

Yellow Head Bumble Bee (*Bombus flavifrons*)

Additional Supporting Information

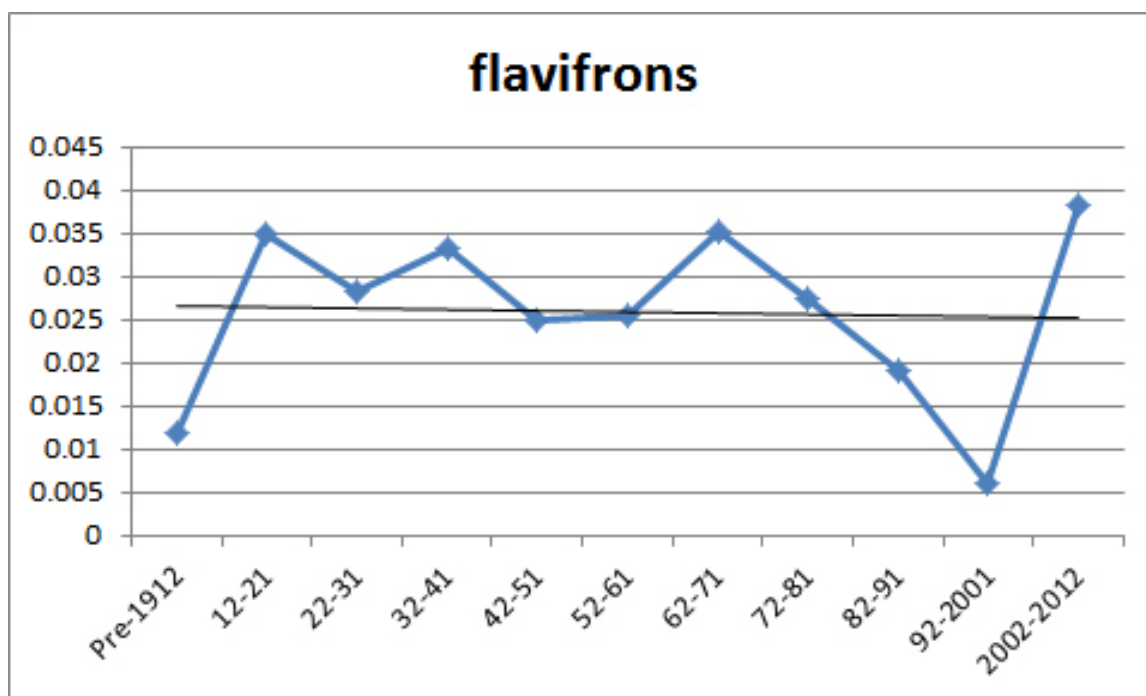


Figure 1. Relative abundance trends of this bumble bee species over the past 100 years are shown. For the relative abundance calculation provided in the Population Section of this assessment (“Current relative abundance relative to historic values”), we divided the North American bumble bee database into historical (1805-2001, N=128,572) and current (2002-2012, N=73,626) records and divided the relative abundance in the current time period by the relative abundance in the historic time period. In addition, we calculated the relative abundance for each decade and examined the regression of relative abundance over time to observe longer term trends, as shown above. We used these calculations, trends, published reports of bumble bee decline, along with the assessors’ best professional judgement to evaluate the change in the species’ population that is suspected to have occurred in the last 10 years.

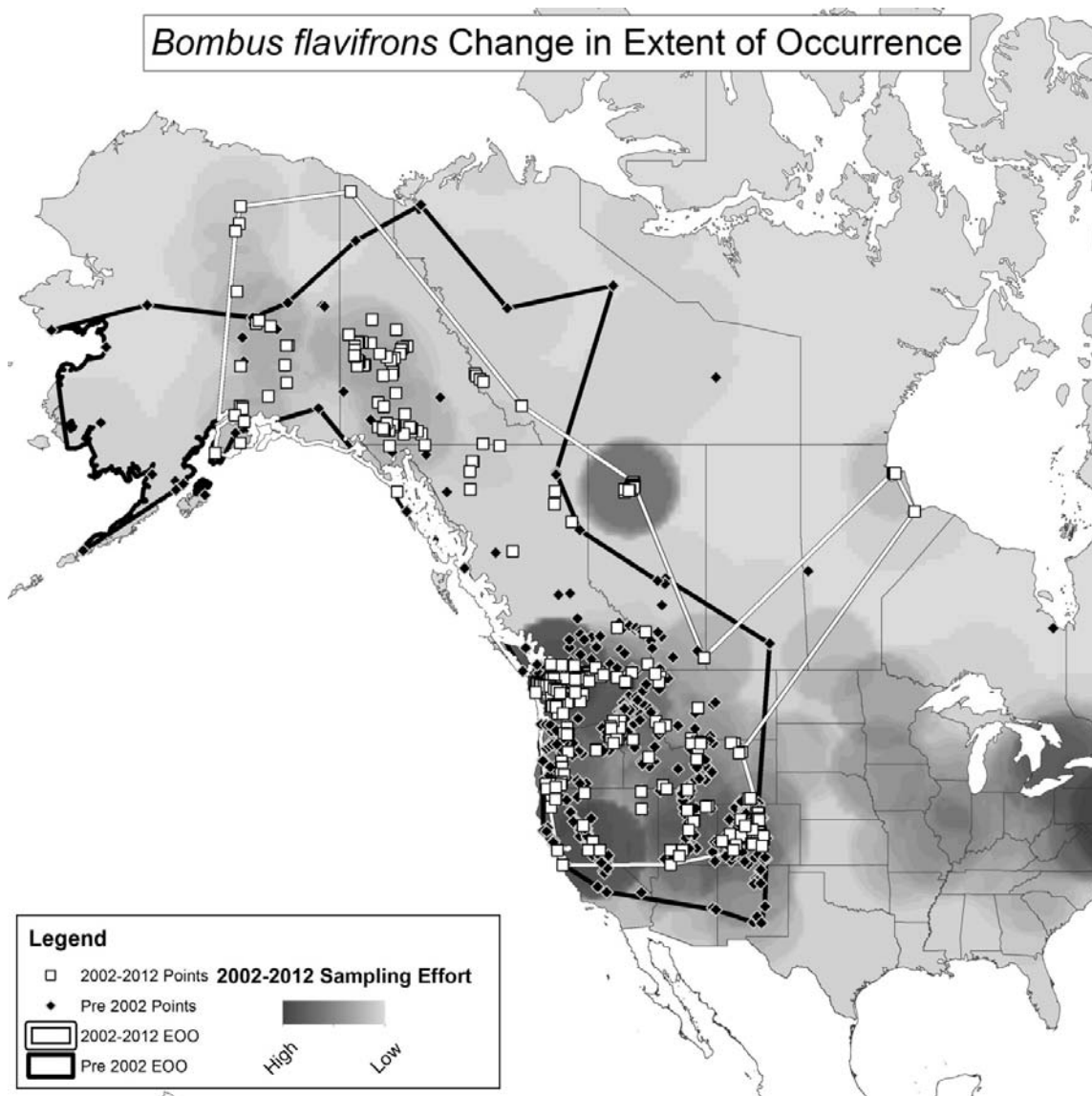


Figure 2. Change in the extent of occurrence (EOO) of this bumble bee species is shown. To produce this map, we divided the records for this species into historical (1805-2001) and current (2002-2012) records. Since the historical database had significantly more specimen records, and therefore could lead to an overestimate of range loss due to an increased chance of including outlying records near the edge of each species' range, we rarefied the historic data set by randomly selecting 74,682 records from the historical time period to build EOO polygons. To measure changes in each species' EOO, we first used a k-nearest neighbours approach to create local convex hulls for each species in each time period (Getz *et al.* 2007). After the local convex hull polygons were created, we clipped the polygons to the North American continent to remove large patches of unoccupied habitat (e.g. the Great Lakes). We also

used sampling effort to inform our confidence in range loss. Areas that had been under-sampled in the recent time period, relative to historic sampling effort, had the area of range loss adjusted down accordingly, to attempt to account for potential sampling error. Using the areas calculated from these polygons, we compared the current area to the historical area to determine changes in range size (see “Current range size relative to historic range” in the Population Section of this assessment). We then used these calculations, trends, published reports of bumble bee decline, along with the assessors' best professional judgment to evaluate the change in the species' population that is suspected to have occurred in the last 10 years. For more details see Hatfield *et al.* (2014).