Title: **Molecular genetic and stable isotopic analysis of dispersal of a migratory songbird**

Background and Significance. Dispersal is the movement of individuals away from their source[1]. Dispersal distances determine recruitment patterns, population structure, gene flow, and thus the ability of organisms to respond to change[2]. However, because dispersal is difficult to measure it has remained poorly understood – particularly for migratory species[3]. Whether migratory songbirds select their first breeding territory within the region of the natal site[3], or whether this process occurs at larger scales[5] is largely unknown[6]. In addition to being of theoretical interest, determining the scale of dispersal and how it is influenced by habitat fragmentation is particularly important in light of recent population declines of migratory songbirds[7]. New techniques in molecular genetics[8] and stable isotopes[9] provide the tools to test dispersal-related hypotheses.

Research Questions and Hypotheses. I will answer two questions: **(1) At what scale(s) do migrant songbirds disperse?** One hypothesis is that birds disperse short distances in order to capitalize on local knowledge about habitat quality[10]. If this is the case, I predict that relatedness (*r*) will be greatest at short distances. That is, relatedness will be spatially autocorrelated. However, because established breeding birds are site faithful, any limits to population size means that individuals may be prevented from breeding in their natal area and could be forced to disperse to vacant sites[11,12]. Indeed, such exclusion could result in first year breeders (SY) dispersing to less favourable habitats during northward migration at range edges[5]. In birds, isotopic ratios are fixed in feather keratin at the time of flight feather growth at the end of the breeding season on the breeding grounds. Natural latitudinal and longitudinal gradients in the occurrence of these isotopes allow for identification of birth or breeding location of the previous year[13]. If continental-scale dispersal occurs, I predict that isotope ratios of SY birds (on the breeding grounds) will be less associated within the local breeding region than older (ASY) site faithful birds. **(2) Does forest fragmentation influence the spatial scale of dispersal?** Previous work has indicated that fragmentation reduces the movement ability of forest songbirds[14]. However, the consequences of this reduced movement to gene flow are unknown. If fragmentation restricts dispersal, individuals in more fragmented habitats should exhibit higher relatedness over shorter distances than those in contiguous habitats.

Methods. I will capture black-throated green warblers (*Dendroica virens*) across a 4000 km^2 forested study area in southeastern New Brunswick in a systematic, spatially-nested design. I will age birds on breeding grounds as SY or ASY using plumage characteristics[15]. Flight feathers will be obtained for genetic and isotopic analysis[16]. Feathers collected in the same region as part of a long-term mark-recapture study (2000-2004, *N*=206) will also be used. Blood will be collected as a second source for DNA. Relatedness of birds will be assessed using mitochrondial DNA[17] and identified microsatellite loci that are available for black-throated green warbler[18,19]. If available loci are insufficient to determine relatedness, additional markers will be isolated through further genetic work. Approximate geographic natal location of SY birds (to within ~6^o latitude and longitude[20,21]) will be determined using hydrogen (δD) and carbon (δ^{13}C) isotopes. These isotope values will be compared to those of known site faithful ASY birds.

References and notes. [1]Nathan et al. 2003. Oikos.103:261-273. [2]Webster et al. 2002 T.R.E.E. 17:76-83. [3]Bowman 2003 Can. J. Zool. 81:195-202. [5]Graves. 1997. Ecology 78:2524-31. [6]Rohwer. 2004. Ecology 85: 423-31. [7]James and McCullogh. 1996. Ecology 77: 13-27. [8]Van Horn. 2004. Molecular Ecology 13: 449-58. [9]Hobson and Wassenaar. 2001. Ecol. App. 11: 1545-53. [10]Danchin. 2004. Science 305: 487-91. [11]Greenwood and Harvey. 1982. Ann. Rev. Ecol. Syst. 13:1-21. [12]Pulliam.1988. Am. Nat. 132:652-61. [13]Chamberlain et al. 1997. Oecologia 109:132-41. [14]Belsisle and Desrochers. 2002. Landscape Ecology 17: 219-31. [15]Pyle. 1997. ID Guide to NA Birds. Part I. Slate Creek Press, CA. [16]Bello et al. J. Veterinary Diag. Invest. 13:162-164. [17]Hoglund and Shorey. 2003. Mol. Ecol. 12: 2457-2463. [18]Lovette et al. 1999. Mol. Ecol. 9:1431-41. [19]Hebert et al. 2004. Nat. Centre for Biotech. Info. http://www.ncbi.nlm.nih.gov/ .[20]Rubenstein et al. 2002. Science 295:1062-1065. [21]Kelly et al. 1999. Oecologia 130:216-221.