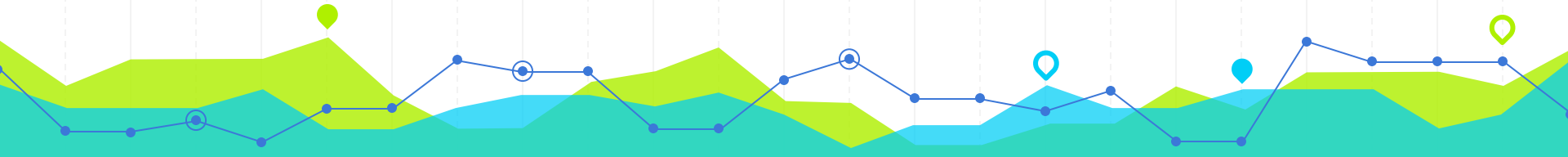


# Halophiles and Biogeography

By Bex Kemp, Adam Wolford and Bonnie Baxter

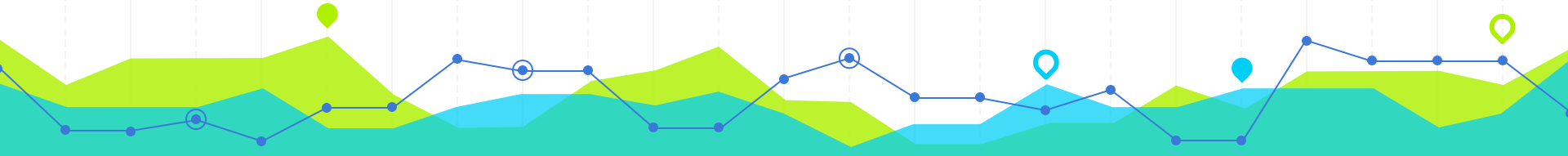
# HALOPHILIC ARCHAEA

- ◉ Halophilic archaea dominate the Earth's many hypersaline environments such as Great Salt Lake (GSL)
- ◉ They are multi-extremophiles, tolerating not only salinity, but also desiccation and high levels of UV irradiation
- ◉ *Halorubrum* is a genus of Halophilic archaea with wide distribution around the Earth
- ◉ The distribution of *Halorubrum* across space and time begs the question of the mechanism behind the biogeography.



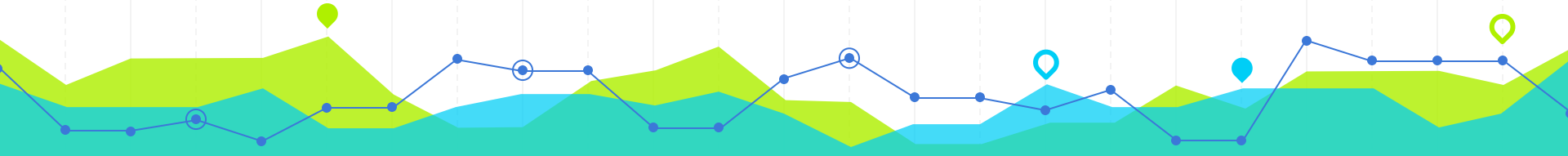
# BIOGEOGRAPHY

- Baas Becking famously postulated that “everything is everywhere; but, the environment selects” to explain the vast diversity of microorganisms and their overlapping geographic distributions
- Recent studies have disputed this idea and suggest other mechanisms of distribution
- Our study investigated bird migration as a mechanism for distributing genetically similar *Halorubrum* strains



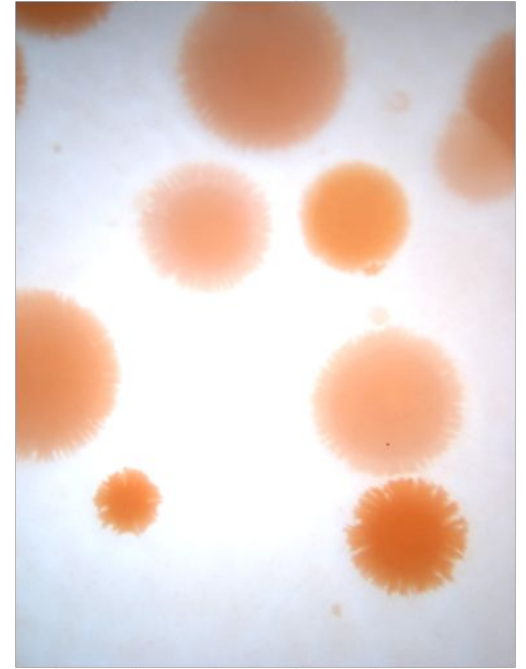
## HYPOTHESIS

We predict that through that bird migration patterns can explain their genetic diversity and biogeography of the location of similar strains



## METHODS

- Halite (salt) was collected from the north arm of GSL
- This halite was added to growth media and incubated for three weeks
- Halophilic archaea from the liquid cultures were plated and grown on solid media for isolation
- Strains were isolated
- The 16S rRNA gene was amplified and sequenced
- GenBank was used to compare sequences of GSL strains to other strains in the genetic database

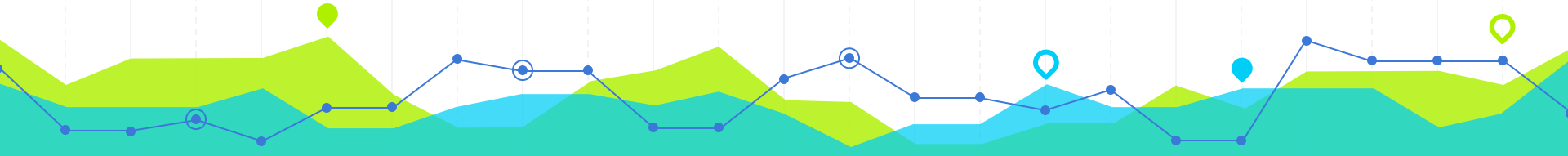


# RESULTS

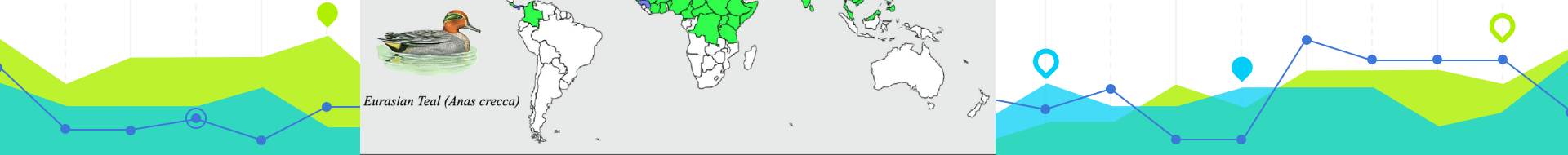
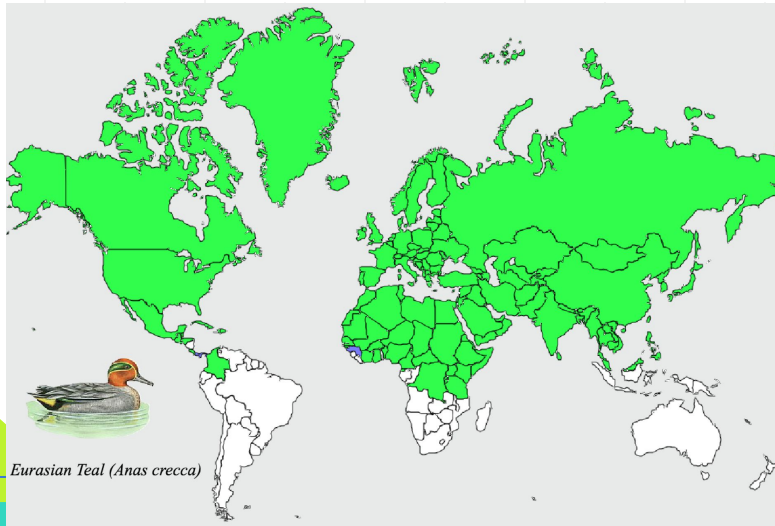
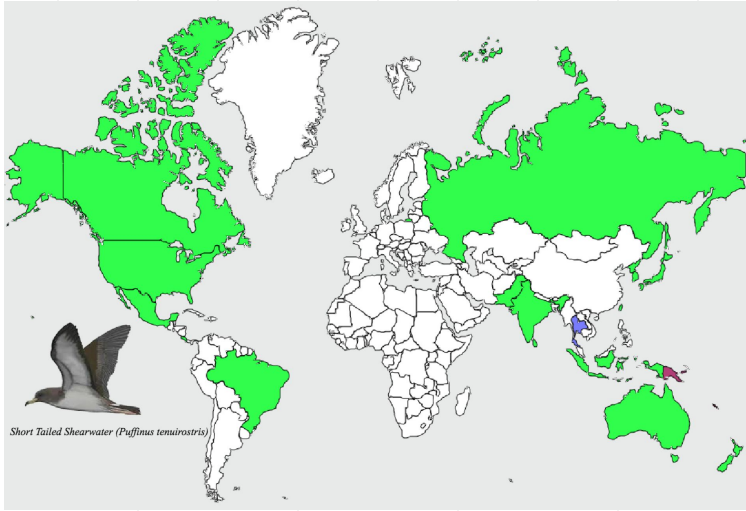


## CONCLUSION

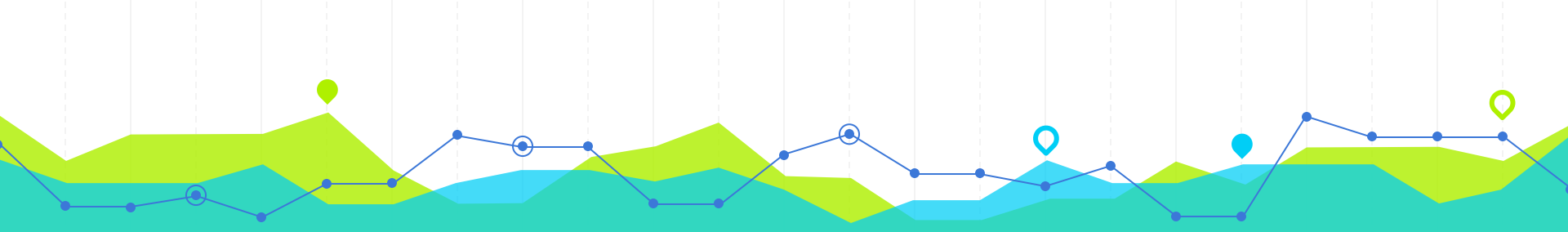
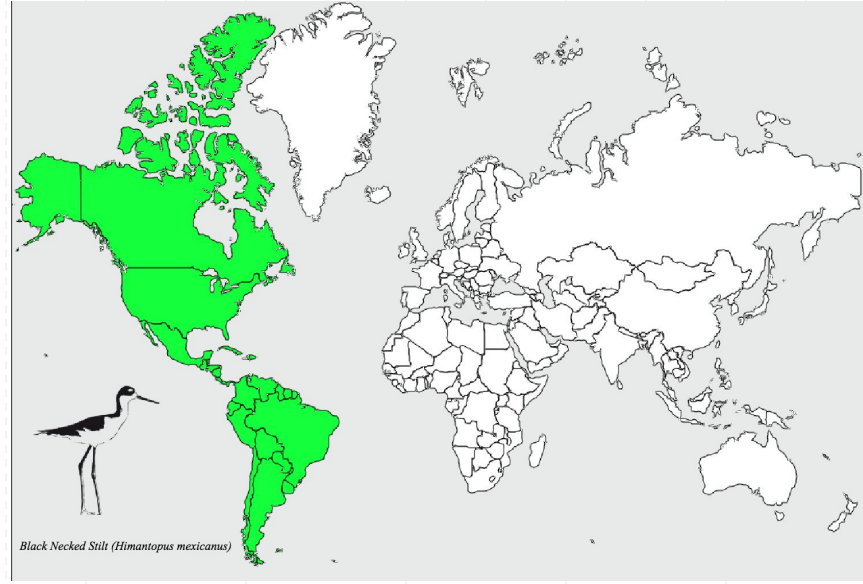
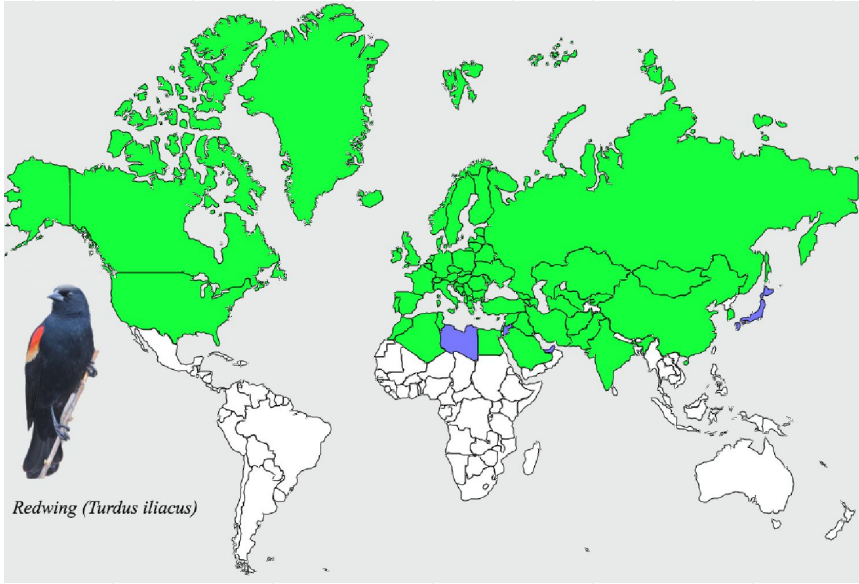
- ◉ *Halorubrum*, as a representative halophilic archaea genus, can survive desiccation in salt crystals
  - ◉ More than 5 million migrating birds visit GSL per year
  - ◉ Salt encrusted in their feathers could contain *Halorubrum* species
- [[[Discuss overlap in migration patterns and biogeog of *Halorubrum*]]]



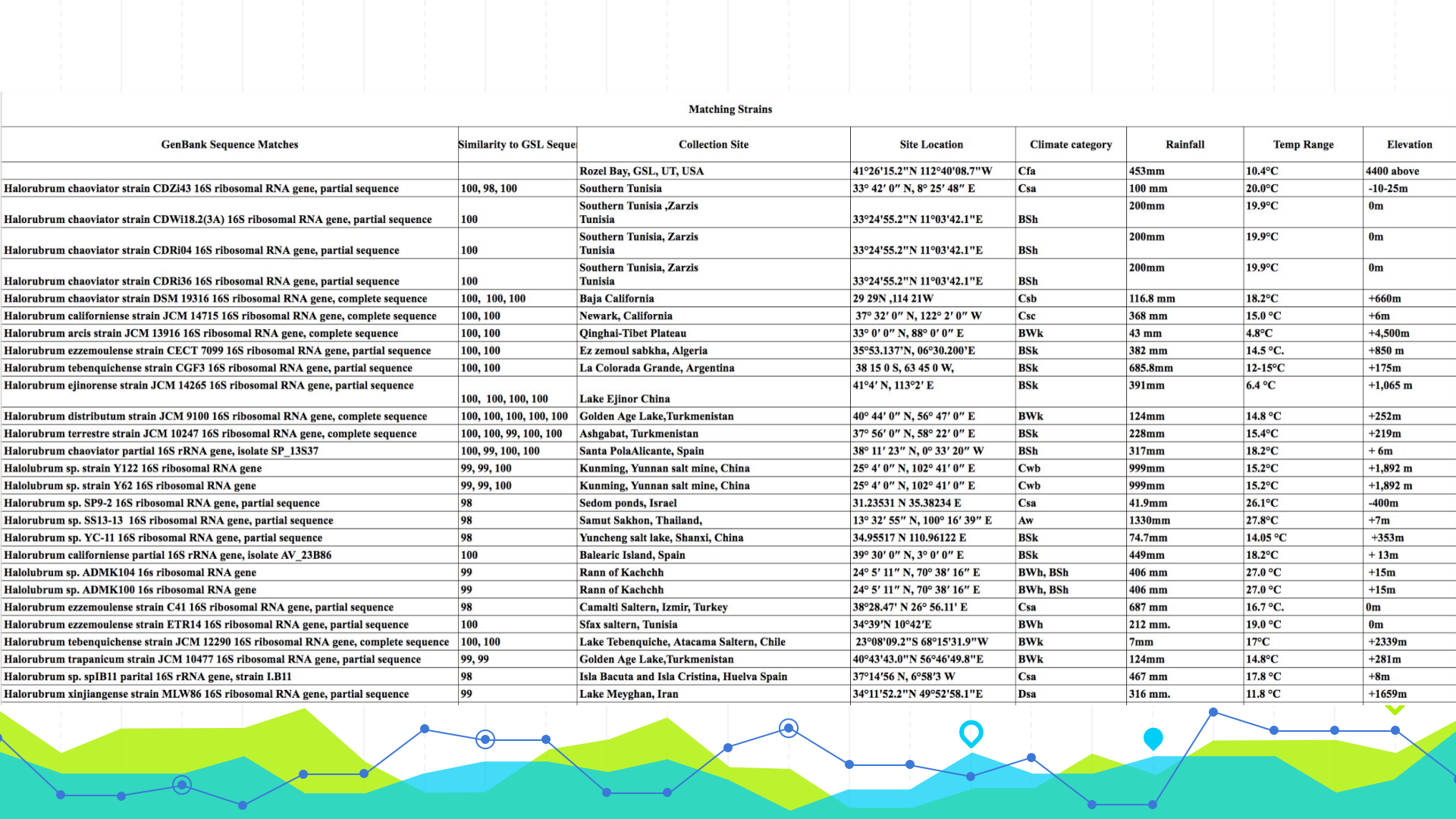
# BIRD MIGRATION

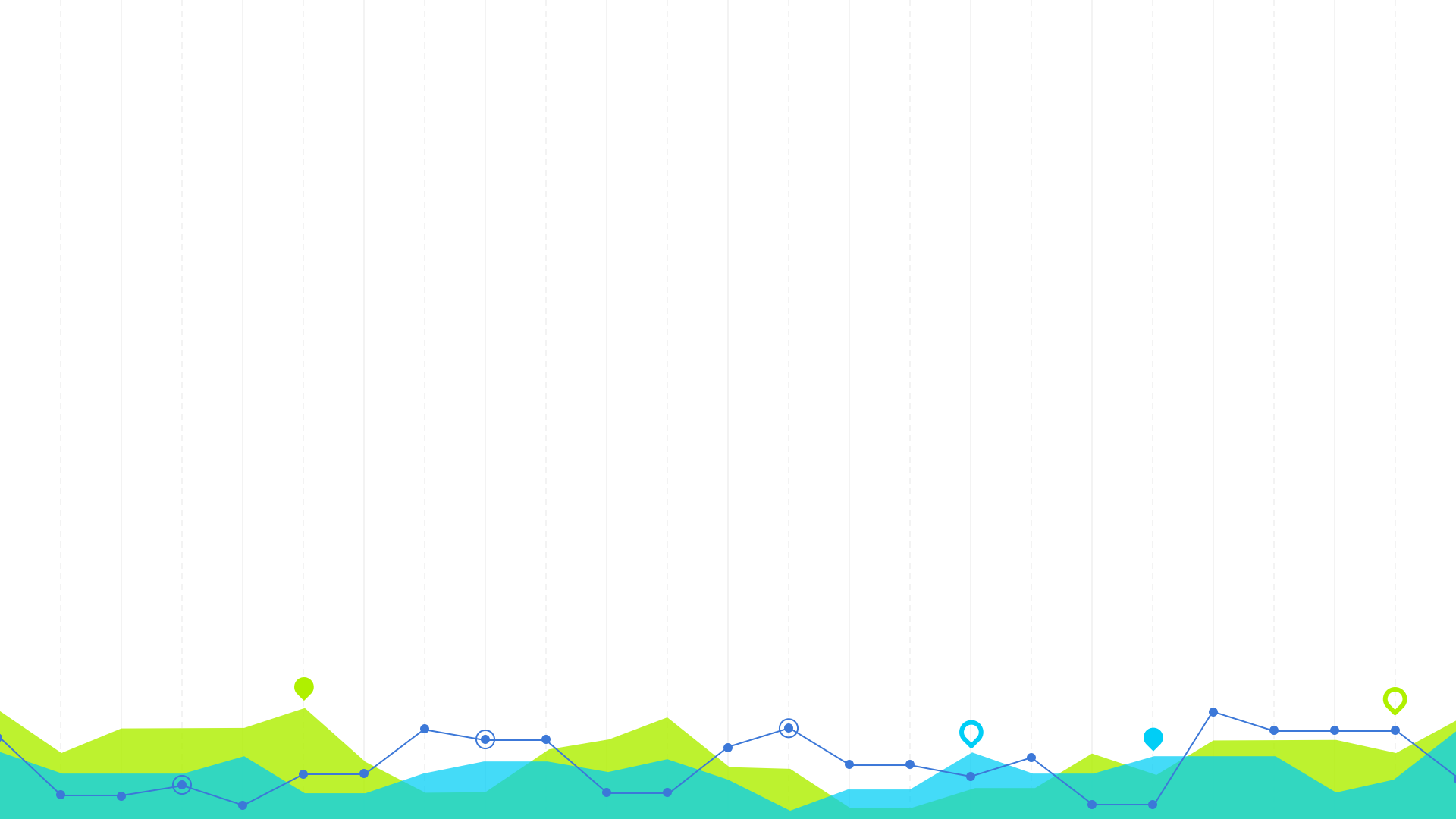




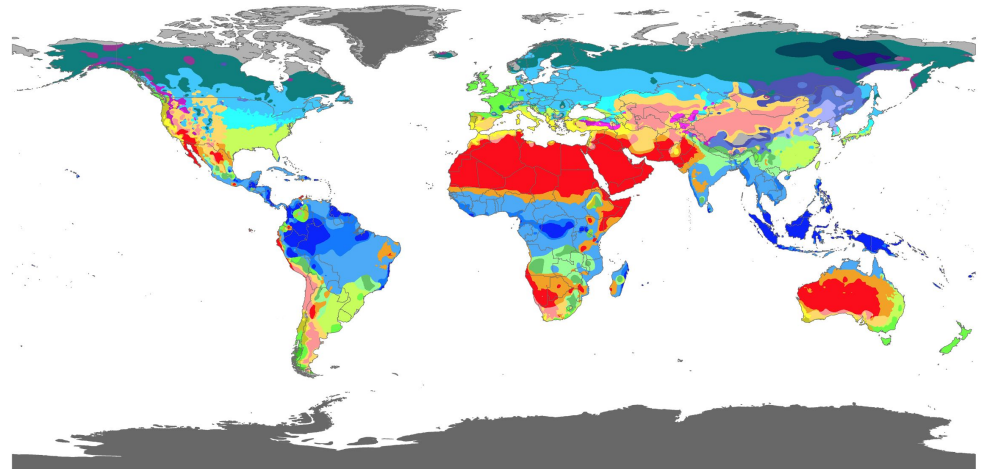


Americas	Eurasian	Long Distance Travelers	Main Suspects
American Avocet ( <i>Recurvirostra americana</i> )	Amur falcon ( <i>Falco amurensis</i> )	Arctic Tern ( <i>Sterna paradisaea</i> )	Black Necked Stilt ( <i>Himantopus mexicanus</i> )
Bald Eagle ( <i>Haliaeetus leucocephalus</i> )	Barn swallow ( <i>Hirundo rustica</i> )	Black Noddy ( <i>Anous minutus</i> )	Eurasian Teal ( <i>Anas crecca</i> )
Bank Swallow ( <i>Riparia riparia</i> )	Common Crane ( <i>Grus grus</i> )	Short Tailed Shearwater ( <i>Puffinus tenuirostris</i> )	Redwing ( <i>Turdus iliacus</i> )
Black Necked Stilt ( <i>Himantopus mexicanus</i> )	Common Pochard ( <i>Aythya ferina</i> )	Sooty Shearwater ( <i>Puffinus griseus</i> )	Short Tailed Shearwater ( <i>Puffinus tenuirostris</i> )
Common Teal ( <i>Anas crecca</i> )	Eurasian Teal ( <i>Anas crecca</i> )	Sooty Tern ( <i>Onychoprion fuscatus</i> )	
Eared Grebe ( <i>Podiceps nigricollis</i> )	Northern Wheatears ( <i>Oenanthe oenanthe</i> )	Tundra Swan ( <i>Cygnus columbianus</i> )	
Green-winged teal ( <i>Anas carolinensis</i> )	Redwing ( <i>Turdus iliacus</i> )	Wedge Tailed Shearwater ( <i>Puffinus pacificus</i> )	
Peregrine Falcon ( <i>Falco peregrinus</i> )			
Snowy Plover ( <i>Charadrius nivosus</i> )			
White faced Ibis ( <i>Plegadis chihi</i> )			
White Pelican ( <i>Pelecanus erythrorhynchos</i> )			
Wilson’s Phalarope ( <i>Phalaropus tricolor</i> )			

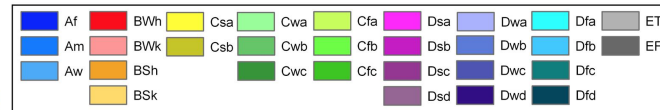
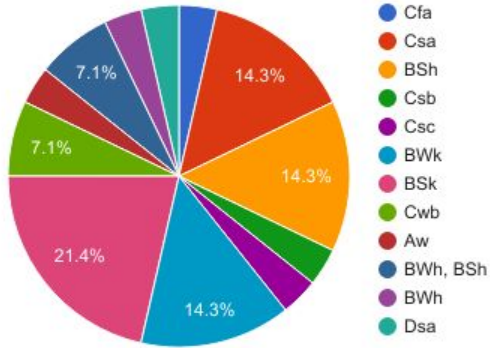




## World map of Köppen-Geiger climate classification



## Climate Category



Contact : Murray C. Peel (mpeel@unimelb.edu.au) for further information

**DATA SOURCE** : GHCN v2.0 station data  
Temperature (N = 4,844) and  
Precipitation (N = 12,396)

**PERIOD OF RECORD** : All available

**MIN LENGTH** : ≥30 for each month.

**RESOLUTION** : 0.1 degree lat/long

**368.8**  
**mm**

Average Rainfall

**17.3**  
**°C**

Average Temperature

**720.9**  
**m**

Average Elevation

