Breeding destinations and migration patterns of the Reed Bunting (*Emberiza schoeniclus*) in the Lake Neusiedl Region

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Distribution of the Reed Bunting

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Phenotypic Divergence among West European Populations of Reed Bunting *Emberiza schoeniclus*: The Effects of Migratory and Foraging Behaviours

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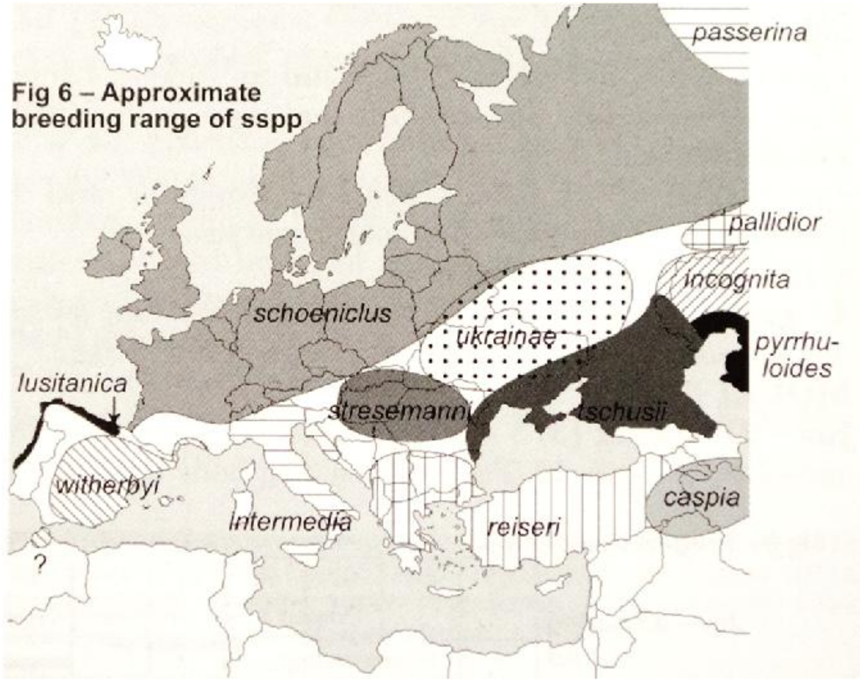
Birdlife International 2018



Demongin 2016

4500-6700 breeding pairs of the Reed Bunting at Lake Neusiedl (M. Dvorak, BirdLife Austria, personal communication)
breeding population: ***E. s. stresemanni***
during migration: ***E. s. ukrainae, E. s. schoeniclus*** (?)
during winter: ?

Research questions

1. Do **different subspecies** of the Reed Bunting (*Emberiza schoeniclus*) **overlap in their wintering area** at Lake Neusiedl and during their **migration** through the region?

2. Can **subspecies** of local breeding, wintering and migratory Reed Buntings be **characterized** by the use of **stable isotope ratios** of their feathers and according to their **morphometric divergence**?

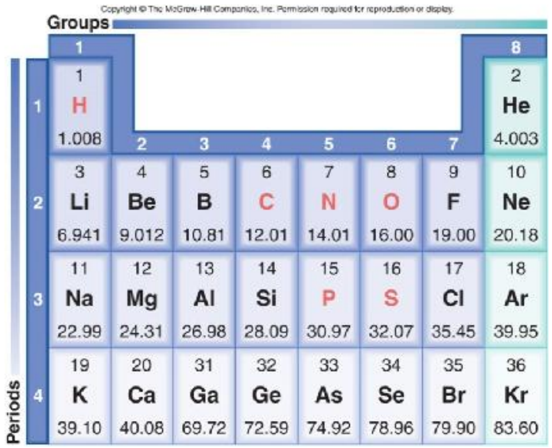
What are stable isotopes? Nearly identical, but…

Atoms of the same element having a **slightly different atomic weight** (different number of neutrons)

The atomic mass of an element is the weighted average of the atomic masses of all of its naturally occurring isotopes

Example: isotopes of chlorine (^{35}Cl, ^{37}Cl) occur in the ratio 3:1.
The average atomic mass of chlorine

= [(35 x 3) + (37 x 1)] /3 + 1 = **35.5**



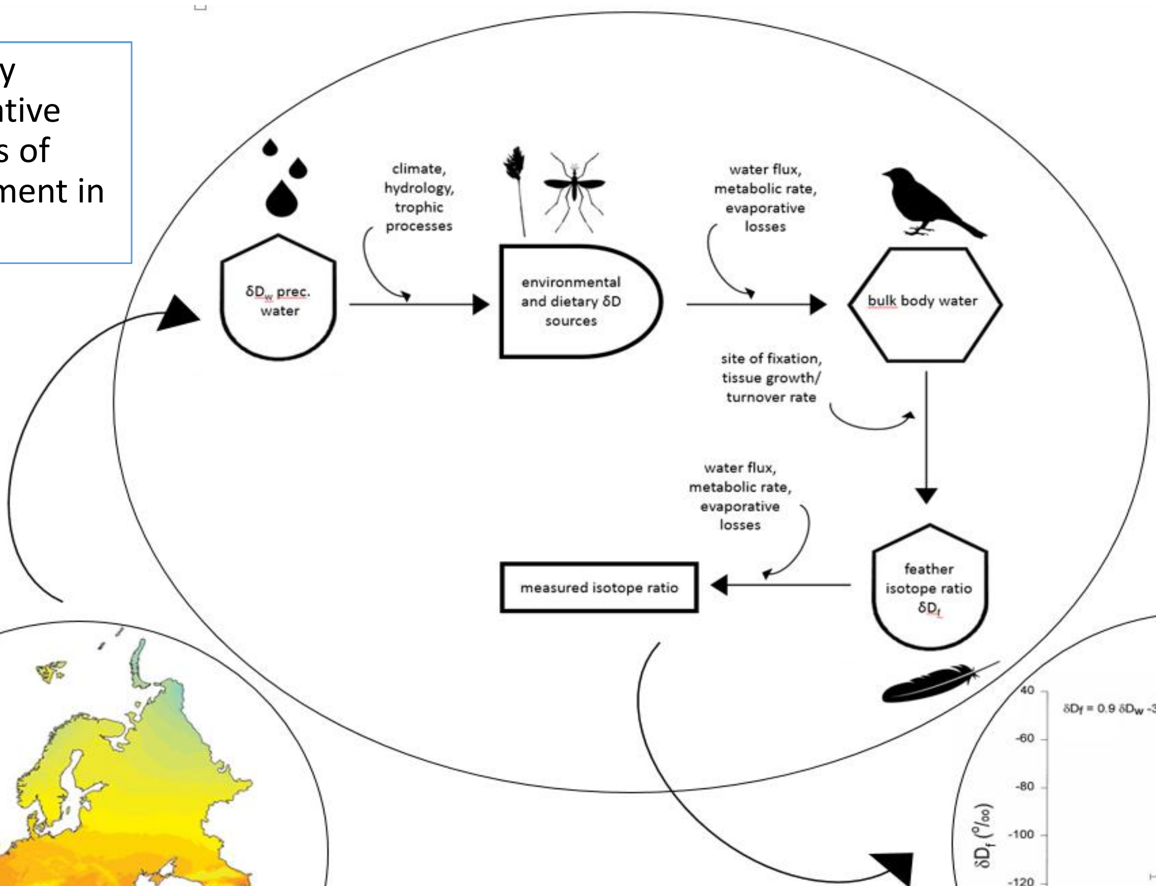
Periods	Groups 1	2	3	4	5	6	7	8
1	1 H 1.008							2 He 4.003
2	3 Li 6.941	4 Be 9.012	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.60

Nearly identical chemical properties
But… properties are not fully equal; tiny differences exist in their chemical and physical properties.

Heavier isotopic species or molecules have a **lower mobility**

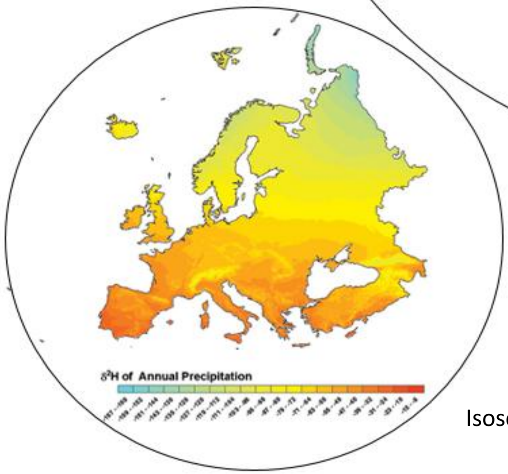
Linkage of d^{2}H patterns in hydrosphere to bulk tissues

Isotope fractionation: any process that causes a relative change in the proportions of isotopes of the same element in compounds.

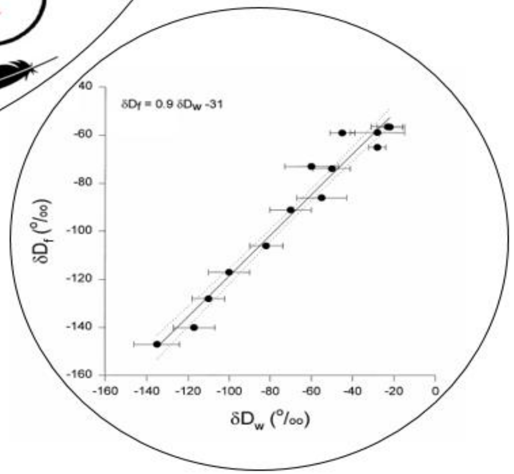


d^{2}H in feathers of songbirds at known locations correlate with precipitation isotope patterns.

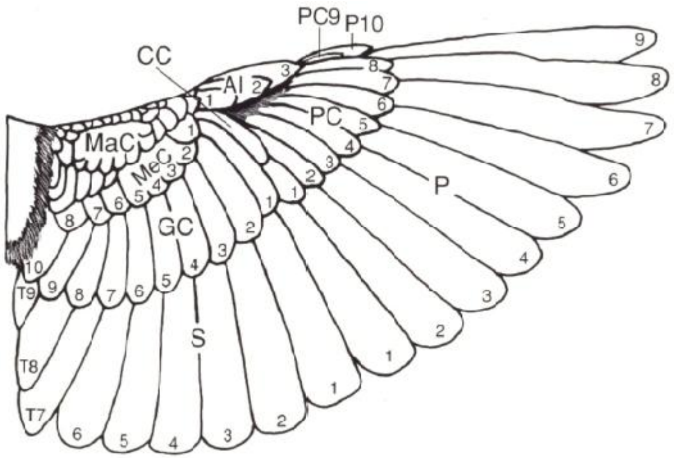
Hobson & Wassenaar 1997



Isoscape Europe. *Bowen G., Purdue University*



Moult in the Reed Bunting



Extent of **postjuvenile moult**
Generally GC, MeC, MaC and CC moulted, sometimes S6, T, A and P7
Extent of **postbreeding moult (adults)**
whole plumage (Jenni & Winkler 1994)

stable isotope analysis of δD, $\delta^{13}C$ and $\delta^{15}N$ of S5 (N= 191)

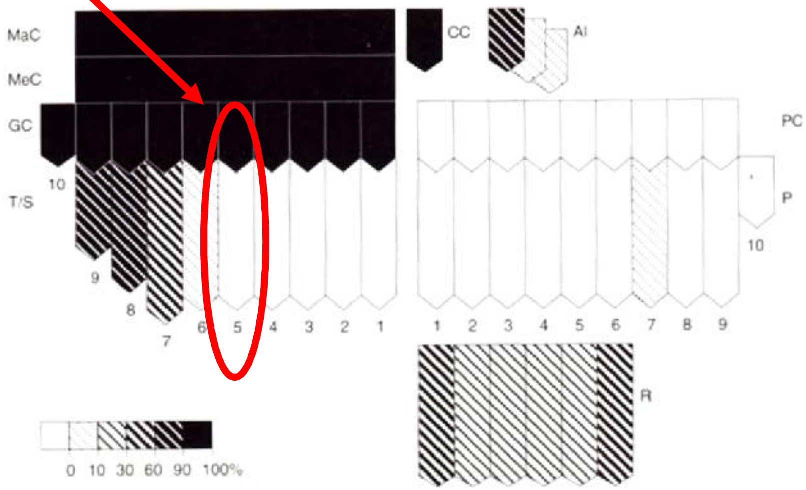
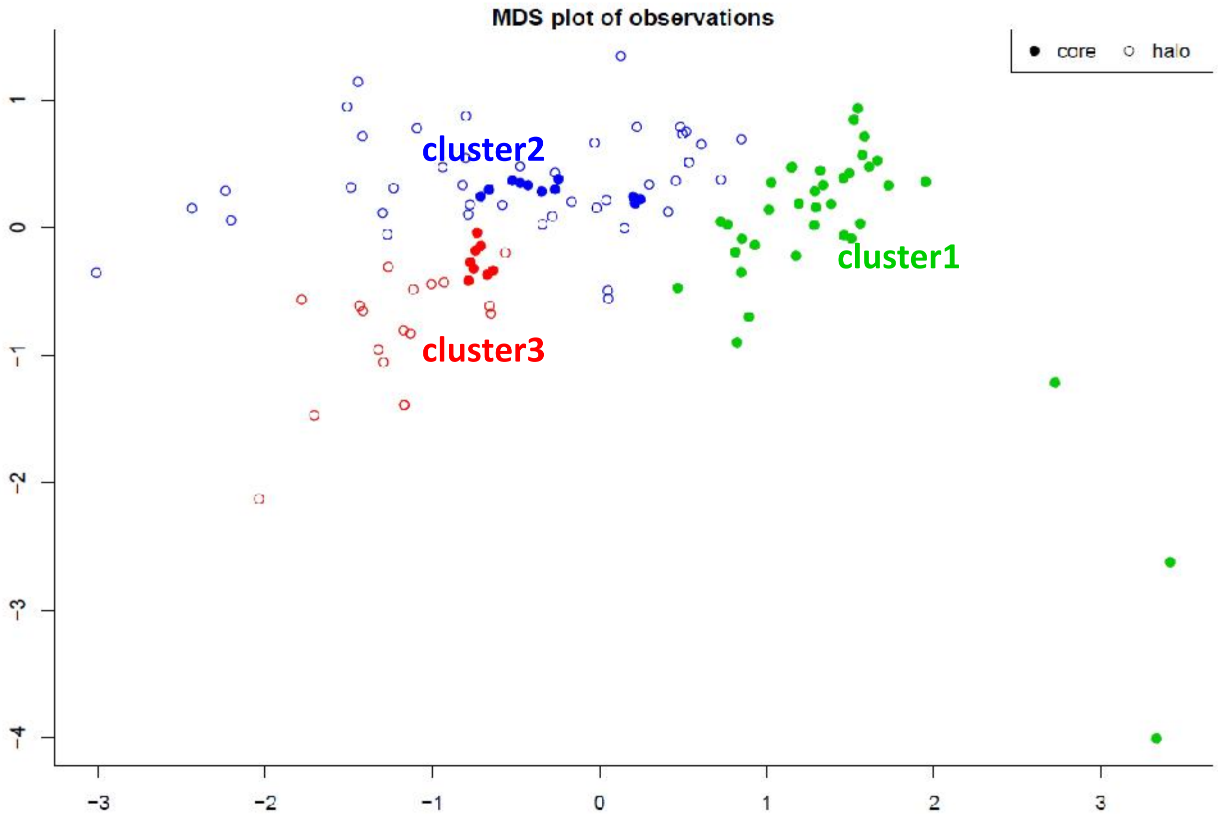


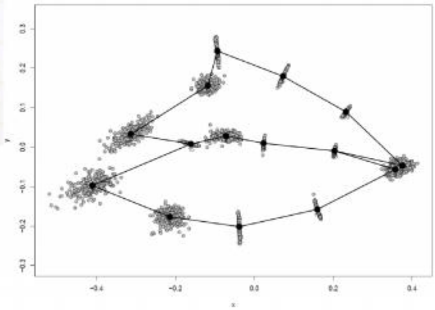
Fig. 644. Extent of postjuv moult on the wing and tail in 1y/2y *Emberiza schoeniclus*.

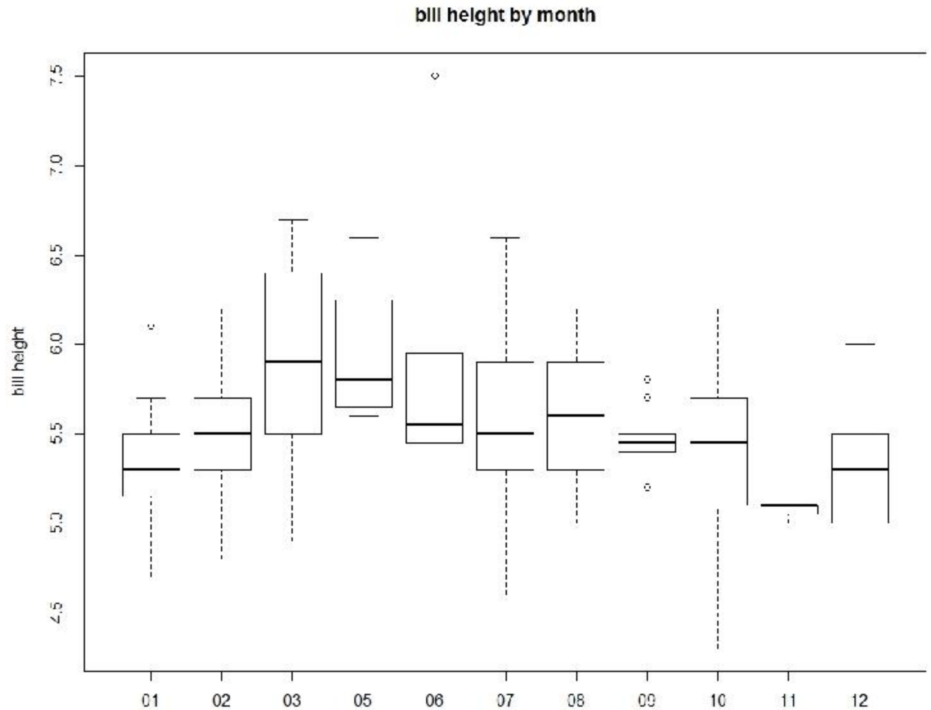
Jenni & Winkler 1994

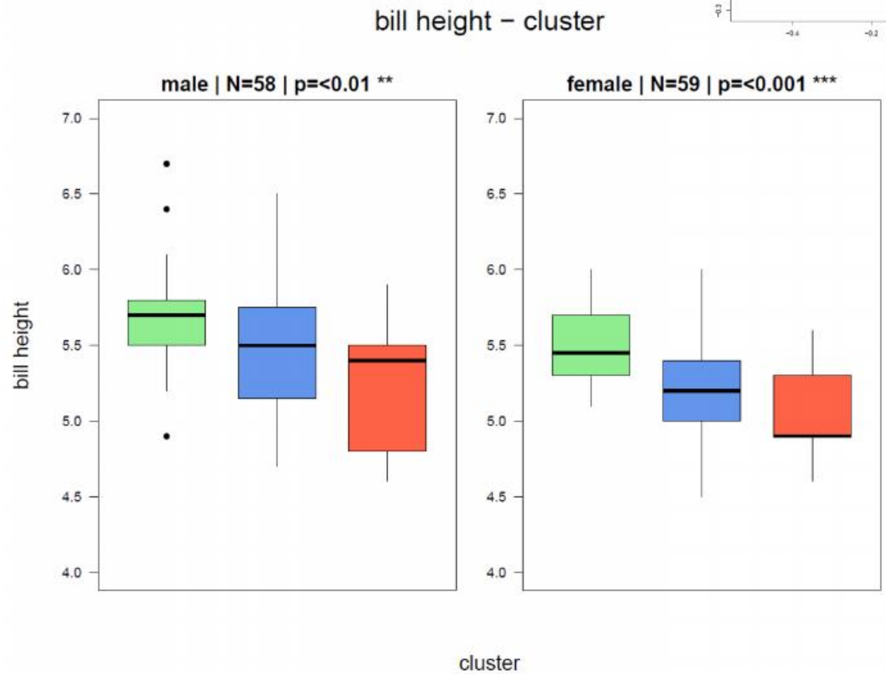
Density cluster



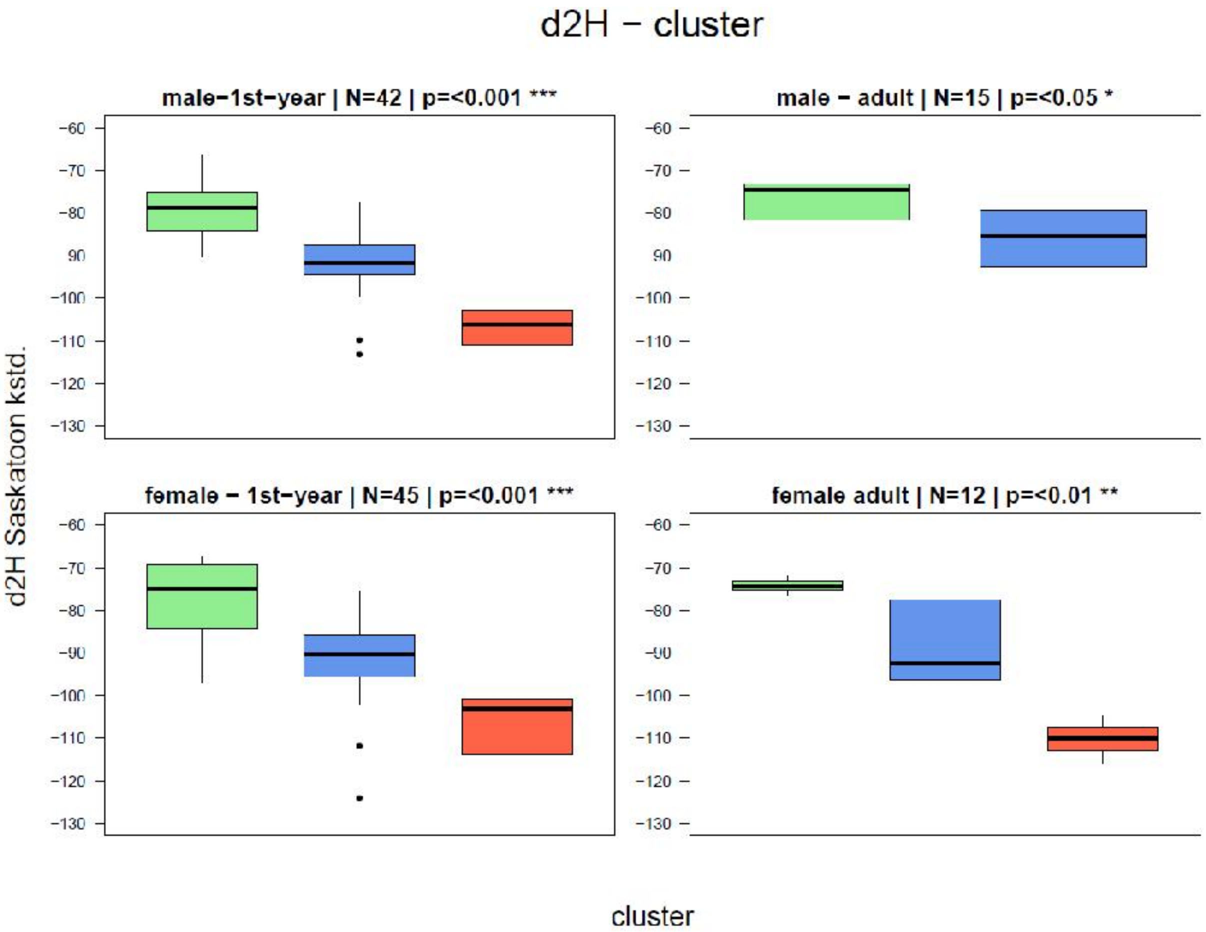
Bill morphology

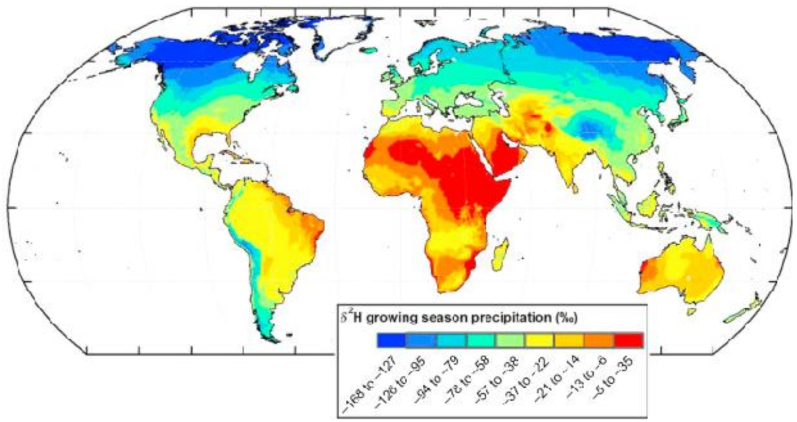






d^{2}H - cluster





Bowen & West 2019

J Ornithol
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ORIGINAL ARTICLE

The roles of environmental and geographic variables in explaining the differential wintering distribution of a migratory passerine in southern Europe

Juan Arizaga · Gerard Bota · David Mazuelas · Pablo Vera

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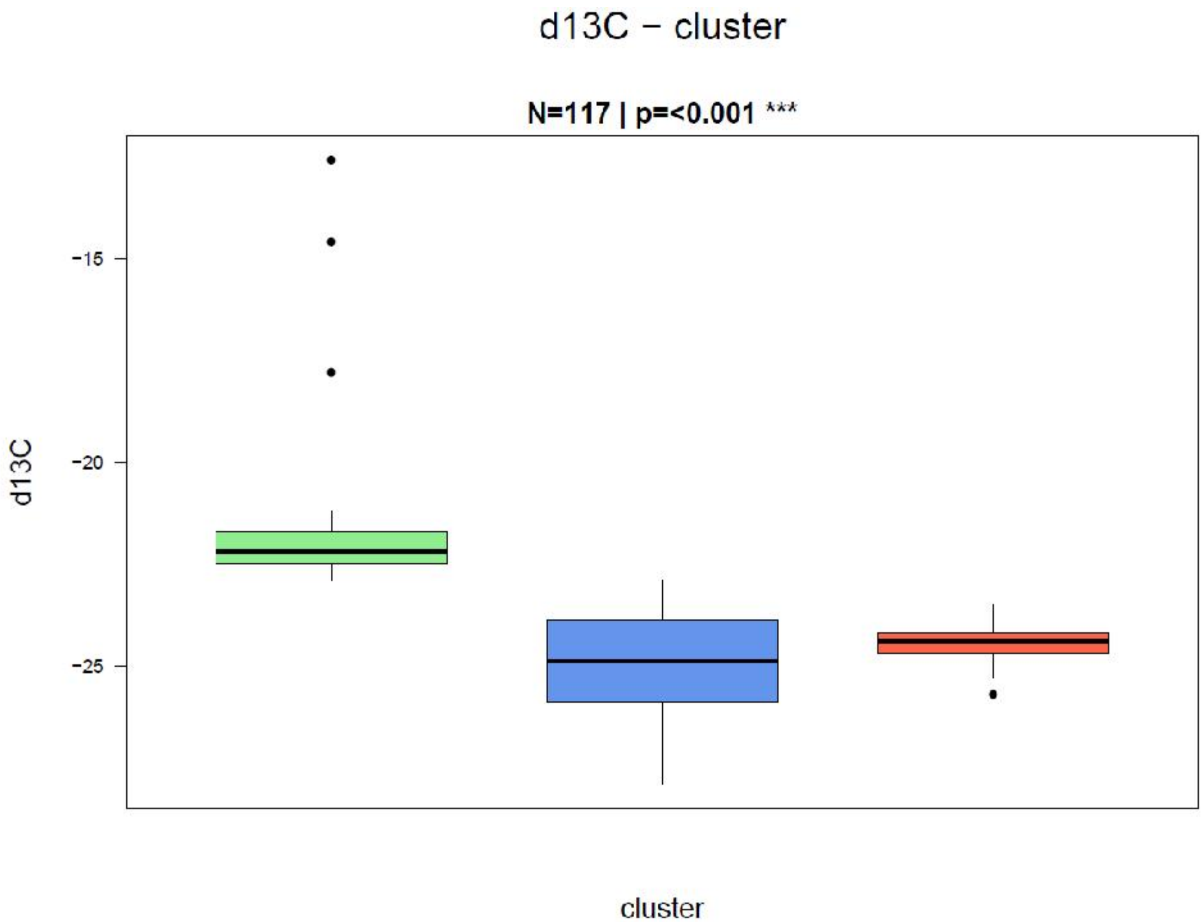
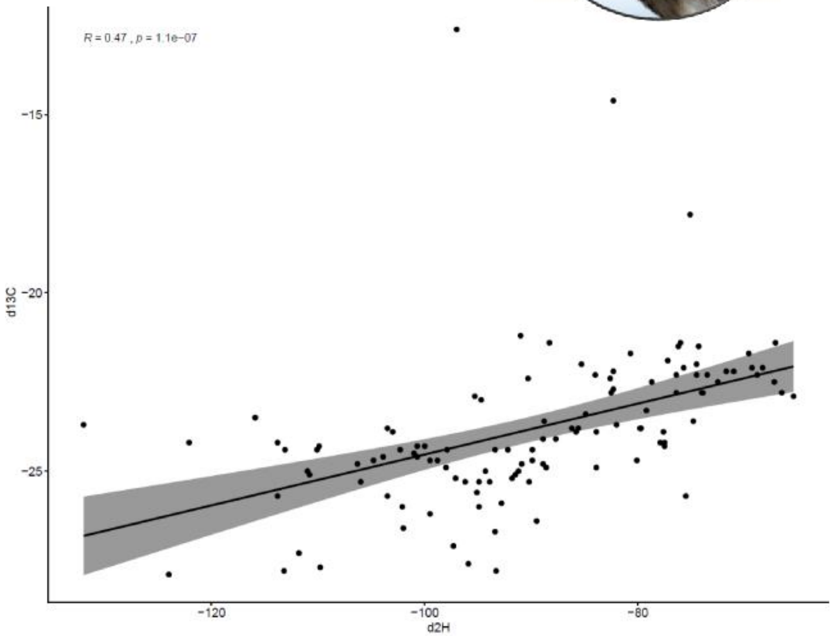
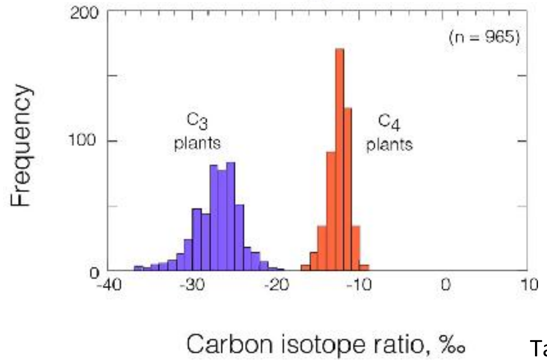
$d^{13}C$ - cluster

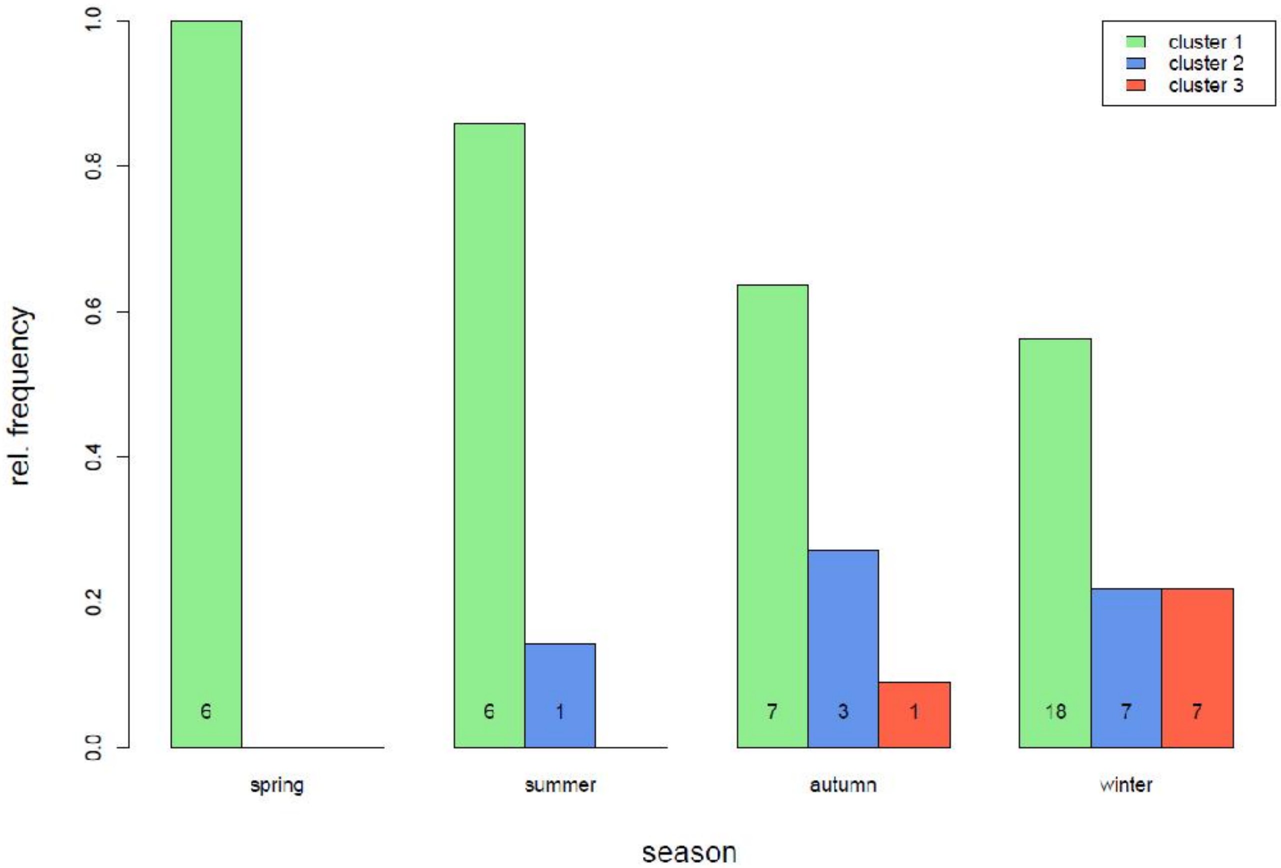






Taiz & Zeiger 2014

Rel. frequency of cluster per season

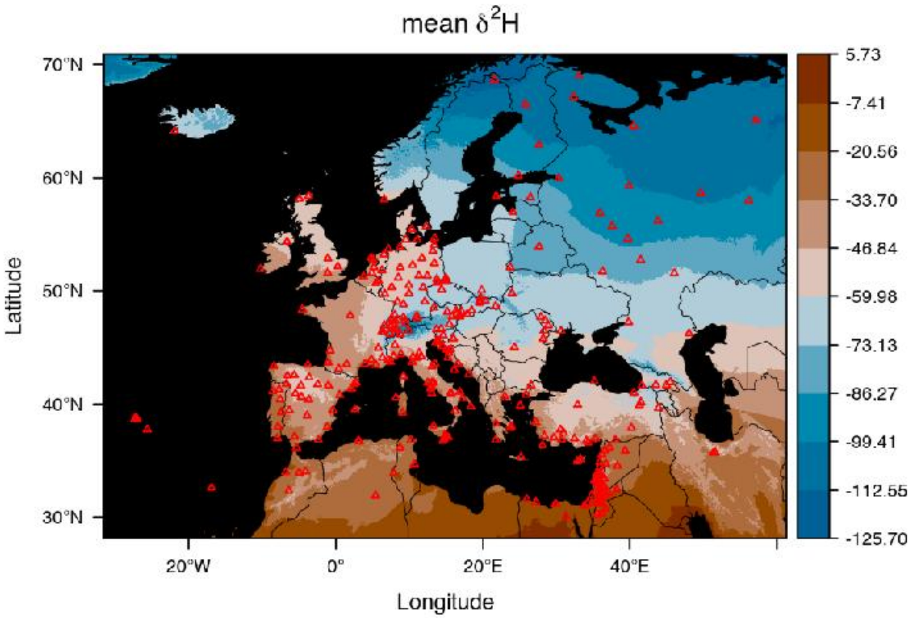


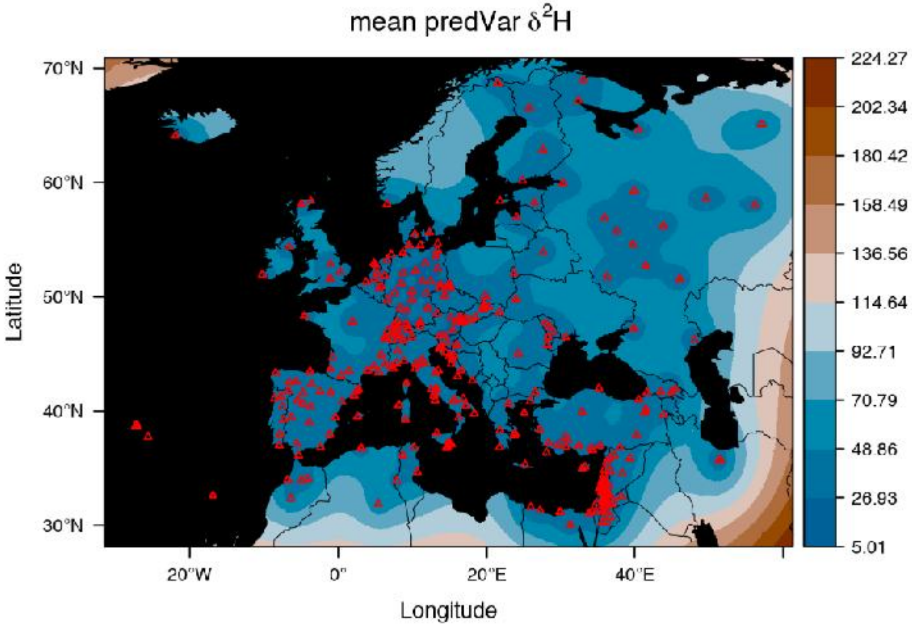
Isoscape construction with IsoriX (Courtiol et al. 2019)

-IsoriX implements a methodology based on mixed models for describing how isotope ratios vary in space.

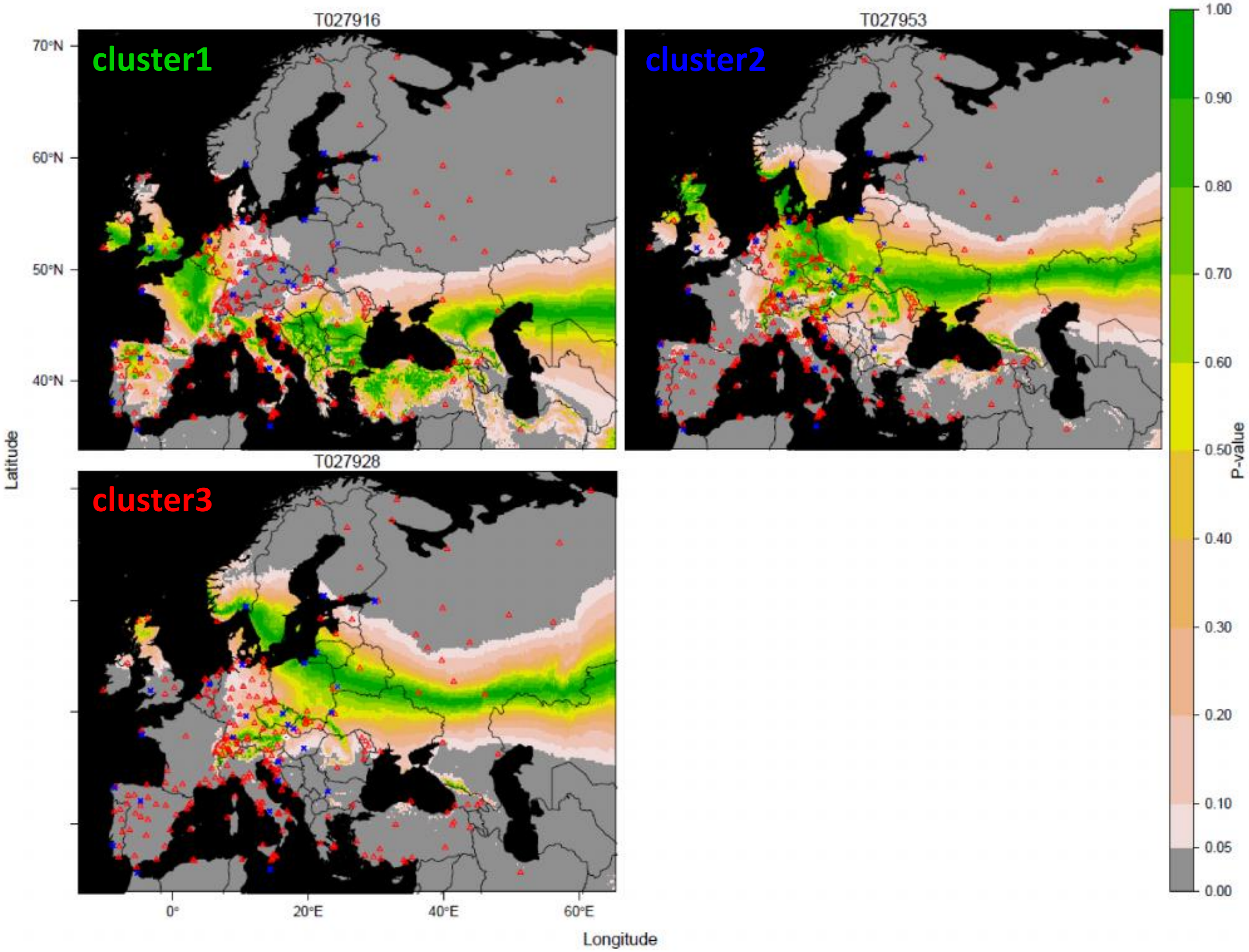
Required information/ data:

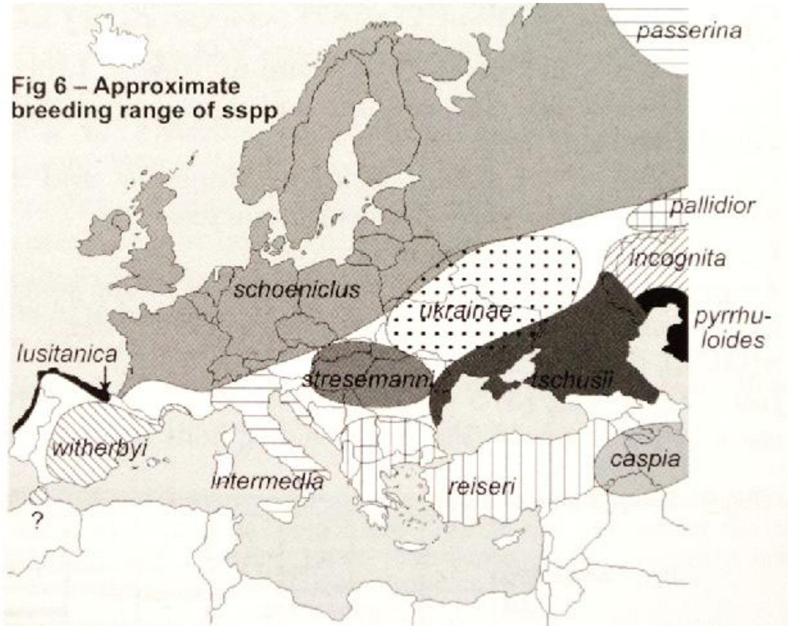
- δ-values from **source samples**
- Known origin samples (fractionation factor -> **calibration**)
- δ of **feather samples** (unknown origin)





Geographic assignment of d^{2}H values of feathers





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