found were not found the year before and about one-third was entirely new. The bars of Figure 1 show the species of each foray and the line shows the total of new species to date—a straight line, suggesting that the total species of mushrooms in Newfoundland & Labrador must be much greater, because so far there is no evidence of leveling off.

There is quite a variation of the estimated number of mushroom species there might be in Newfoundland and Labrador. Moser reported 3,457 species in Europe in his 1983 compendium of European mushrooms (1). Extrapolating from this, Redhead believes the total for Canada to be some 4-5,000 species. Because there are fewer species of trees and types of climate in Newfoundland, he believes 2,000 - 2,500 to be a reasonable estimate for our province (2). On the other end of the spectrum, Leacock uses the oft-quoted figure of 10,000 macrofungi For North America (3), which would suggest up to 7-8,000 in Newfoundland and Labrador. This antipodal opinion is based on a solid foundation of ignorance: we do not know how many mushroom species there are—not here, not anywhere. In their book, *Biodiversity of Fungi*, Mueller and coauthors state, "No region of the world as yet has a complete mycota equivalent to a vascular-plant flora, a condition likely to persist for some time." (4). Replacing "for some time" with "forever" is probably more accurate.

From the above it follows that the straight-line cumulative species curve is not unique to FORAY NEWFOUNDLAND & LABRADOR. Indeed, the cumulative species curve of the North American Mycological Association (NAMA), the world's largest amateur mushroom club, continues to rise in a straight line since the inception of its forays in 1962 (3). NAMA's forays are conducted all over North America, encompassing many regions and habitats, so the theoretical target is all mushroom species growing in North America. NAMA's cumulative species is now just shy of 3,000, with no hint that the curve is going to level off. Clearly, the number of mushroom species in North America is significantly more than 3,000. How much, we don't know, hence the varying opinions.

The rise of the cumulative curve in a straight line has been reported by other workers in both similar and more limited situations. Kendrick presents findings from16 years of forays of the Cascade Mycological Society, conducted in a consistent general area (5). Similarly, five years of forays in six sites on Vancouver Island produce a straight line (6). The same is true for surveys of single sites, 21 years in Switzerland (7) and 10 years in Scotland (8) – no sign that the number of species is beginning to come to an end. Extrapolating our preliminary curve onto these other experiences suggests it may require a very long time of forays in Newfoundland and Labrador before a change in the slope of the curve can be detected. In all likelihood, an estimate of 100 years should not be excessive.

The implication of the foregoing is clear: compilation of a complete list of all macromycotal taxa in a region such as Newfoundland and Labrador can never be accomplished with present technology. Never. While it may take 100 years to record all the taxa present now, at the end of 100 years the taxa here will differ. Some species may die out. Others will evolve. Others will undergo adaptation, enabling them to settle here. The impact of global warming, pollution and habitat encroachment over 100 years will all change the mycoflora. Many mushrooms have specific substrate and plant partner needs; any change to

these requirements will result in a change to the mycoflora. Our present method of species documentation is akin to shooting at a moving target from a firearm fixed in position.

These concepts are very important to understand for individuals, agencies and organizations engaged in the study, determination or protection of biodiversity, because surveying mushroom biodiversity is quite unlike that for most other areas of natural history:

1. a foray or one-time survey of the mycoflora of a region is unlikely to recover more than 5, at most 10%, of the total taxa of the region and

2. the time required for a complete survey is so long that the mycoflora of the region will be different at the end of the survey period from what it was at the beginning;

3. thus, a complete species tally with present methods is an impossibility for any region.

Indeed, to me one of the appeals of mushrooming is that I have never gone out without finding at least one species I have not seen before, even after years of mushrooming. For those of us participating in mushroom forays, learning this is not a disappointment, but a thrill. We do not go on forays to find every species in existence. We go to learn about mushrooms. From our data, we just have. Surely it is kind of nice to think that this was all brought to light right here in Western Newfoundland, reflecting on our own experience and looking at our own data. Although mushrooms have been collected and studied for centuries and people may well have been aware of some of the concepts before, a relationship between the species collected in one outing to the total number of species in the area has not been articulated in print before. The reader interested in pursuing this subject further is referred to a somewhat overly verbose description of the May Model (a model relating the species recovered at any foray to those of the region) in McIlvainea (9). Analysis of our data to test the model is underway and will be submitted for consideration to the same journal.

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Acknowledgements

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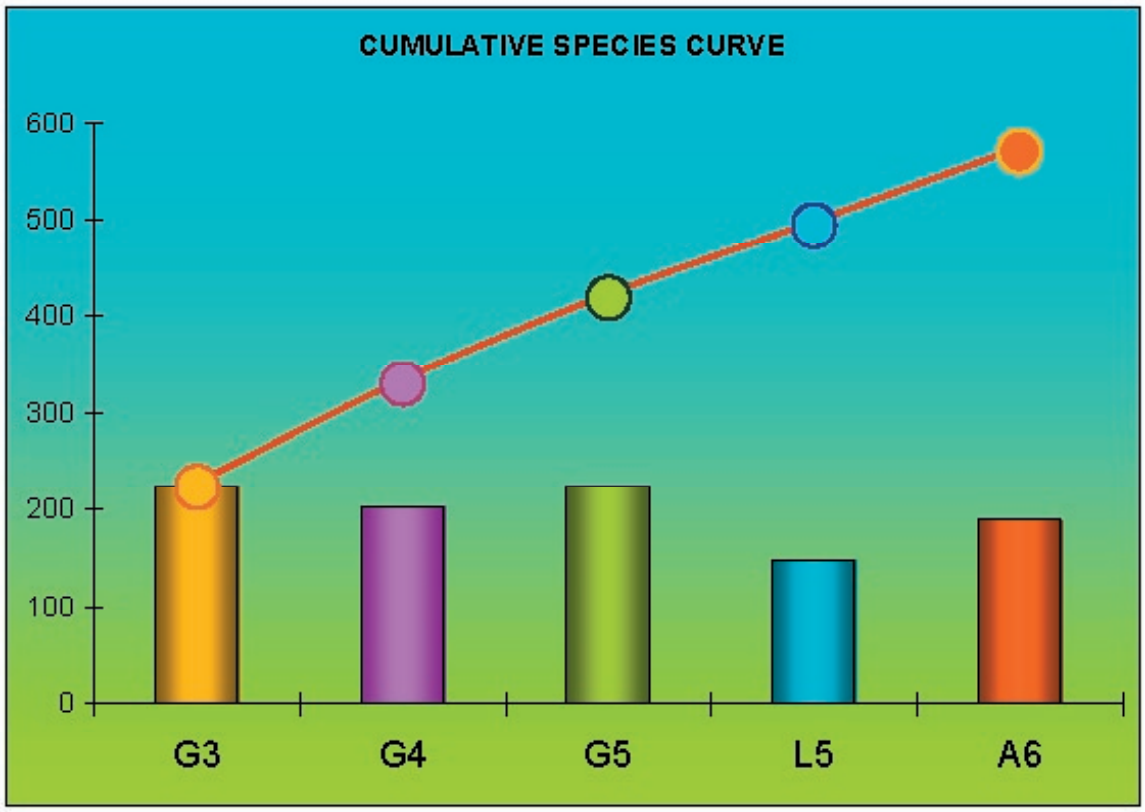

FIG 1 Cumulative Species Curve - The cylinders represent the number of species collected in each of our forays to date, Gros Morne National Park in 2003 (G3), 2004 (G4) and 2005 (G5), Labrador Straits in 2005 (L5) and the Avalon Peninsula in 2006 (A6). The line depicts the cumulative species list, now up to 570. It rises essentially as a straight line, suggesting that this number is nowhere near the limit of all taxa for the areas surveyed.