



**Refining the geographic source
of a fall Neotropical Migrant at
Inglewood Bird Observatory in
Western Canada using $\delta^2\text{H}$
measurements and genetic
analyses of feathers.**

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Calgary Bird Banding Society (CBBS)

Inglewood Bird Observatory

**Doug Collister
President**

March 2019



Hi Everyone. My name is Doug Collister and I am the current president of the Calgary Bird Banding Society (CBBS). We operate Inglewood Bird Observatory(IBO) located within the City of Calgary in the province of Alberta in Western Canada. IBO is within a Federal Migratory Bird Sanctuary.



Like many other bird observatories IBO is magical at sunrise.



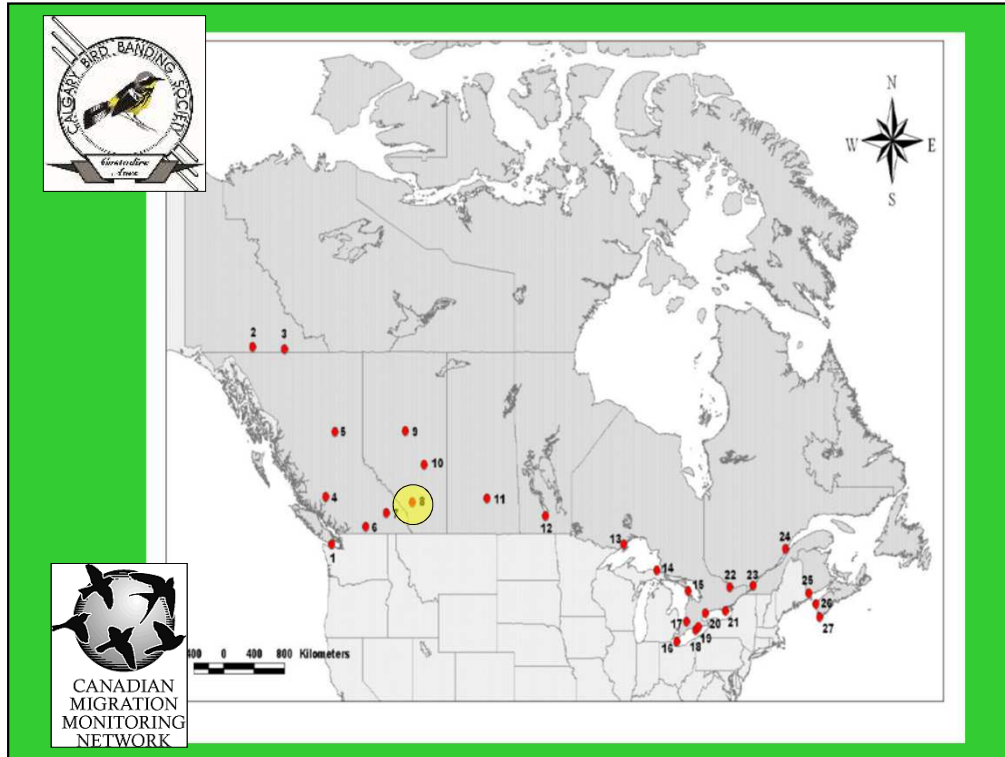
Canadian Migration Monitoring Network

A collaboration of:

- Member Stations (n=27)
- Bird Studies Canada
- Canadian Wildlife Service



IBO is a member station of the Canadian Migration Monitoring Network a collaboration of the member stations, Bird Studies Canada and the Canadian Wildlife Service



IBO is the highlighted station on this map of the CMMN.



PRIMARY GOALS OF THE CMMN

- to monitor, through a comprehensive network, land bird population trends across Canada, with a focus on "northern" species that are not well-monitored by other programs
- to conduct cooperative projects on bird migration and ecology



The CMMN was founded in the early 1990s primarily to monitor trends of boreal forest Neotropical migrant land-birds. Since then CMMN's objectives have broadened to include research of almost any kind relating to migration.



MIGRATION MONITORING AT INGLEWOOD BIRD OBSERVATORY

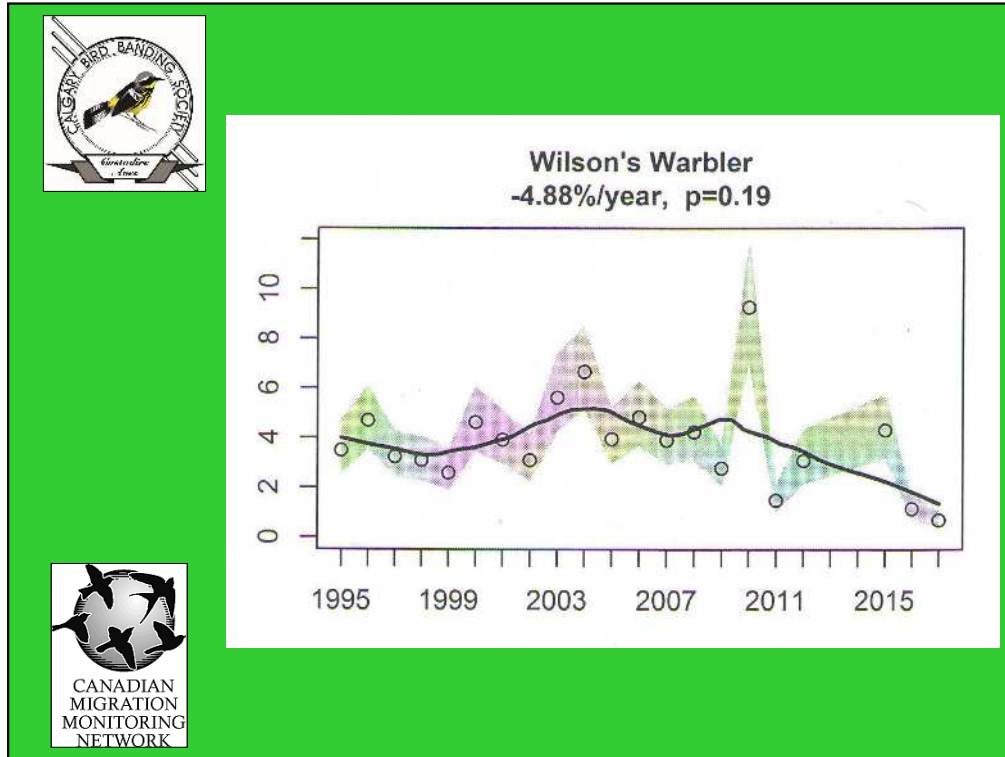
- **standardized mist-netting,
12 - 30-mm nets, 6-hrs daily
over entire fall migration
period (28 July – 6 October)**
- **2019 marks the 24th year of
fall migration monitoring
since 1995**



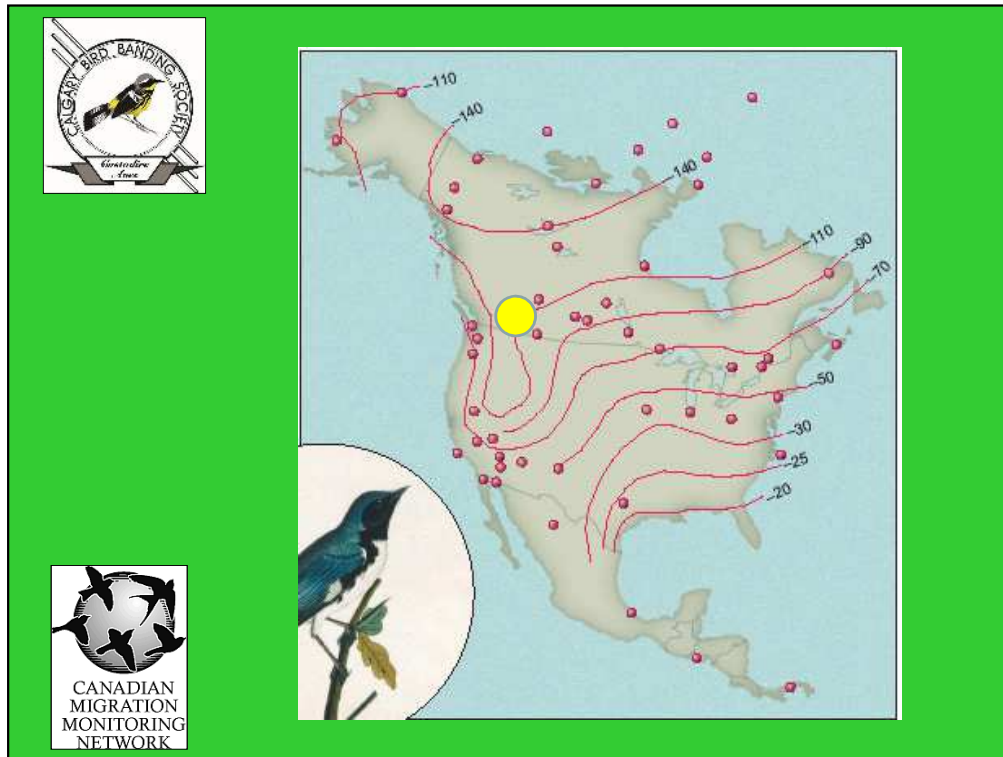
At IBO we monitor only with mist-net capture data.



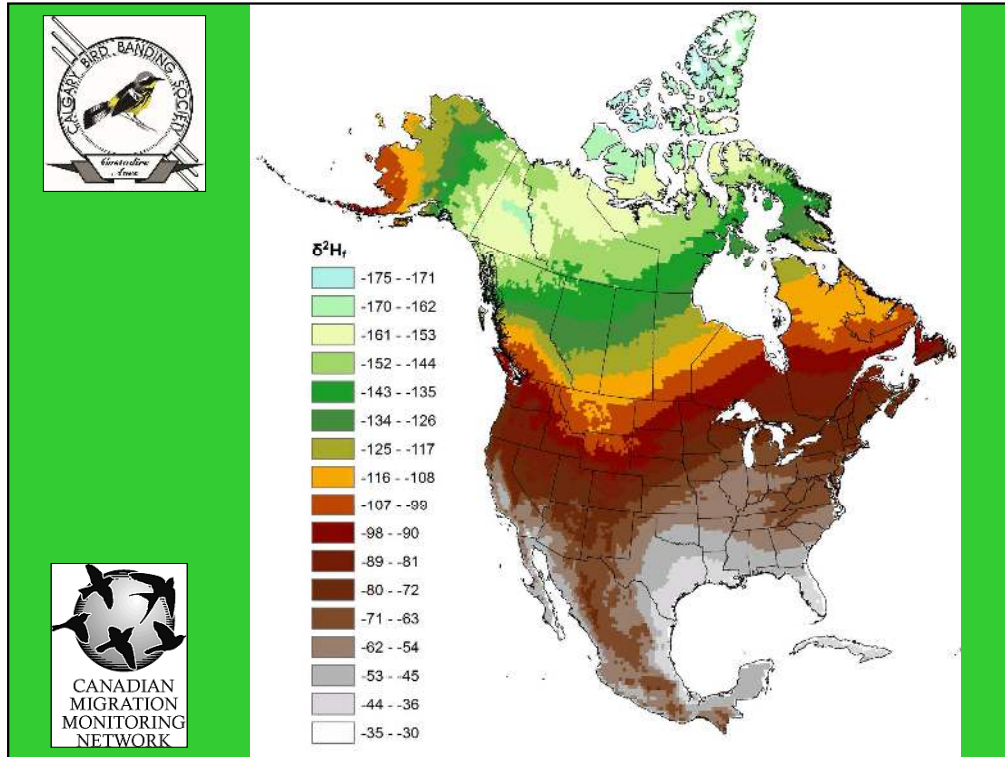
Our mist-net array is in Inglewood Bird Sanctuary a Federal Migratory Bird Sanctuary. We operate in the southern portion of the sanctuary which is closed to the public. The numbers indicate net locations.



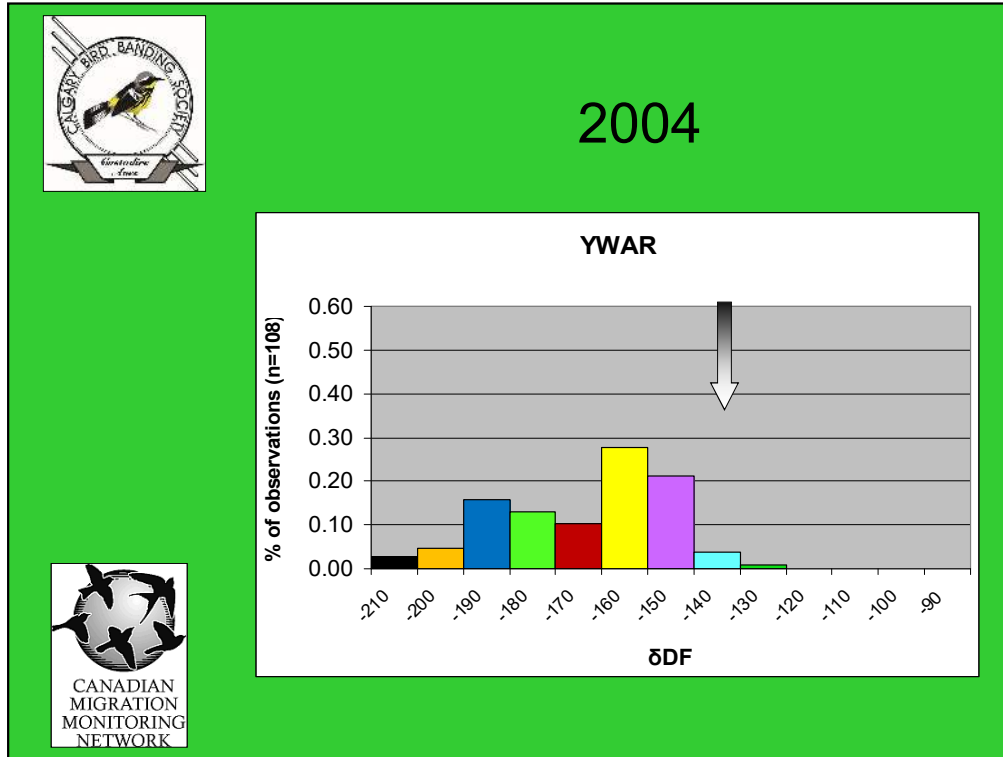
IBO has been a member station of CMMN since 1995 and has data for every fall since except 2013 when a major flood made the site temporarily unsafe. This is our most current trend for Wilson’s Warbler, the subject of this presentation, through 2017. As you can see the trend was stable until 2009 and exhibits a downward trajectory thereafter. Not significant but worrisome.



A major goal of the CMMN including IBO is to try and identify the geographic origin of the Neotropical Migrants we monitor to facilitate focusing conservation efforts when needed. A tool we have embraced at IBO is using d2H stable isotope analyses of feather material to narrow down the latitude where our migrants generated those feathers. This figure illustrates how d2H varies latitudinally in North America getting more negative from south to north. Note that IBO, the yellow circle, in SW Alberta is located in an area that appears less predictable because of the adjacent Rocky Mountains.



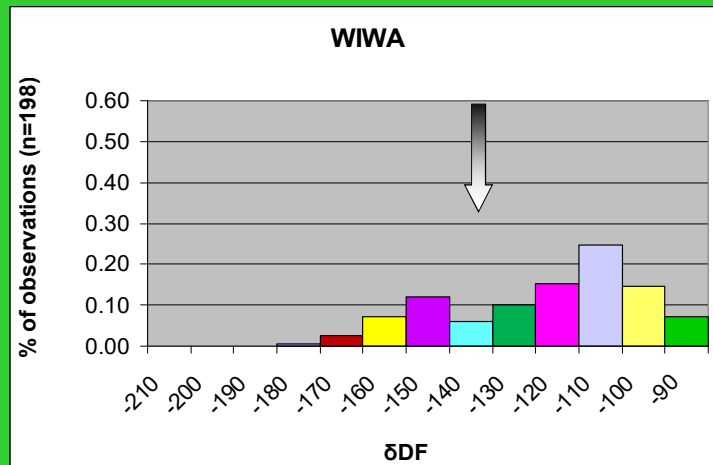
This is another presentation of the same information using colours instead of contours to show the north to south variation.



This a typical example of the results we obtained from our d2H analyses. Keep in mind that more negative values suggest a more northerly origin. Also note that the arrow is pointing to the reference value at IBO. All of our monitored species showed variations on this profile suggesting a northerly origin. Except for one. Wilson's Warbler.



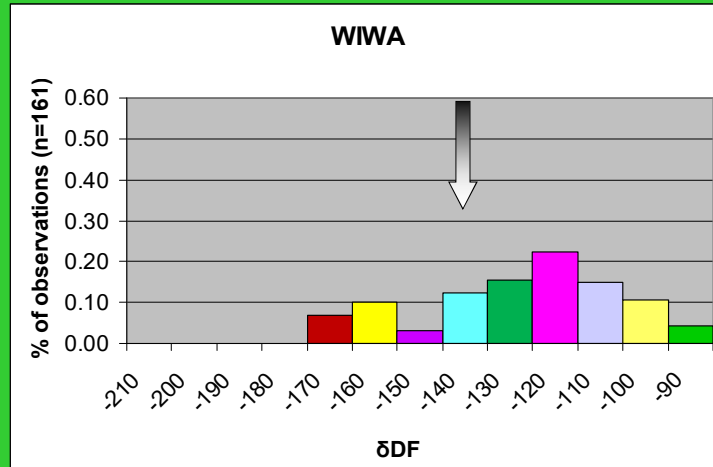
2004 (n=200)



As you can see our 2004 sampling program suggested a southerly origin. We wondered if something had gone wrong with the analyses so we sampled again in 2008.



2008 (n=163)



Again the results suggested a southerly origin.



Ruegg KC et al. (2014) Mapping migration in a songbird using high-resolution genetic markers Mol Ecol 23:5726-5739 doi:10.1111/mec.12977



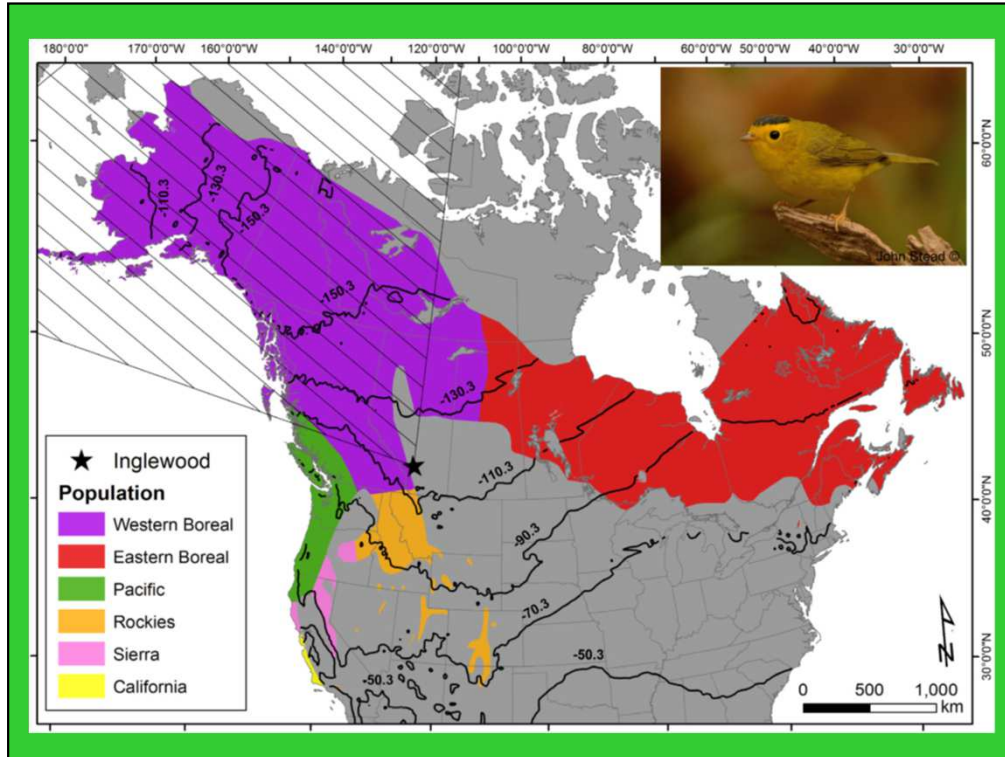
Fortunately Wilson's Warbler is a well studied species. Dr Kristen Ruegg differentiated populations of Wilson's Warbler using genetic analysis.



In addition to the 200 and 163 WIWA feather samples collected in 2004 and 2008 respectively we collected another 161 samples in 2015 for both stable isotope and genetic analyses to try and nail down the origin of WIWAs migrating through Inglewood in the fall.



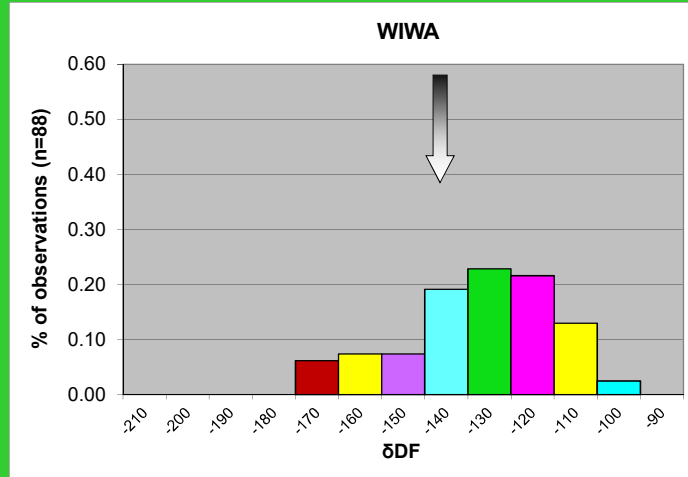
So we sampled Wilson's Warbler feather material a third time in 2015 with the intention of having Dr. Ruegg's lab conduct genetic analyses. We also analyzed the feathers for d2H.



These are the Wilson's Warbler populations that Dr. Ruegg et al delineated. We wondered if it was possible the WIWA from the Rockies population south of us were moving north prior to initiating their southward migration. We know there are species that migrate north after breeding. For example Prairie Falcons from the western US have been shown to move north to southern Alberta post-breeding.



2015 (n=161)



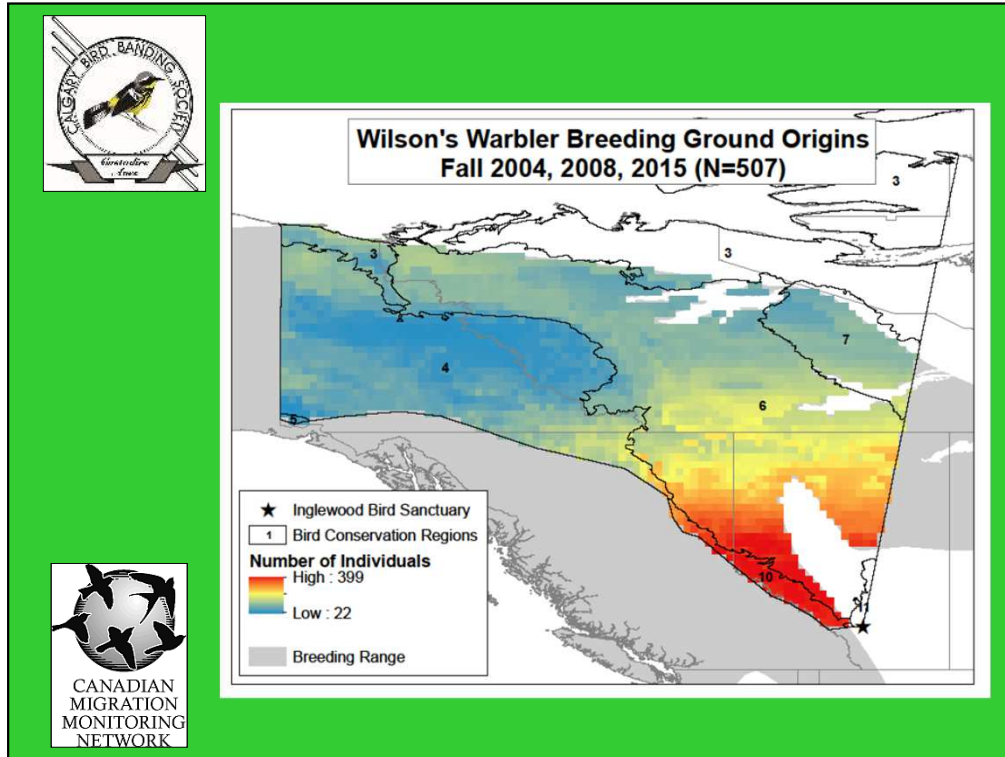
The d2H results were the same in 2015 as 2008 and 2004.



The high-resolution genetic analysis indicated that the majority (96.3%) of birds migrating through our study site in 2015 were derived from the western boreal population group (n = 155). The remaining birds were from the eastern boreal (n = 3), Pacific Northwest (n = 1) or the Rocky Mountain (n = 2) populations. All Wilson's Warblers determined not from the western boreal population were juveniles.



The genetic analyses showed that essentially all of the Wilson's Warblers we sampled in 2015 were from the western boreal population and not from the Rockies population.



This is the probability map of the origin of Wilson's Warblers migrating through IBO in fall. Red is high probability, blue is low. Known Wilson's Warbler range, the continental divide and the likely direction of migration from banding recoveries also informed this map. We are not sure why the d2H values appear anomalous but perhaps the adjacent mountains to the west have something to do with it. Western Boreal Wilson's Warblers breeding range does include the Rocky Mountains west of IBO.



Kardynal, Kevin J, Douglas M. Collister, and Keith A. Hobson. 2018. **Origins of Wilson's Warblers migrating through southwest Canada: Adding value to banding data by using stable isotopes and genetic markers.** *Anim. Migr.* 2018: 5: 17-28.



If you are interested in the full details of our study please refer to *Animal Migration* 2018.