Ornithophily and Ornithophilous Flowers

Bird Pollinators

Presented by
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www.birdingadventuresinc.com

The main objective of this presentation is to explore three questions:

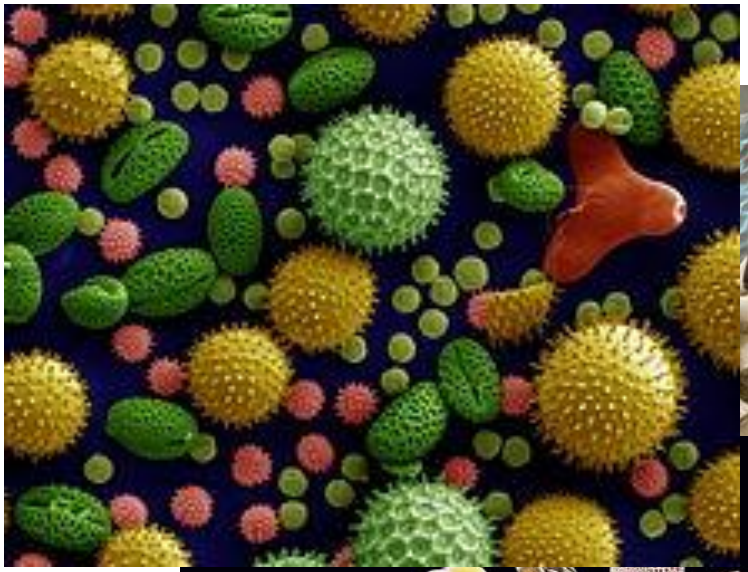
Why and how do flowers attract nectarivorous birds?

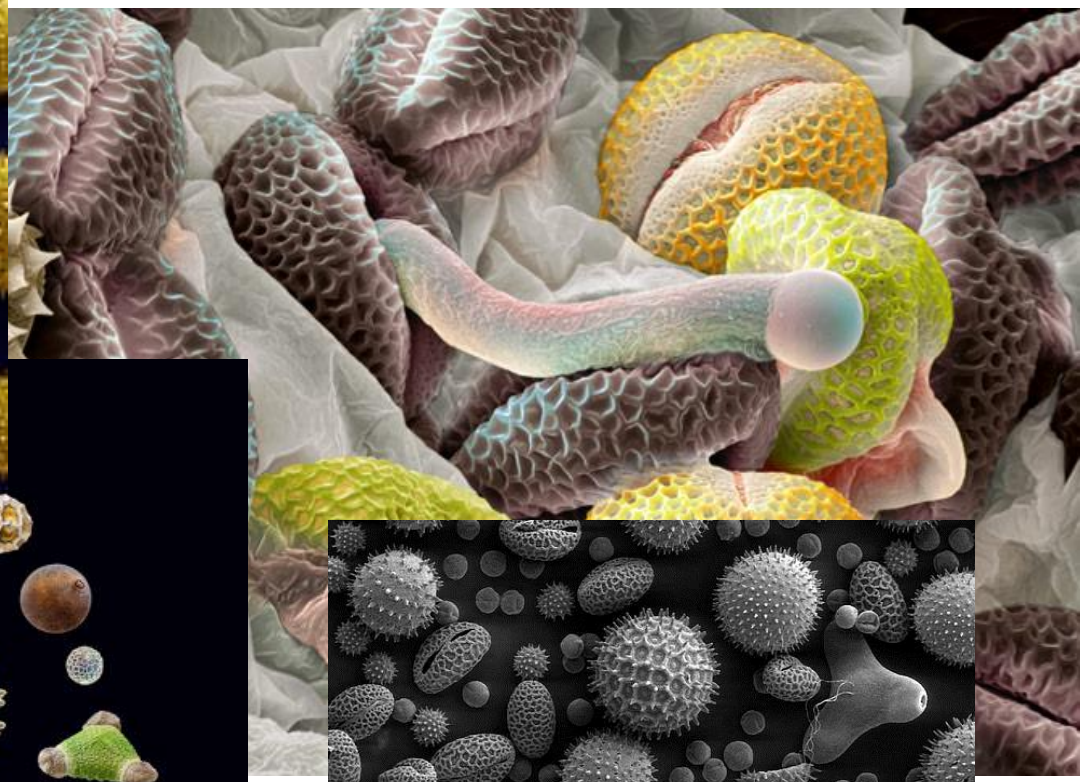
How do birds conduct pollination?

Who are the avian pollinators?

Why? Because it's all about **me**.....

POLLEN





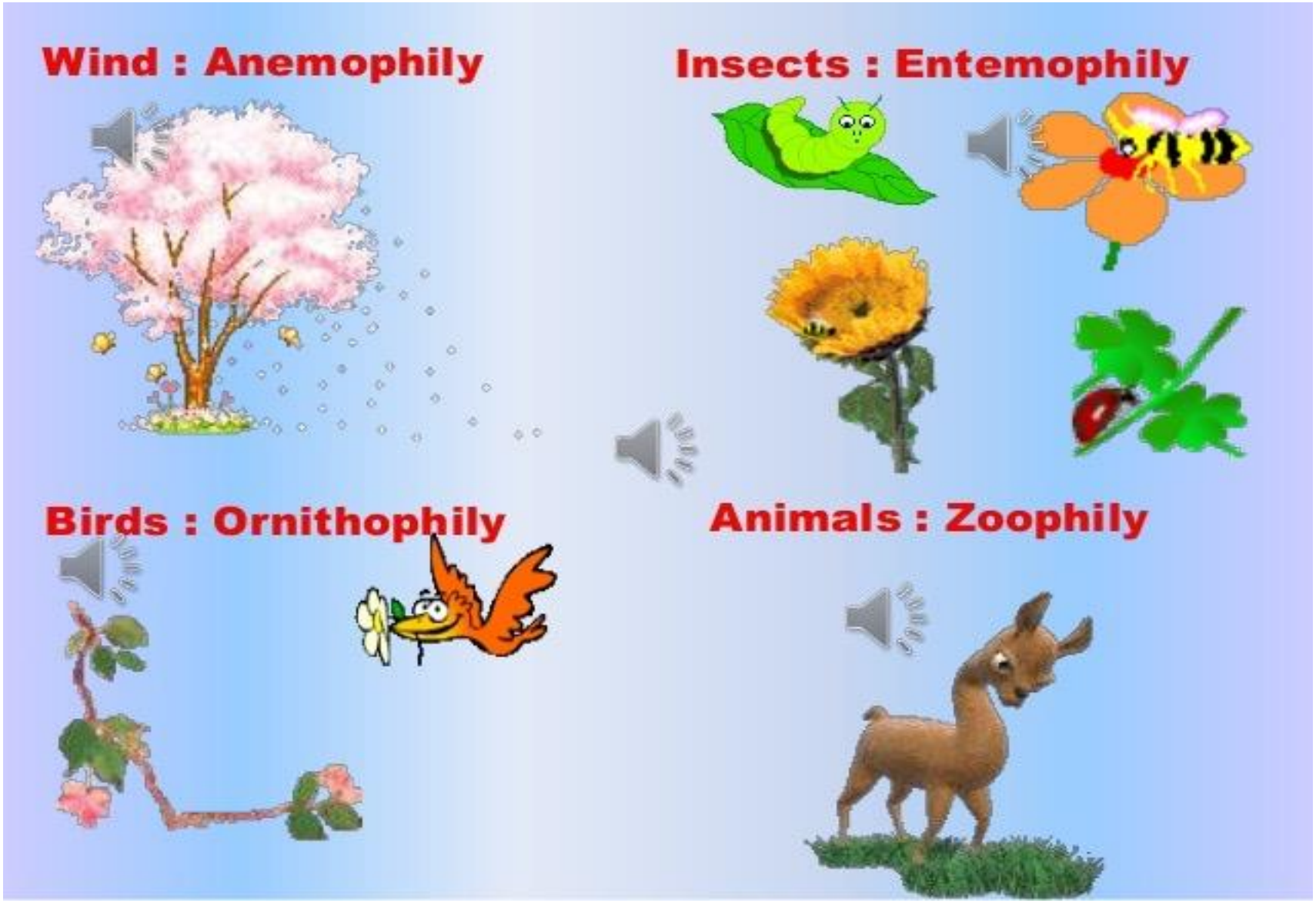
Pollen's Biggest Problems…

How to spread its genetic material

How to attract pollinators

How to guarantee that they'll come back for more

How to spread pollen.

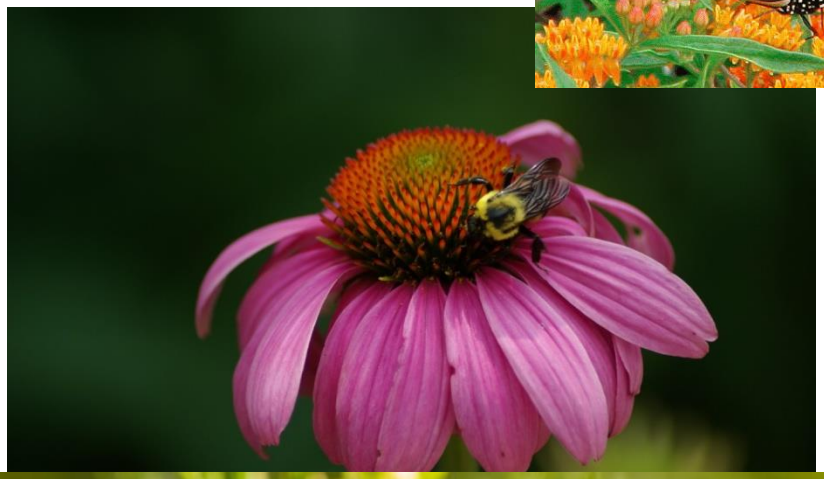


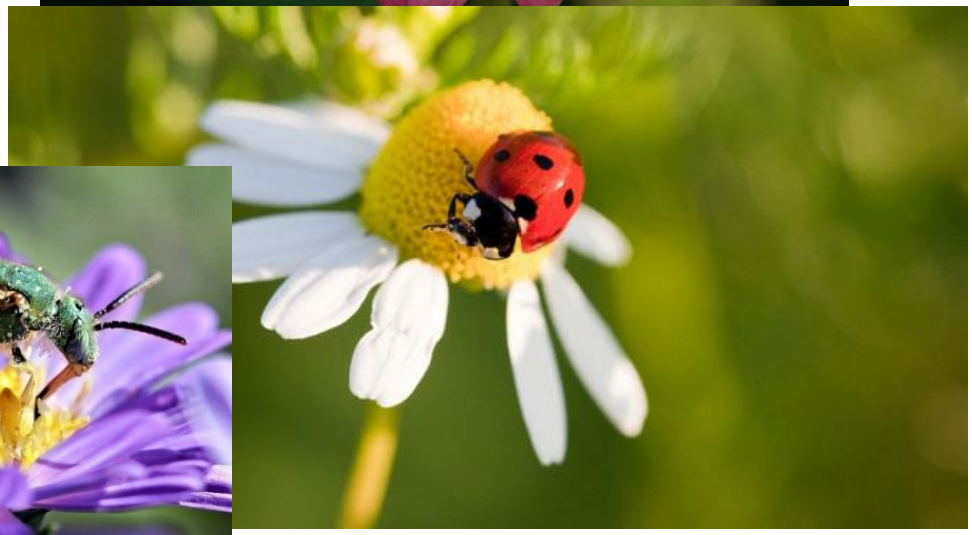
Wind pollination

- Lack of scent production
- Lack of showy floral parts (resulting in inconspicuous flowers)
- Reduced production of nectar
- Production of enormous numbers of pollen grains
- Light weight and non-sticky
- Well-exposed stamens
- Feathery stigmas

Insect pollination

- Large brightly colored petals with fragrance
- Pollen grains large and present in small numbers
- Pollen grains may be sticky
- Stigma lies within petals
- Flowers may be solitary or as an inflorescence





Mammalian pollination

Bird pollination--Ornithophily

In North America, there are more than 200 native nectar producing flowering plants that use a variety of bees, butterflies and bats to transfer pollen.

At least 150 species (or over 500 genera) of these flowers are primarily, or exclusively, pollinated by nectarivorous birds.

One hundred and fifty million years of evolution have provided these flowering plants with physical features that prevent the other pollinators from being successful.

The ‘Floral Syndrome’ of Ornithophily

What physical features make a flower ornithophilous?

Scent is of little or no use for birds.
Usually produce a vivid floral display of mostly red, orange or purple hues.

Why Red?

Hummingbirds lock onto the warmer colors of the ultra-violet spectrum, not including yellow which is preferred by bees.

Floral posture

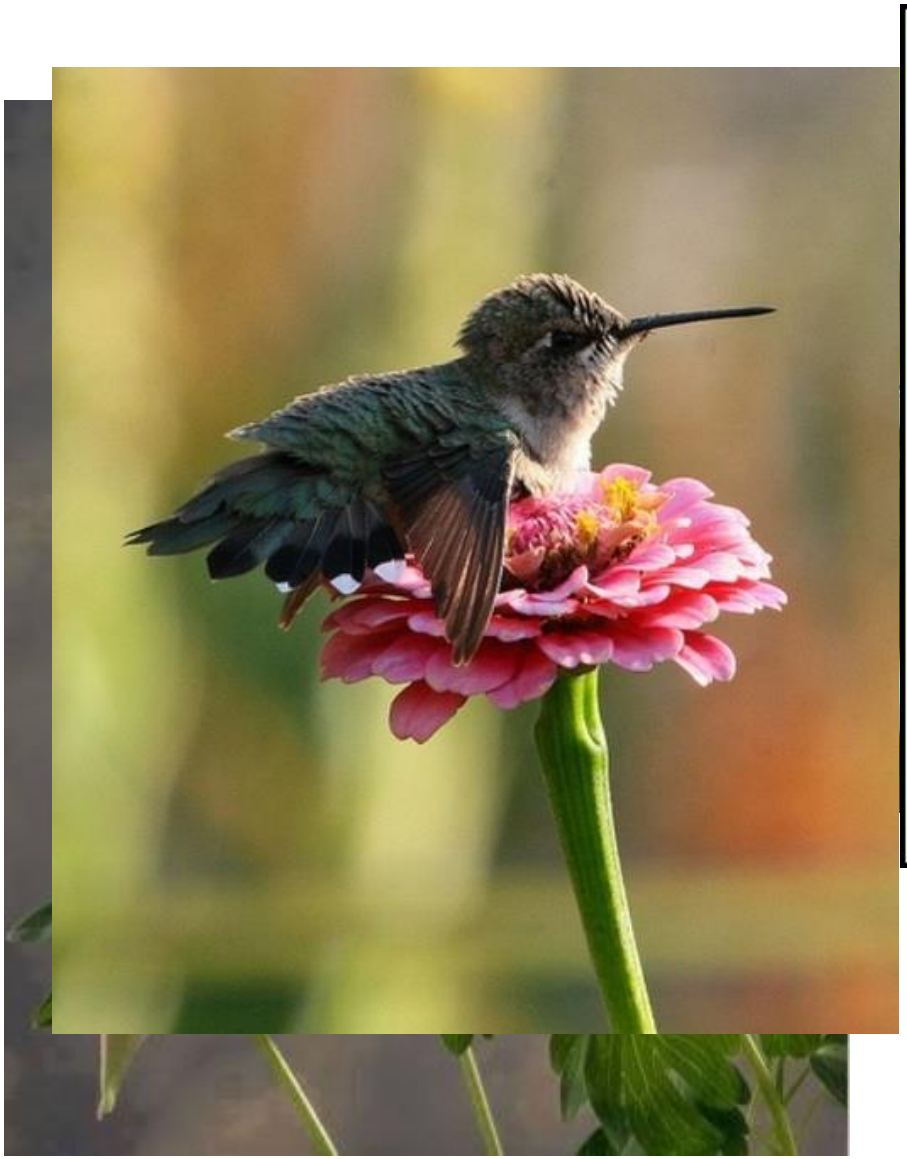
Flowers loosely clustered and on tips of flexible stalks.

Nectary usually deep within the long floral tube…

…enabling flower to accurately place **pollen** on bird's bodies.

Floral posture

An absence of landing platforms



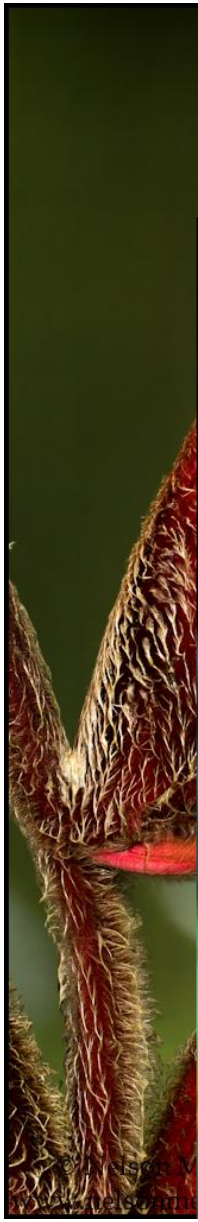
Floral posture —provide landing platforms for some passerine species.

Malachite Sunbird
and
Rat’s tail babiana

Protect the plant from vigorous foraging by birds

Mechanical strength of the flower by the formation of hard tissue in various floral parts.

Protection of ovules placed away from nectaries or hidden channeled visually or mechanically to the



Ornithophilous flowers show a strong convergent evolution with shapes of bills.

Pollinator Syndrome Traits Table

Trait	Bats	Bees	Beetles	Birds	Butterflies	Flies	Moths	Wind
Color	Dull white, green or purple	Bright white, yellow, blue, or UV	Dull white or green	Scarlet, orange, red or white	Bright, including red and purple	Pale and dull to dark brown or purple; flecked with translucent patches	Pale and dull red, purple, pink or white	Dull green, brown, or colorless; petals absent or reduced
Nectar Guides	Absent	Present	Absent	Absent	Present	Absent	Absent	Absent
Odor	Strong musty; emitted at night	Fresh, mild, pleasant	None to strongly fruity or fetid	None	Faint but fresh	Putrid	Strong sweet; emitted at night	None
Nectar	Abundant; somewhat hidden	Usually present	Sometimes present; not hidden	Ample; deeply hidden	Ample; deeply hidden	Usually absent	Ample; deeply hidden	None
Pollen	Ample	Limited; often sticky and scented	Ample	Modest	Limited	Modest in amount	Limited	Abundant; small, smooth, and not sticky
Flower Shape	Regular; bowl shaped – closed during day	Shallow; have landing platform; tubular, c	Large bowl-like, Magnolia	Large funnel like; cups, strong perch support	Narrow tube with spur; wide landing pad	Shallow; funnel like or complex and trap-like	Regular; tubular without a lip	Regular: small and stigmas exerted

For More Information

Why
do
flowers
want
to
attract
avian
pollinators?

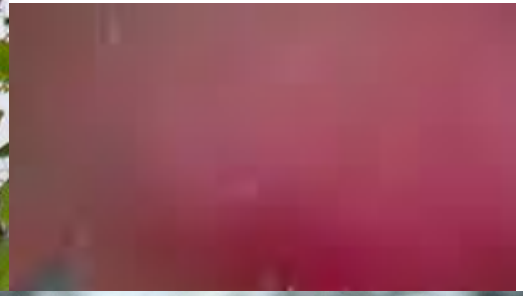
Attributes of nectarivorous birds.

(or, why birds are better pollinators than insects.)

Persist in colder, higher altitudes

The hardy **Ecuadorian Hillstar** lives higher than any hummingbird on earth and is frequently found way above the treeline at 17,000 feet.

Active during inclement weather conditions.



How do flowers guarantee birds will come back?

Nectar

Sugar composition

Nectar is mainly composed of fruit sugars such as glucose and fructose (hexoses), and/or the disaccharide sucrose.

55% sucrose, 24% glucose and 21% fructose

Hummingbird-pollinated flowers generally have sucrose-dominant nectar, whereas flowers pollinated by passerine perching birds tend to have hexose-dominant nectar.

Passerine birds often feed on fruits as well, and it has been suggested that the 'taste' for hexose fruit sugars derived from this frugivorous feeding.

Amino Acids may affect the 'taste' of nectar.

Nectar Volume

Bird pollinated flowers tend to produce larger quantities of nectar than insect pollinated flowers.

Sugar concentration

Inversely proportional to volume. Large quantity of nectar but relatively dilute.

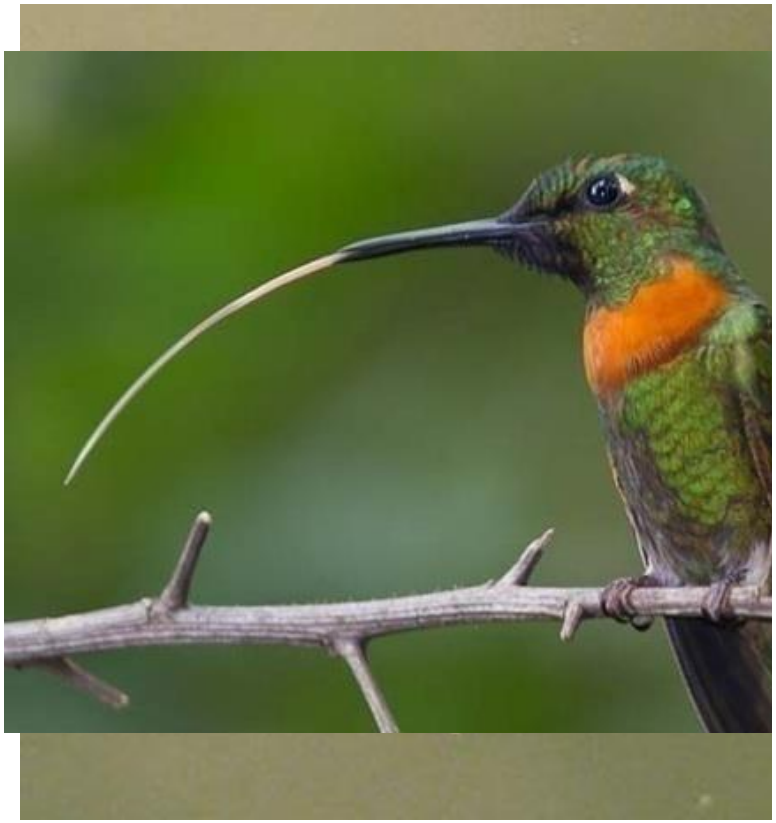
Viscosity

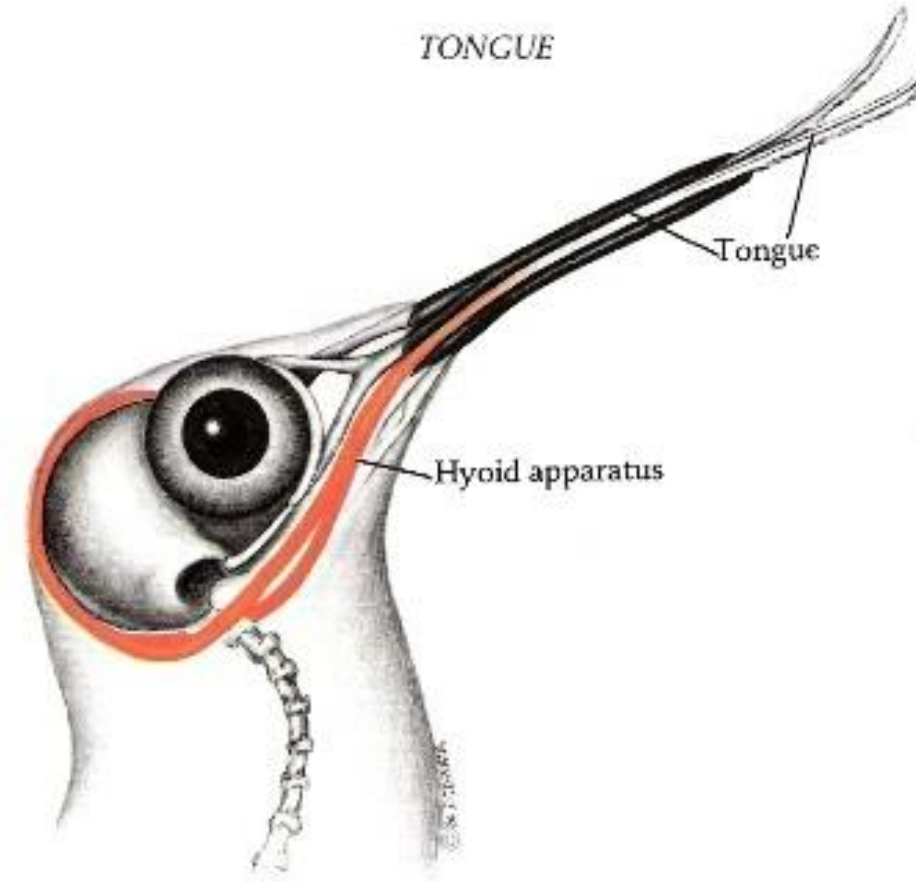
Sugar concentration of nectar determines its viscosity, which is an important physical property that is thought to affect the ease of uptake of nectar by birds.

Digestion

Hummingbirds can easily digest fructose since the sugar does not pass through the liver, but is instead absorbed like sucrose directly into the blood.

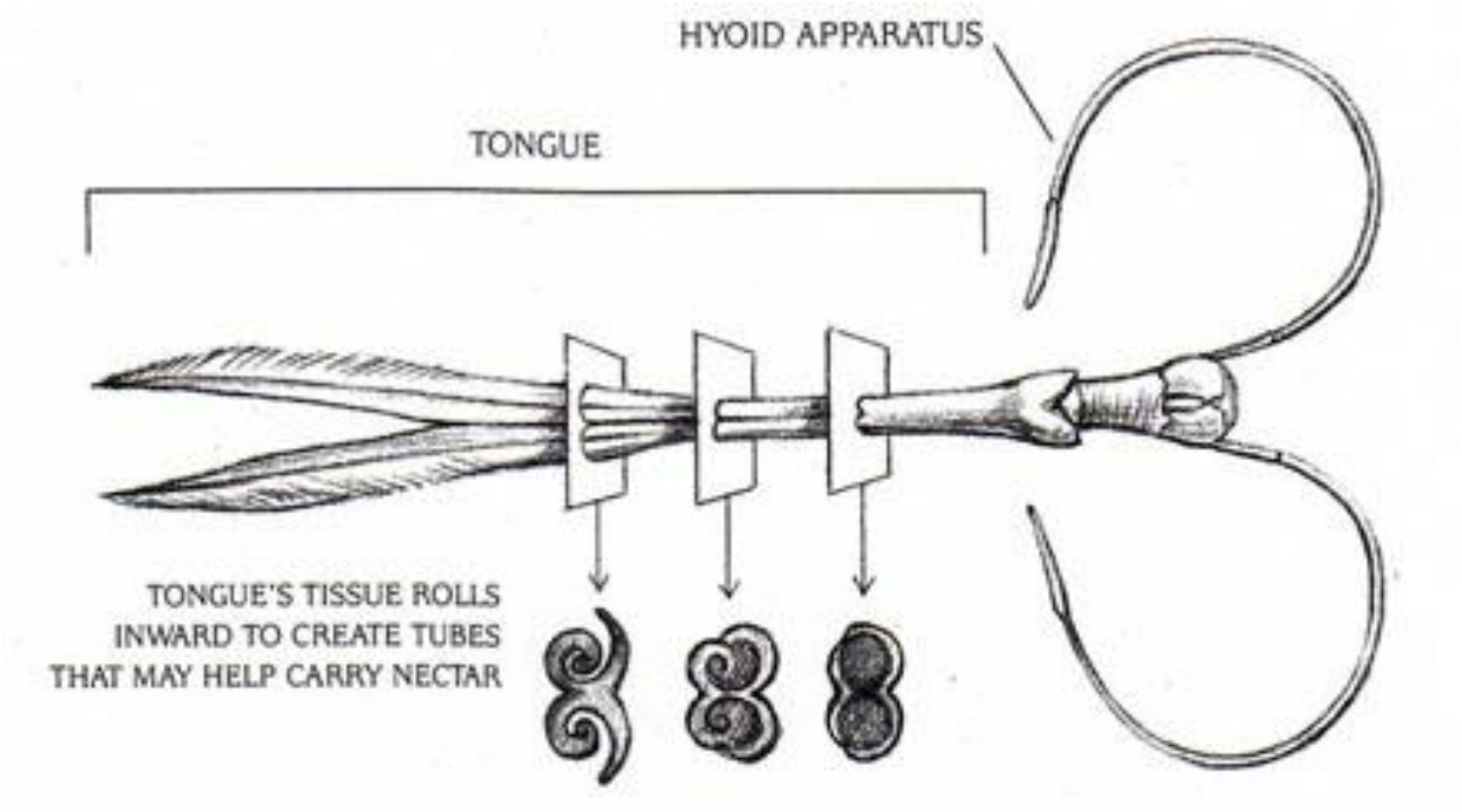
Hummingbird tongue





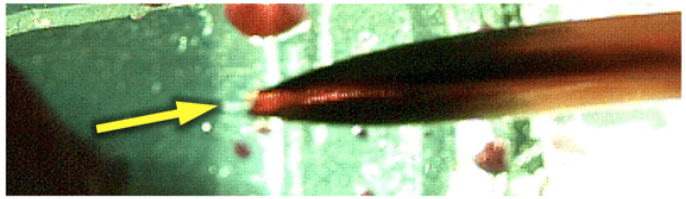
A three gram hummingbird can drink 43 grams of sugar water in one day, a full 14 times its body weight.

Hummingbird tongues act as elastic micropumps, allowing the bird to drain between five and 10 drops of nectar from a flower within 15 milliseconds (about 100th of a second).



When a bird first extends its tongue, the normally tubular tip is flattened shut. But when the tongue reaches the nectar, the tissues spring back to their normal cylindrical shape, creating a suction that fills the tongue reservoir. Finally, the bird retracts its tongue and squeezes the nectar from the tubes by flattening the tongue.

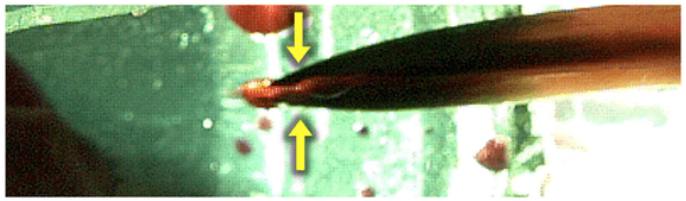
Pumping Action



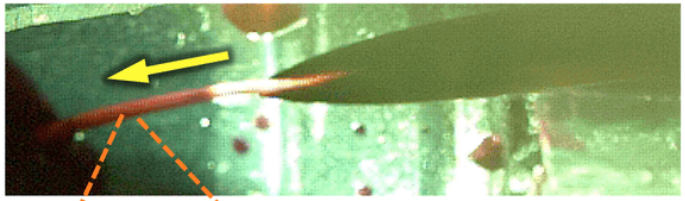
Red-dyed nectar

Bill base

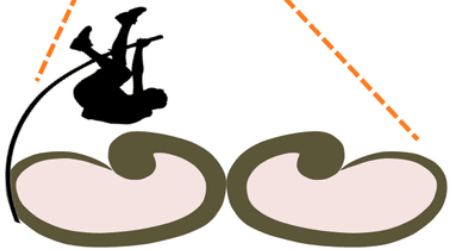
Tongue is pulled back in



Beak squashes the tongue

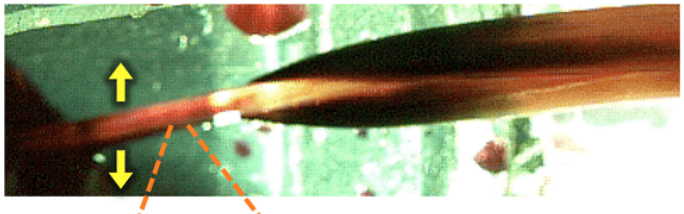


Tongue is extended and stays flat

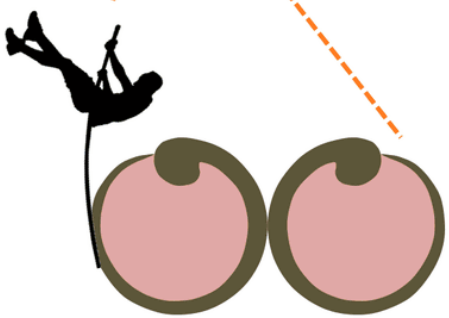


Cross section of the tongue

Flattening the tongue stores elastic energy



Tongue springs open, pulling nectar in



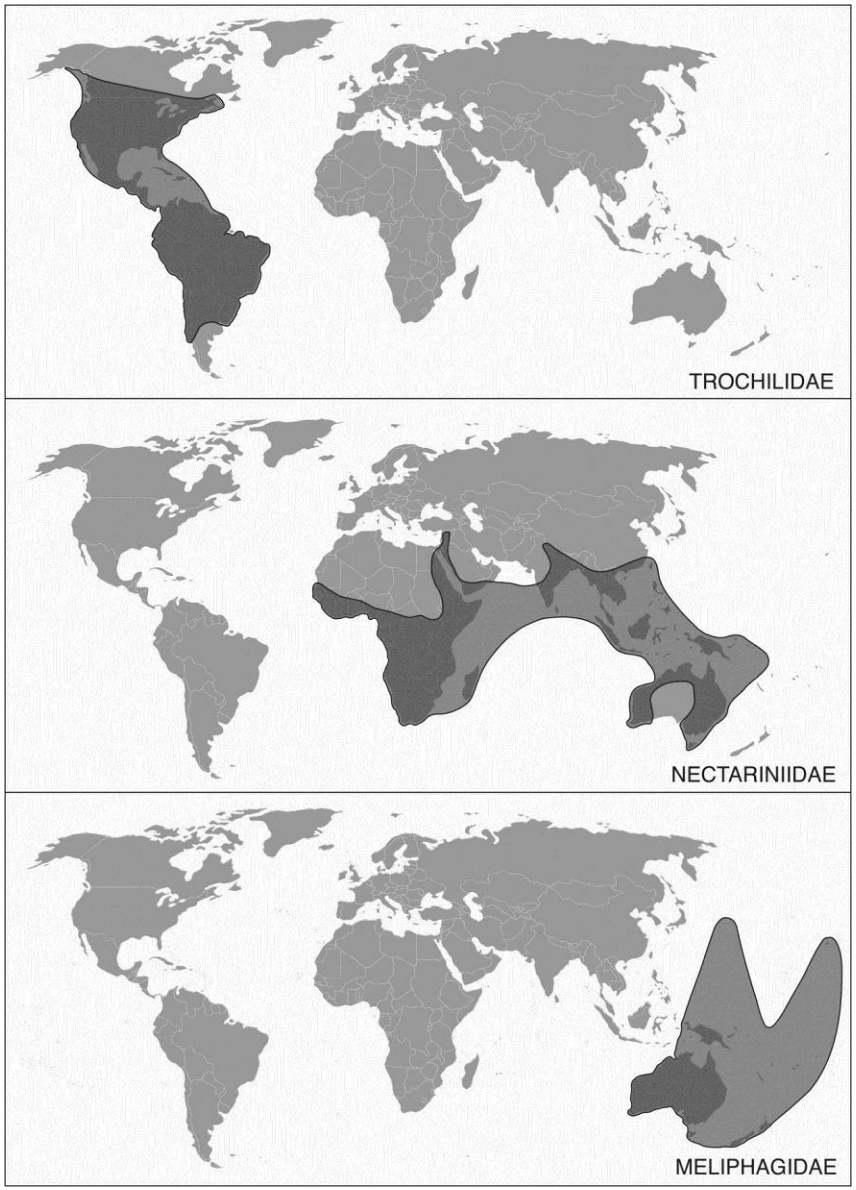
When the tongue touches the nectar, the energy is released and the tongue springs back into its tube-like shape

Although hummingbirds have bills that are highly specialized for nectar feeding, insects form a normal part of their diet.

A hummingbird is more likely to charge at an insect and catch the bug at the base of its widened beak, because the widening trick saves the hummingbird the trouble of trying to getting the prey down its throat.

Who are the avian pollinators?

Approximate world distributions of the three main families of flower visiting birds



Hummingbirds (Trochilidae)

Sunbirds (Nectariniidae)

Honeyeaters (Meliphagidae)

As many as 50 families of birds pollinate flowers.

JOURNAL OF Experimental Botany

Quentin Cronk, and Isidro Ojeda J. Exp. Bot. 2008;59:715-727

136 species of passerine birds

Rarely hover

Only insectivorous

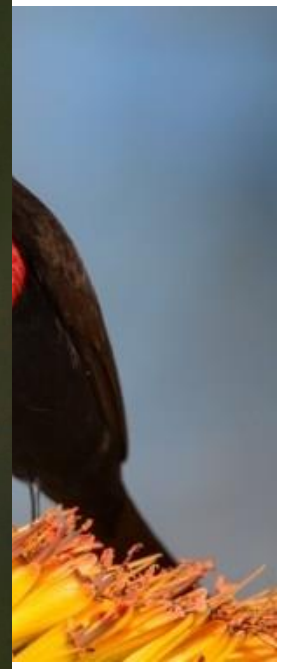
Need short corolla to reach nectar

Need platforms for perching.

Purple-throated Sunbird(male)

South Africa

Southern



Sunbird

Common Sunbird-Asity

Strongly sexually dimorphic

The Philippines

Metallic-winged Sunbird

Olive-backed Sunbird(male)

Maroon-naped Sunbird

Vietnam

Little Spiderhunter

Streaked Spiderhunter

Asia

Brown-throated Sunbird

Purple-throated Sunbird

Crimson Sunbird

The honeyeaters are very important pollinators of Ericaceae, Myrtaceae and Proteaceae in **Australia, New Zealand and Hawaii.**

Red-Headed Honeyeater

Scarlet Honeyeater

Blue-faced Honeyeater

In **South Africa**, the White-eyes (Zosteropidae) are another important group.

Cape Sugarbird displaying

The Hawaiian honeycreepers (Fringillidae) in the **Hawaiian Islands**

ʻIʻiwi
Scarlet Hawaiian Honeycreeper

Hawaiian Mamo
Extinct

ʻAkiapōlāʻau'
(pronounced *ah-kee-ah-POH-LAH-OW)*

The honeycreepers and tanagers(Thraupidae) in **Central and South America**

Green-headed Tanager

Purple Honeycreeper

Paradise Tanager

North American Orioles (Icteridae)

Orchard Oriole

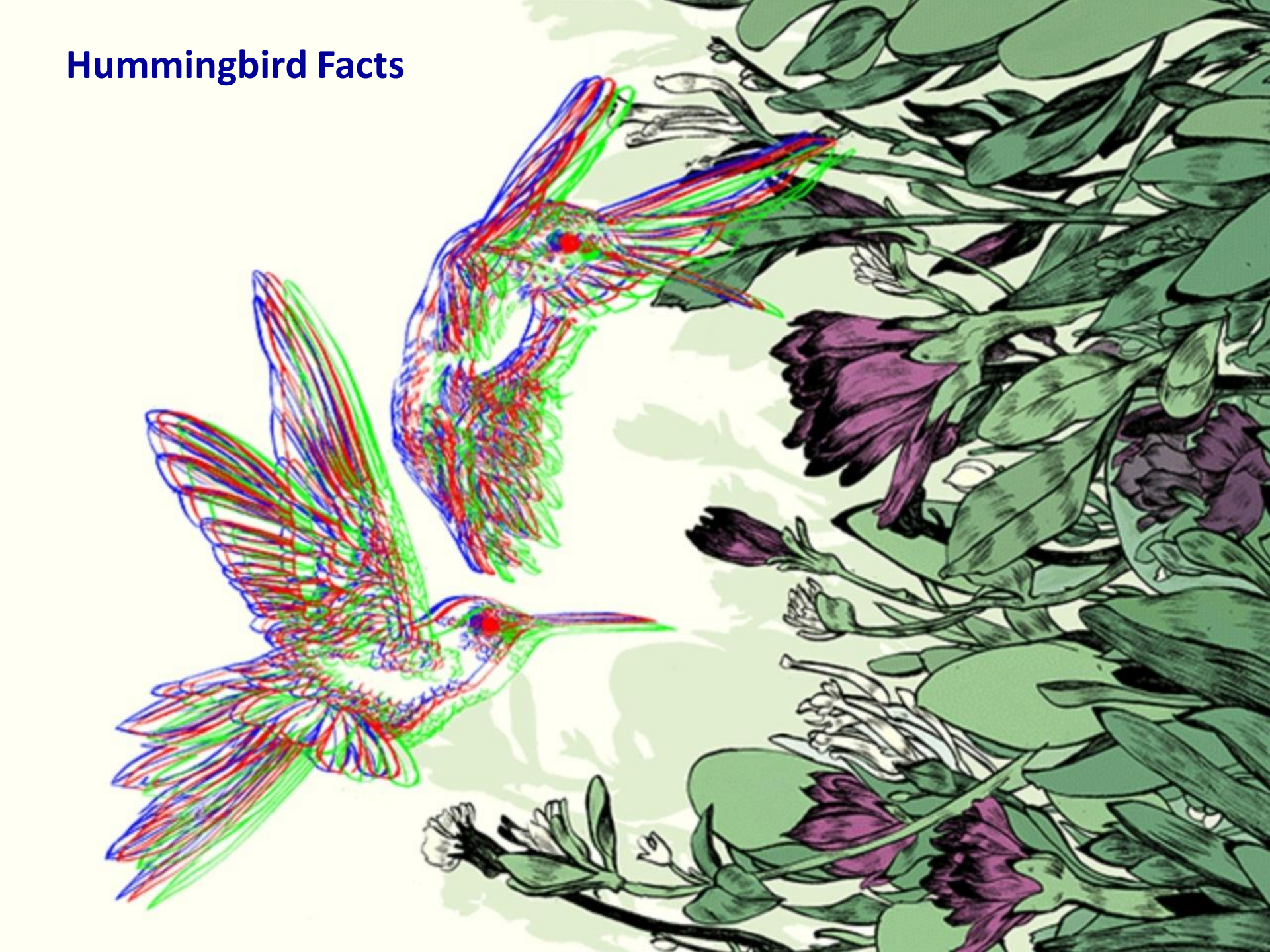
Baltimore Oriole

Flowerpiercers refer to their habit of piercing the base of flowers to access nectar that otherwise would be out of reach.

Slaty Flowerpiercer

Masked Flowerpiercer

Hummingbird Facts



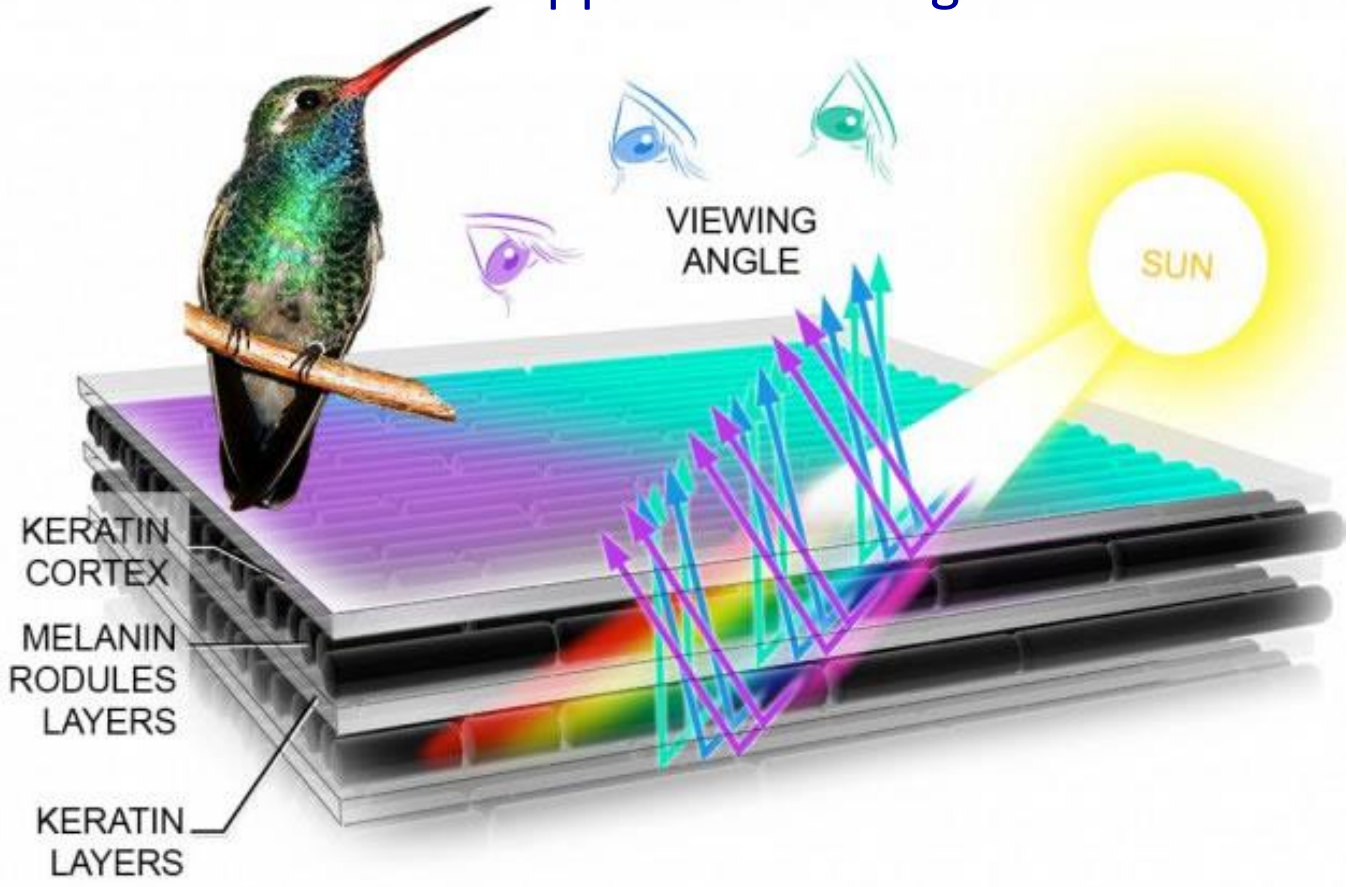
338 total species of hummingbirds in the Western Hemisphere

Colombia 147
Peru 135
Ecuador 134
Venezuela 104
Brazil 84
Panama 59
Costa Rica 54
Mexico 50
Honduras 42
Guatemala 39
Nicaragua 34
Belize 26
Argentina 24
El Salvador 23
North America 20
Chile 9

Feather colors

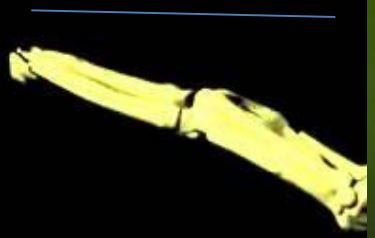
Iridescent colors of the gorget are the result of the refraction of incident light caused by the microscopic structure of the feather barbules.

The refraction works like a prism, splitting the light into rich, component colors. As the angle between the source of light, these microscopic platelets and our eyes changes, the color of the feathers appears to change too.

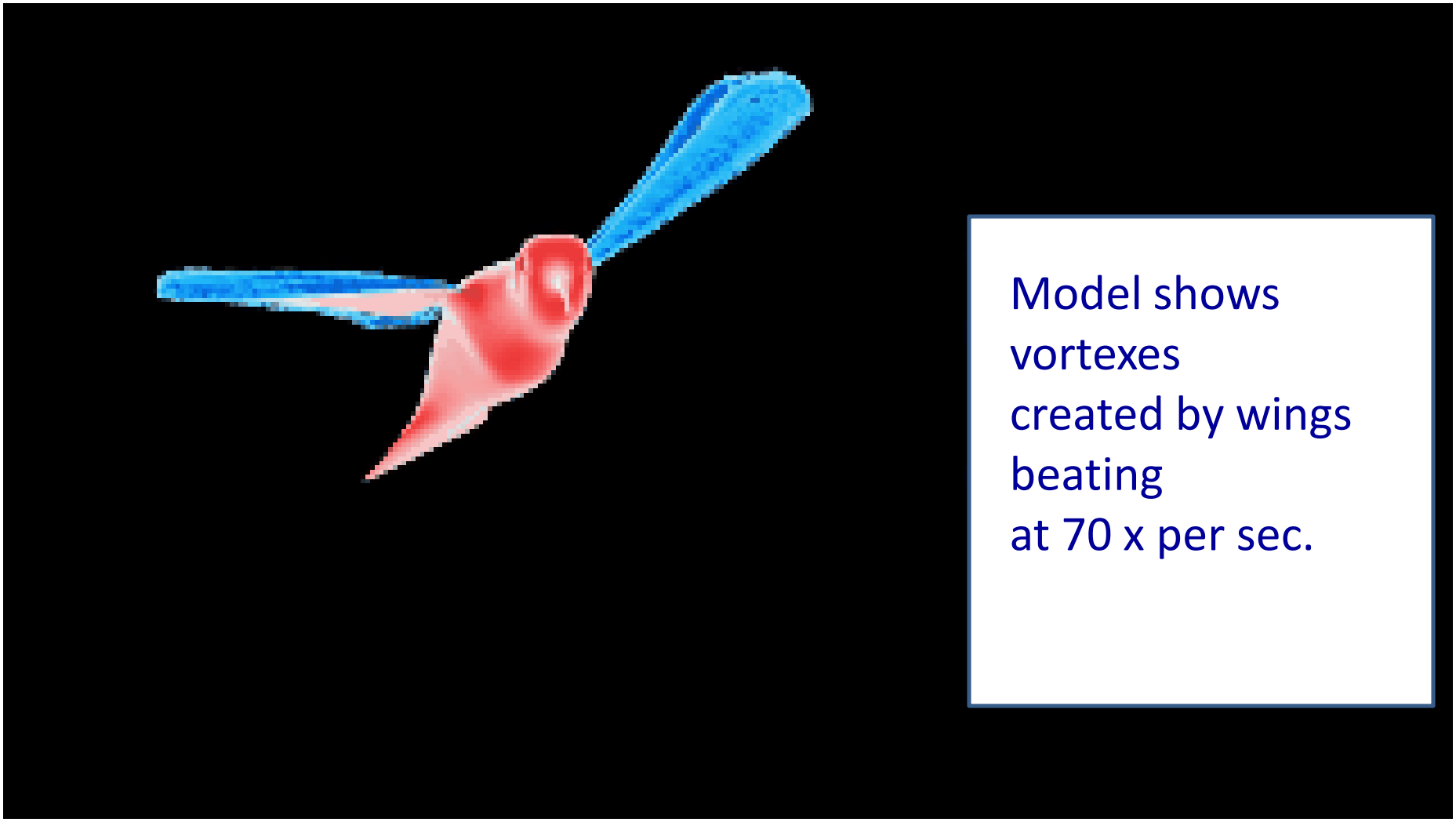


I have four species of hummingbirds coming to my feeder!

Hummingbird Wing

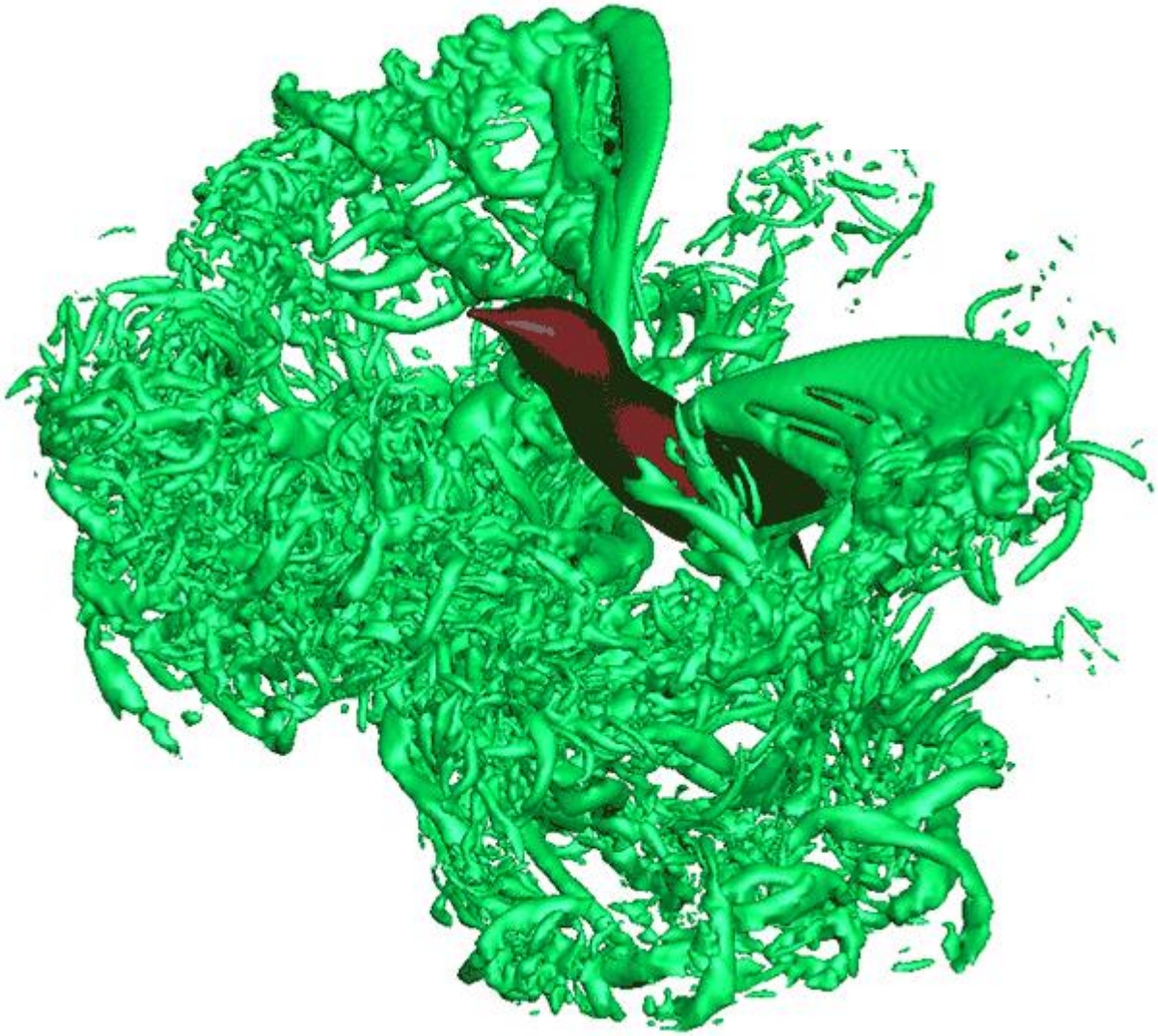


Hummingbird Flight



Model shows
vortexes
created by wings
beating
at 70 x per sec.

Complex air currents created by the tiny birds' wing beats have found they create tiny tornadoes in the air that are key to their mastery of flight.



Hummingbirds may be divided into two subgroups that exhibit different foraging strategies.

Hermits are **trapliners** specializing on large, showy flowers.

Traplining involves visiting many plants sequentially for short visits, flying from plant to plant often over some distance

Advantages? Dependable, can be taught, minimal competition, reduce time and energy searching, choose only high nectar flowers, good sources of nectar

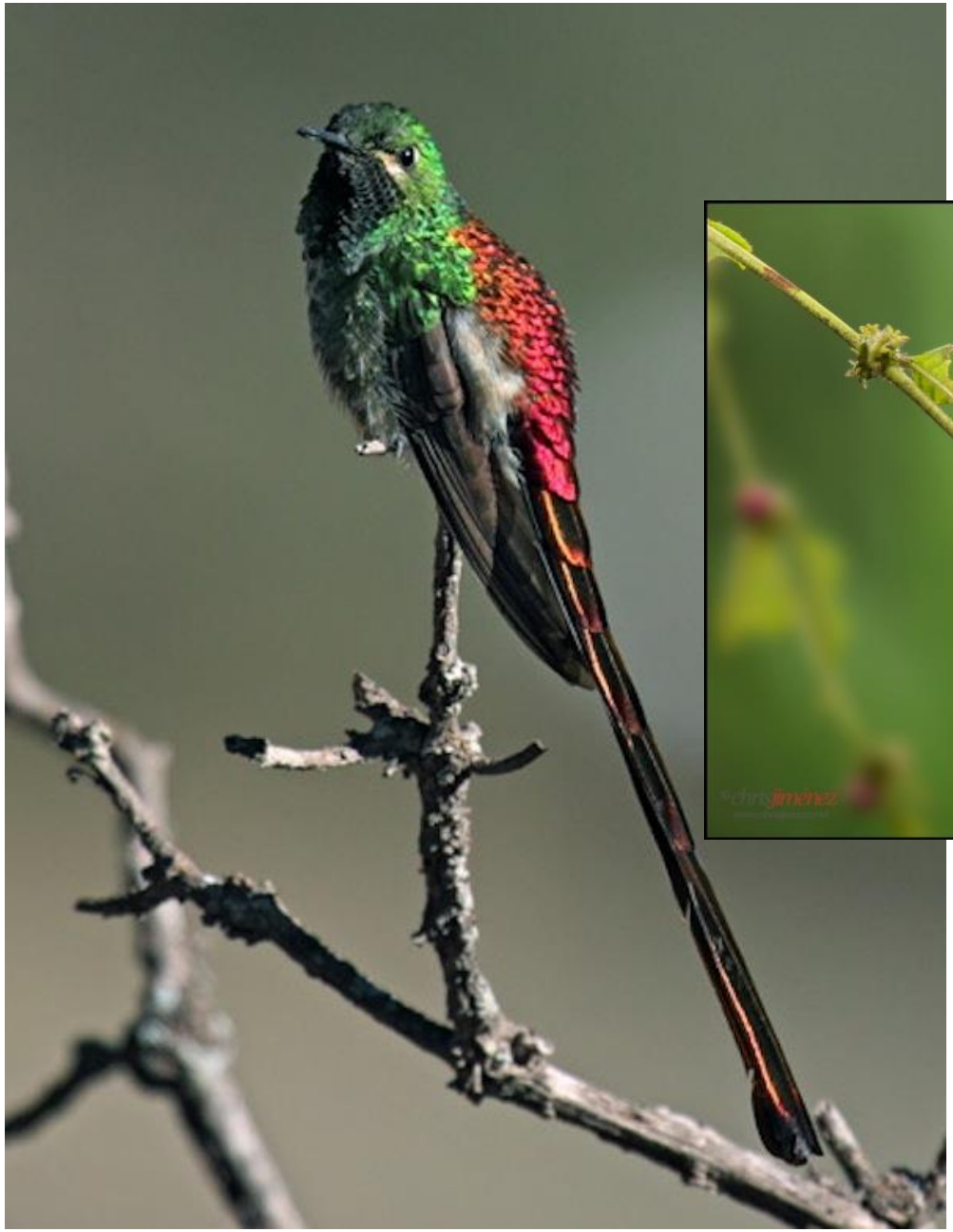
Disadvantages? Must wait for refill, need to remember new position, is a detour pathway, lose contact with potential mates, or leks, fewer cross-pollination

Territorial feeding

Non-hermits have short straight bills and a tendency to hold territories and thus non-hermit pollination behavior favors self-pollination. Birds are heftier and more aggressive.

Chestnut-breasted Coronet

Red-tailed comet



Snowcap

Glowing Puffleg

Sparkling Violetear

Rufous-capped Thornbill

Rainbow-bearded Thornbill

Wine-throated Hummingbird

Marvelous Spatuletail

Violet-tailed Sylph, Aglaiocercus coelestis
© Photo by Glenn Bartley www.glennbartley.com

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The biggest hummingbird…

Giant Hummingbird

20 grams

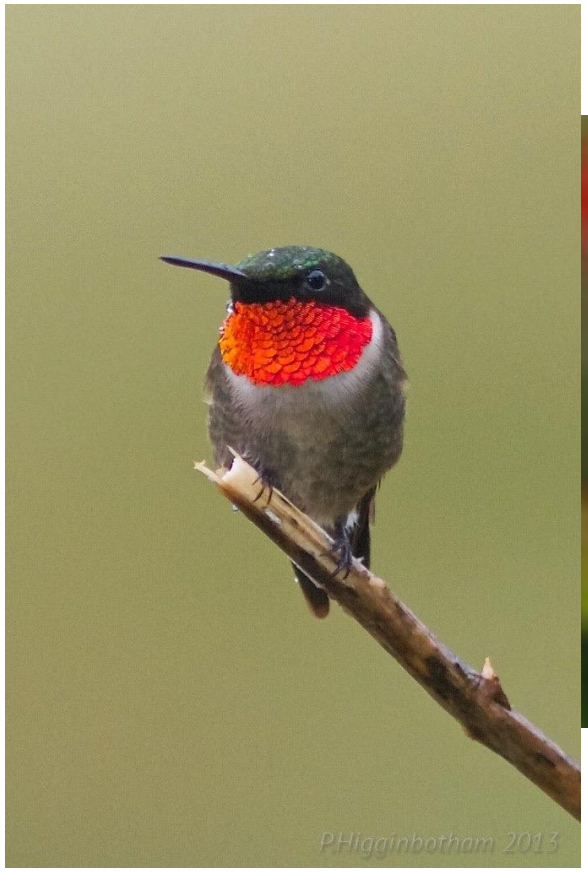
Wingspan 8.5 inches

To the smallest…

Bee Hummingbird

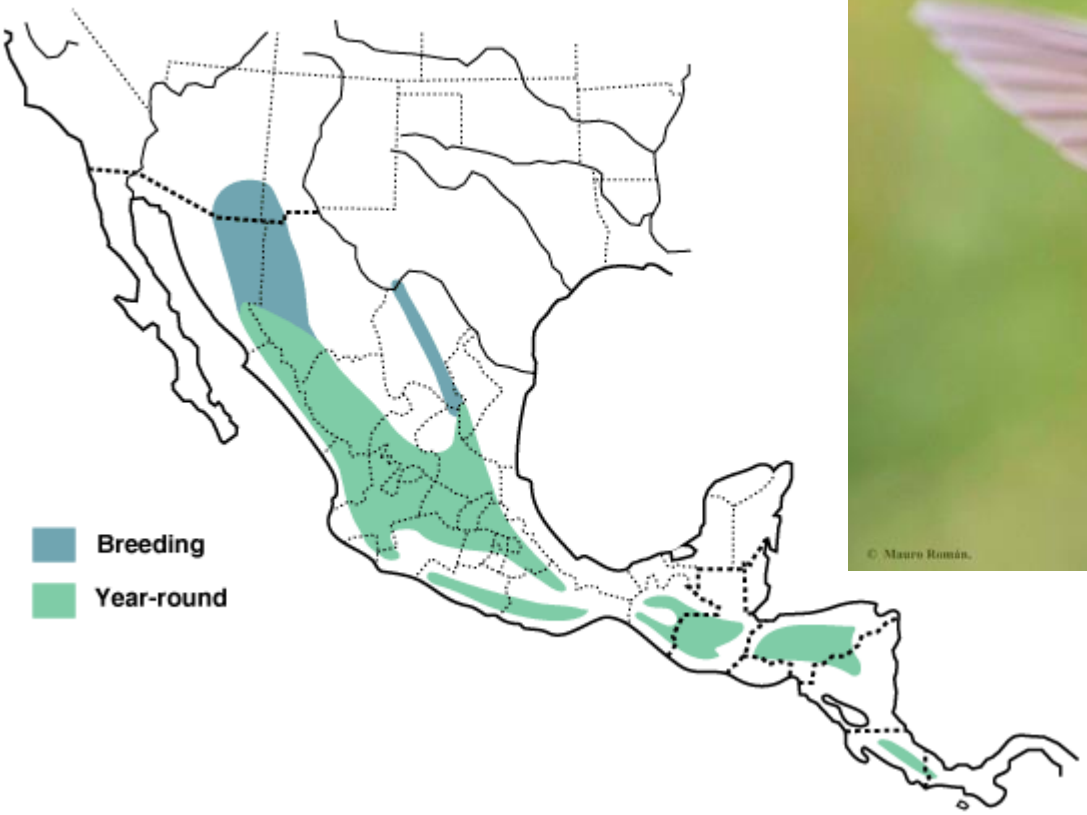
2 grams

North American Hummingbirds



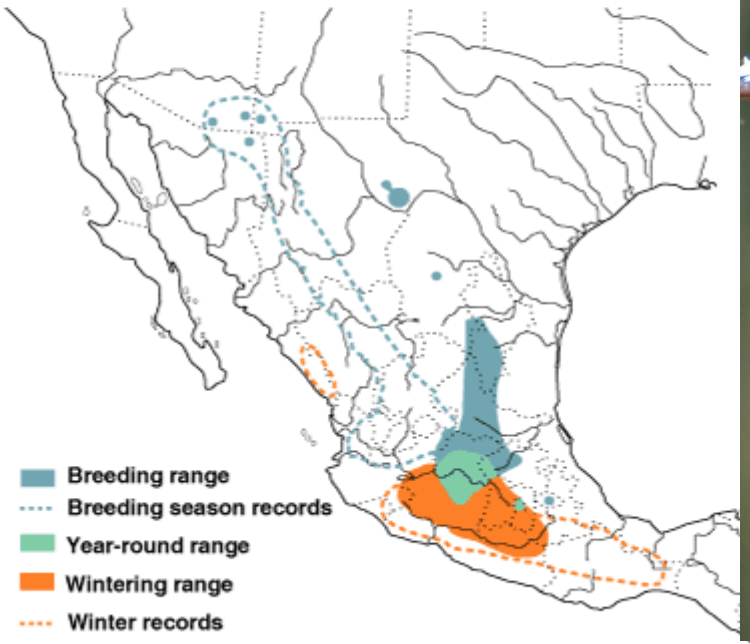
Twenty six species of hummingbirds have made appearances in North America. Fifteen have bred. Only one is a breeding resident east of the Mississippi

Magnificent Hummingbird



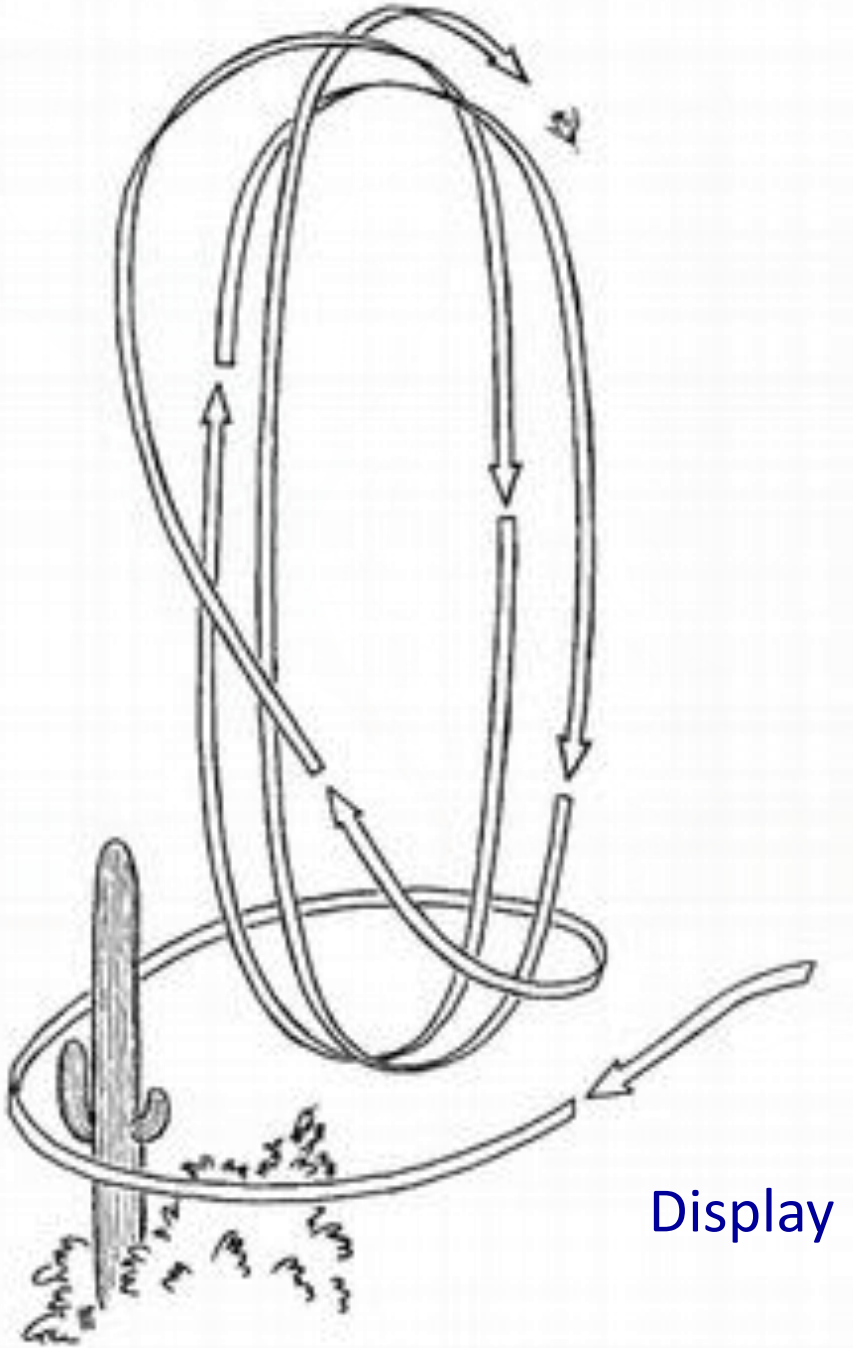
The large and striking Magnificent Hummingbird just barely reaches the United States in the higher elevations of the desert Southwest.

Lucifer Hummingbird



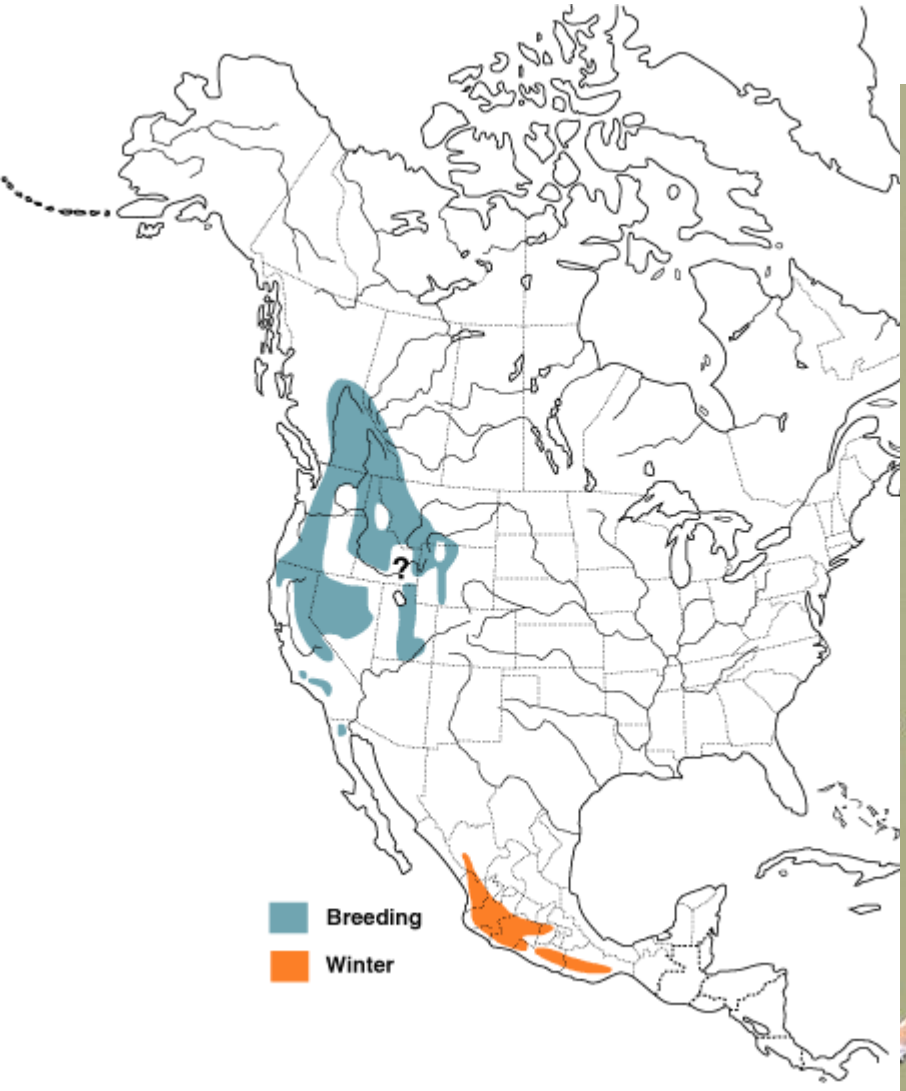
Specializes in Agave plants which are mostly pollinated by bats. Lucifer is a nonpollinating nectar thief because flower design results in no contact between stamens and a small hummingbird.

Costa's



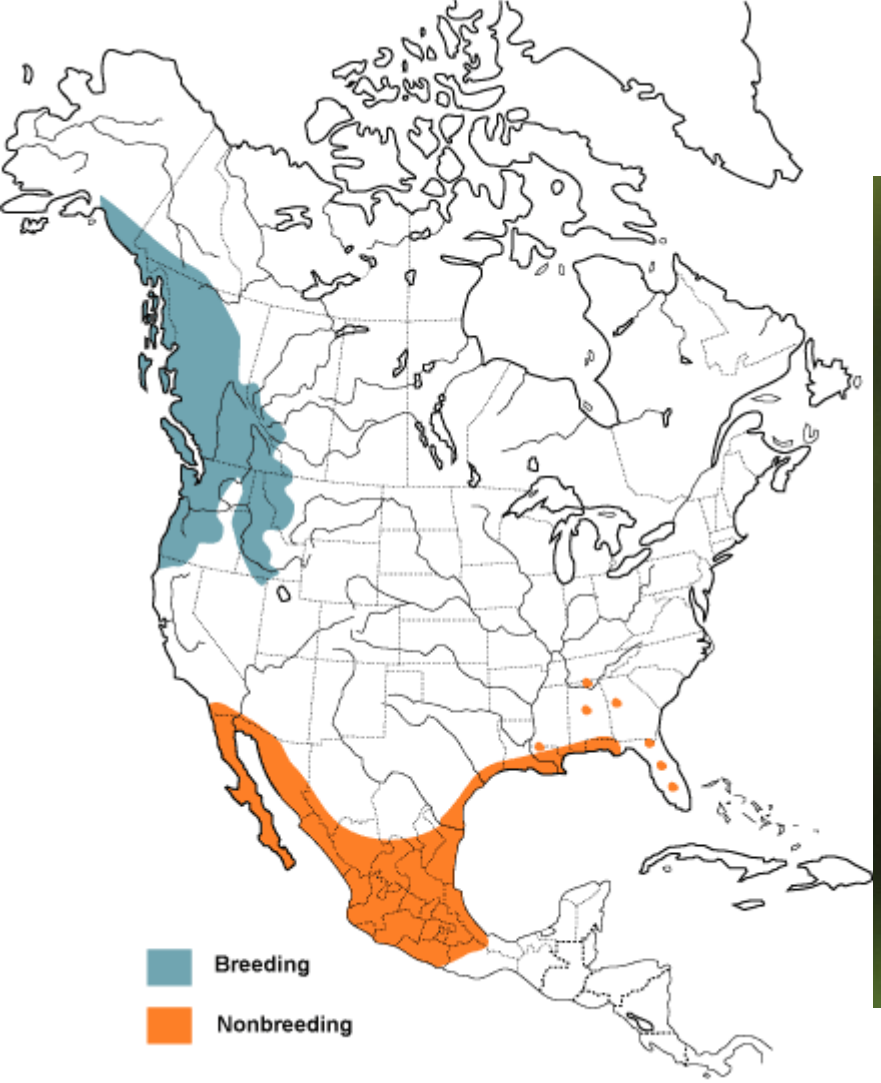
Display pattern of diving and whistling.

Calliope



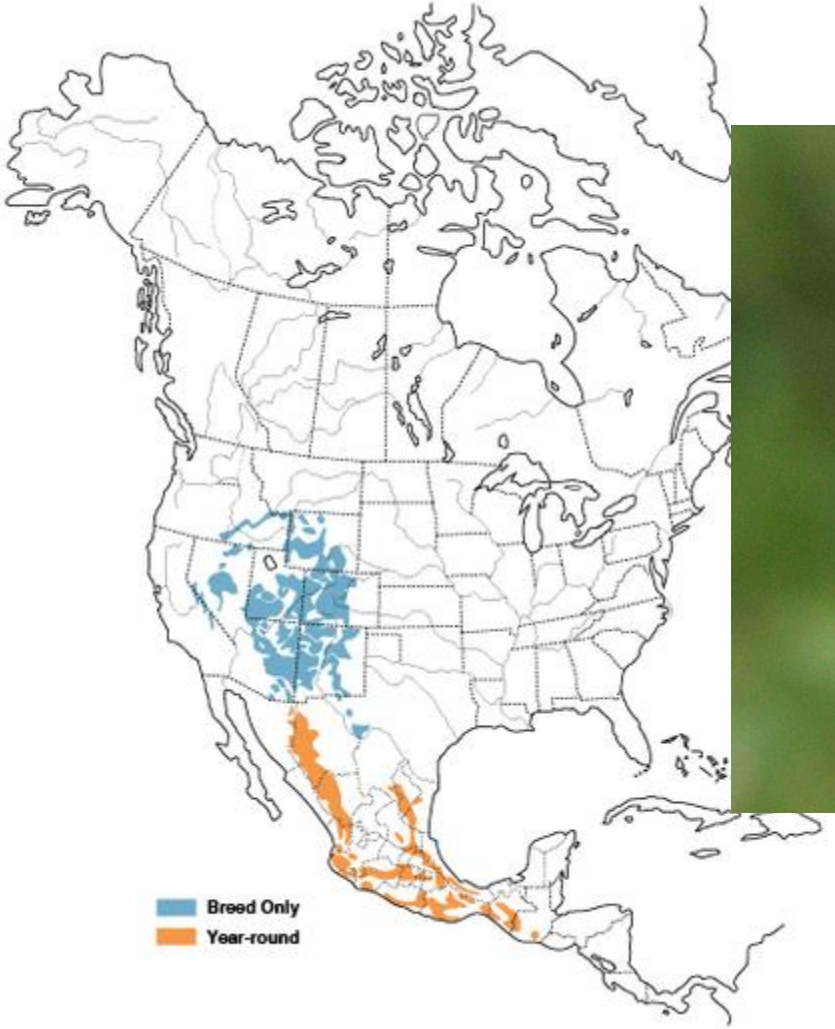
A montane species,
the smallest North American breeding hummingbirds.

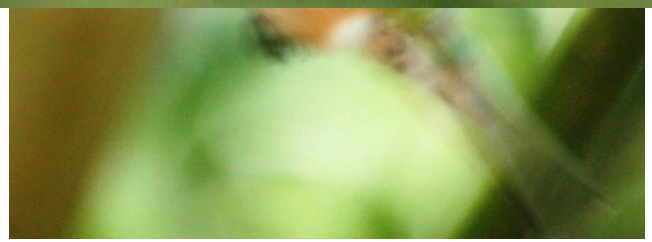
Rufous



North America's "extremist" hummingbird, widely known in the west for its aggressive nature and farthest persistent range eastward.

Broad-tailed

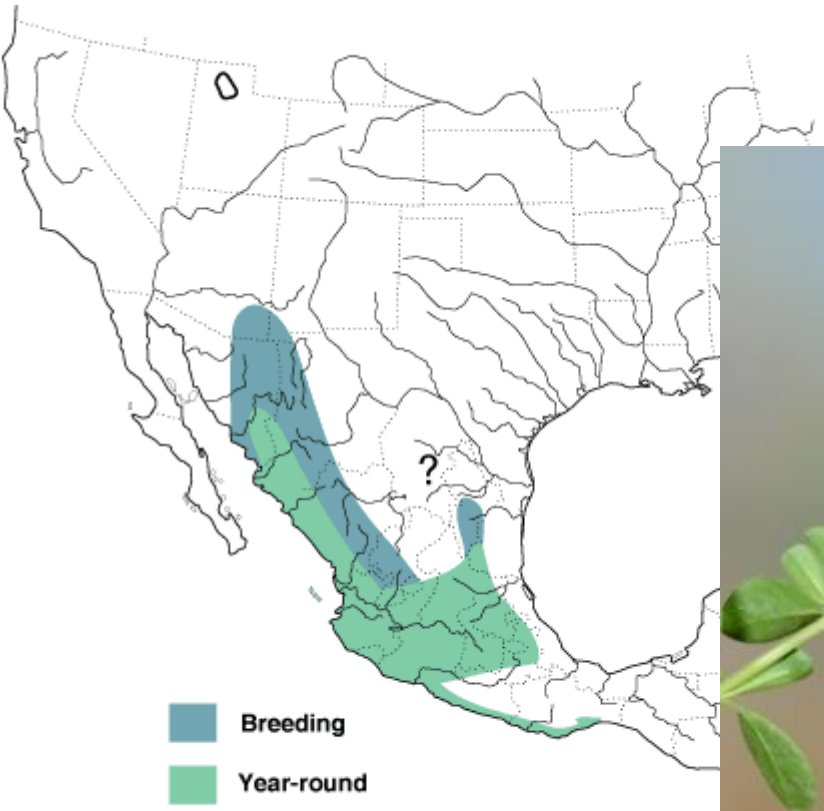




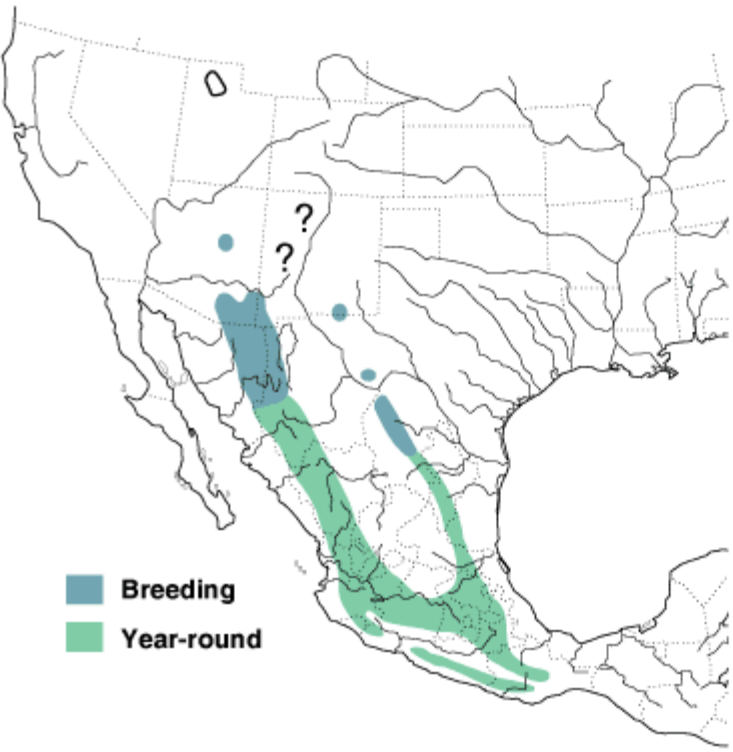
A promiscuous breeder, courting male Broad-tails perform spectacular aerial displays – a series of high climbs, dives, and hovers, accompanied by a loud wing trill that is heard also during aggressive territorial displays.

Well known for taking advantage of sapsucker wells, eating insects and, perhaps, the sugary sap.

Broad-billed



In late spring and summer many individuals migrate to extreme northern Mexico, portions of southeastern Arizona

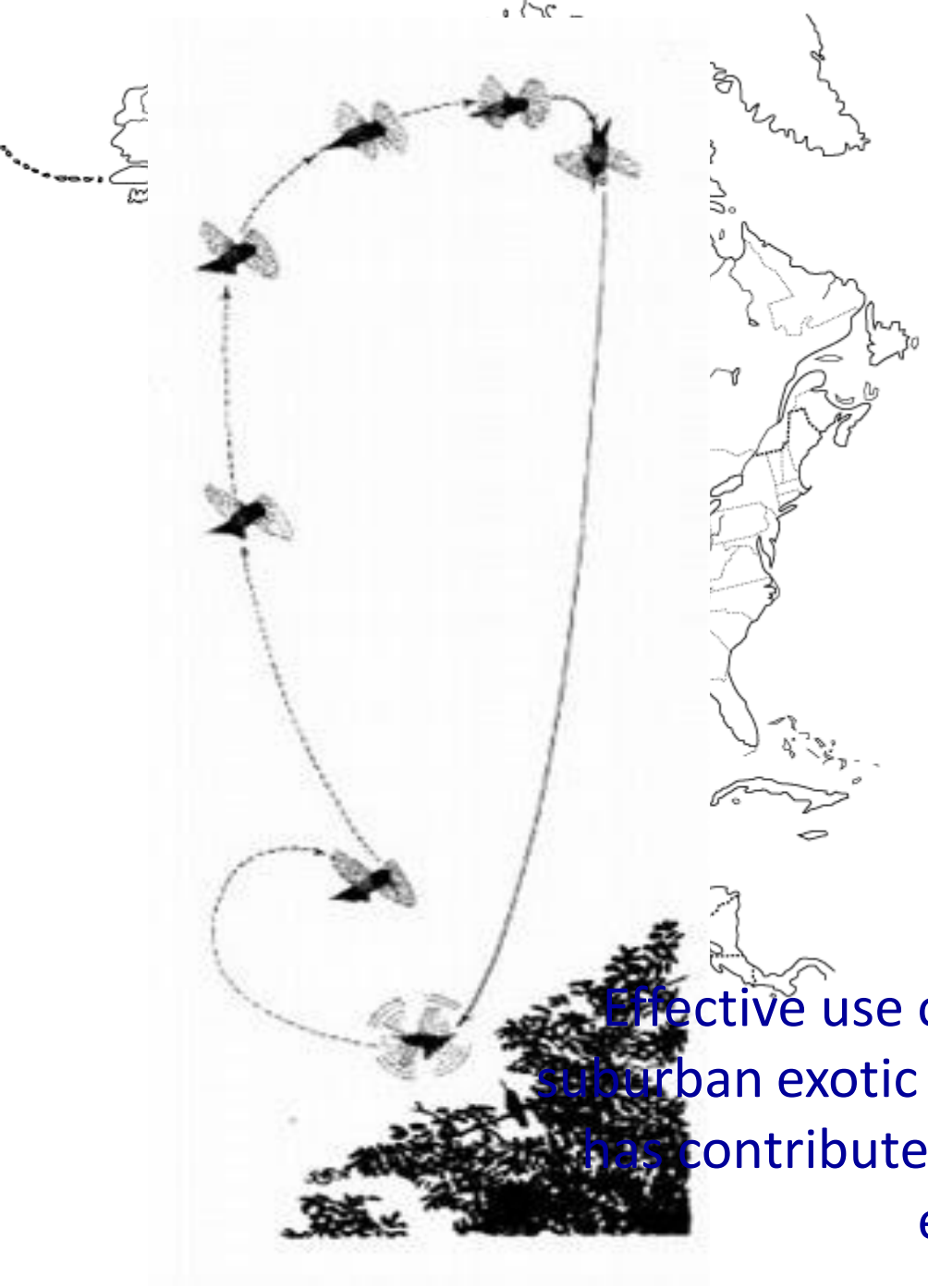


Blue-throated

One of the most ecologically selective, preferring the edges of montane conifer forests in the highlands of Mexico and the shady understory of deciduous streamside forests in the “sky island” mountain ranges of the southwestern United States

Violet-crowned

Nests almost exclusively in the Arizona sycamore trees

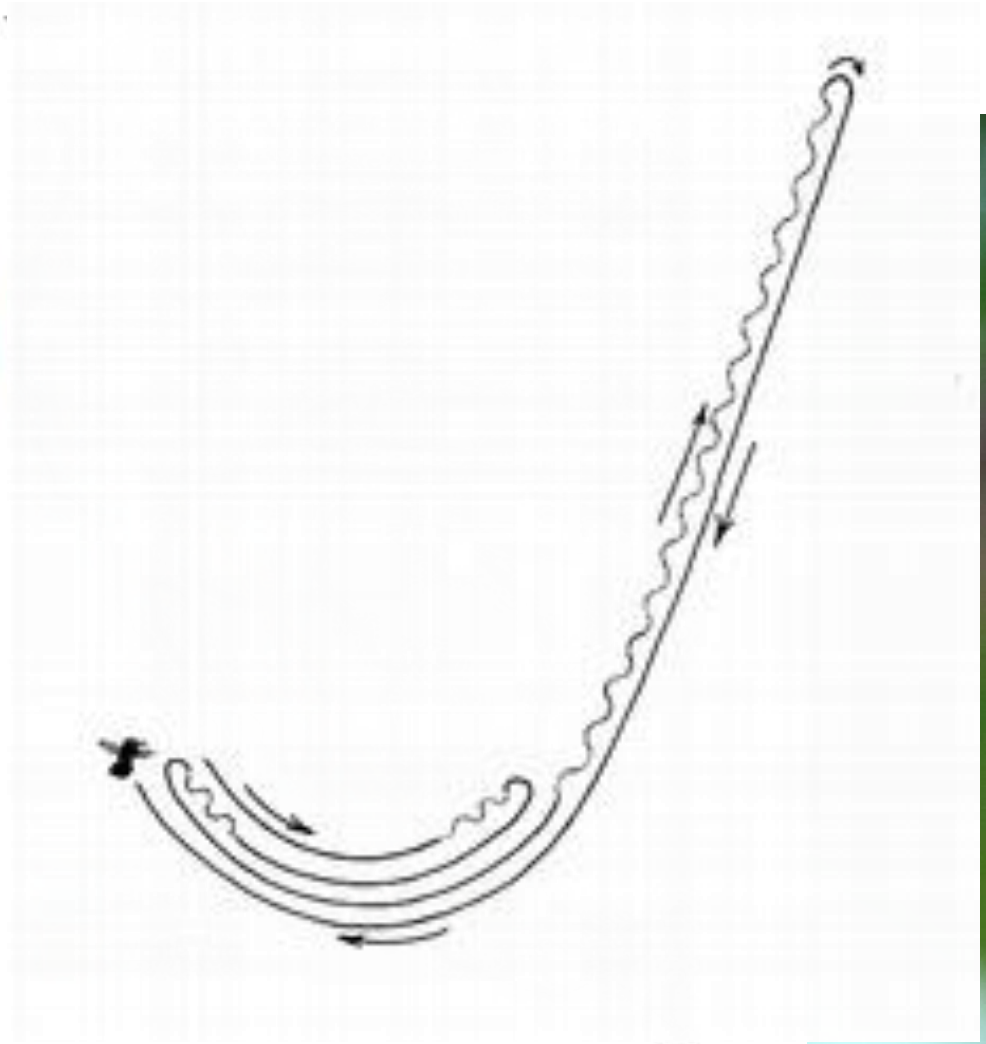


Anna's

Effective use of widely cultivated urban and suburban exotic plants and hummingbird feeders has contributed to its increased numbers and expanded range.

Black-chinned

Noteworthy for being rather generalized, occurring in a variety of settings, and for its abundance.



Allen's

Pulls out of his power dive just above the object of his display while emitting a loud, metallic shriek with his tail feathers.

White-eared

Seen most often coming to feeders in mountain canyons, in areas dominated by oak, pine, or Douglas-fir.

Buff-bellied

Lower Rio Grande Valley, the species is regularly found in thorn forest with an understory of tropical sage (*Salvia coccinea*), Turk's-cap (*Malvaviscus drummondi*), coral bean (*Erythrina herbacea*), and tropical sage .

Ruby-throated

A trans-gulf migrant, these individuals often double their body mass by fattening on nectar and insects prior to departure.

Helping Hummers

Plant Natives for Hummingbirds

trumpet honeysuckle (Lonicera sempervirens)

scarlet beebalm (Monarda didyma)

lemon beebalm (Monarda citriodora)

wild bergamont (Monarda fisulosa)

cardinal flower (Lobelia cardinalis)

and trumpet creeper (Campsis radicans)

columbine (Aquilegia canadensis)

native salvias

Save spider webs in your yard and around the house.

Ornithophily

Written, produced and directed by
Georgann Schmalz

Choreography by
Georgann Schmalz

Birding Adventures, Inc.
www.birdingadventuresinc.com

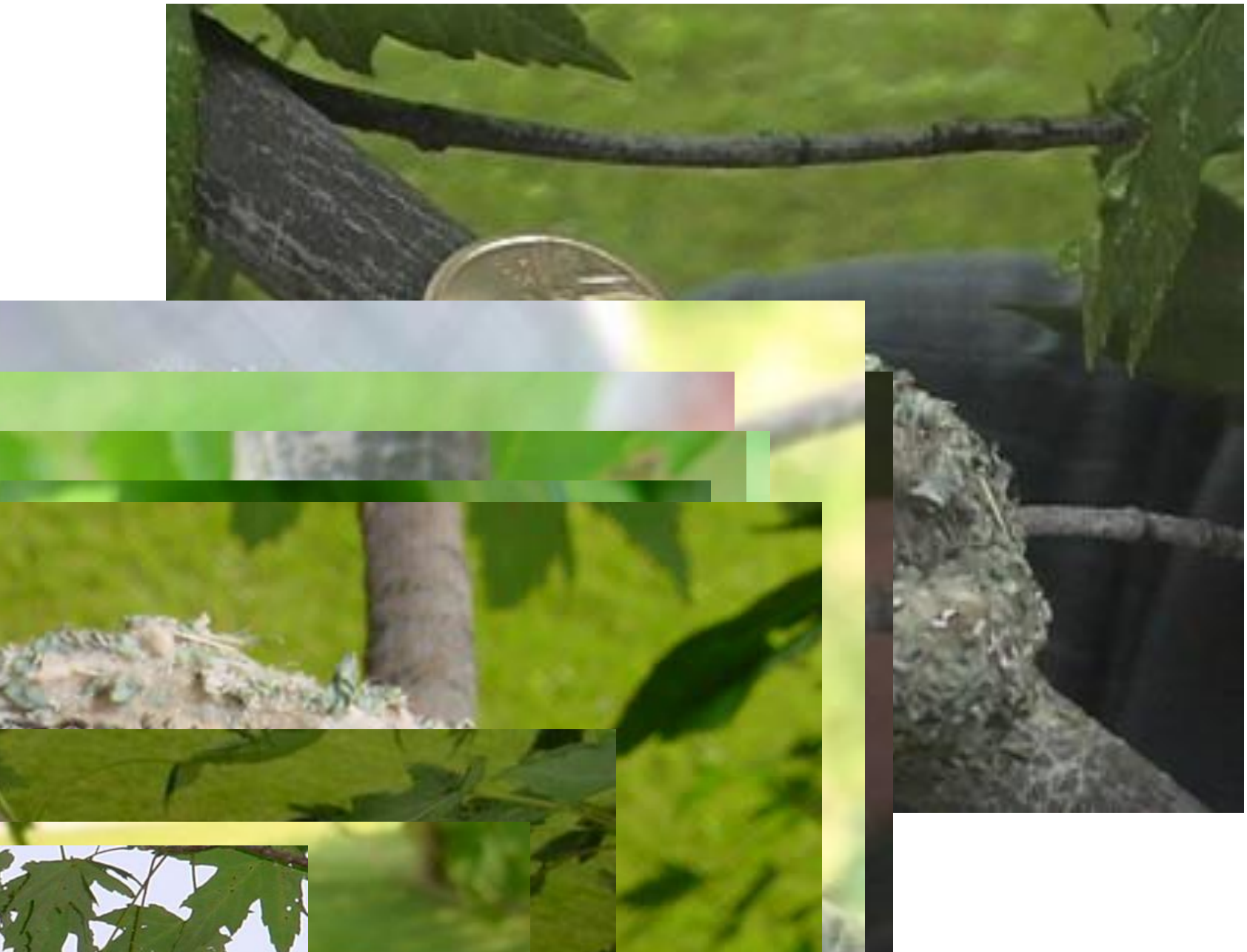
Winter hummingbirds in Georgia

calliope had first seen in the Peach State during the winter of 1998-99.

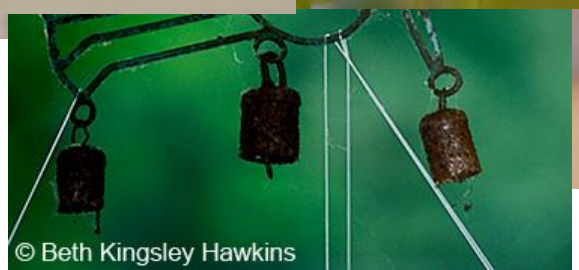
Anna's Only three confirmed records

Black-chinned five confirmed

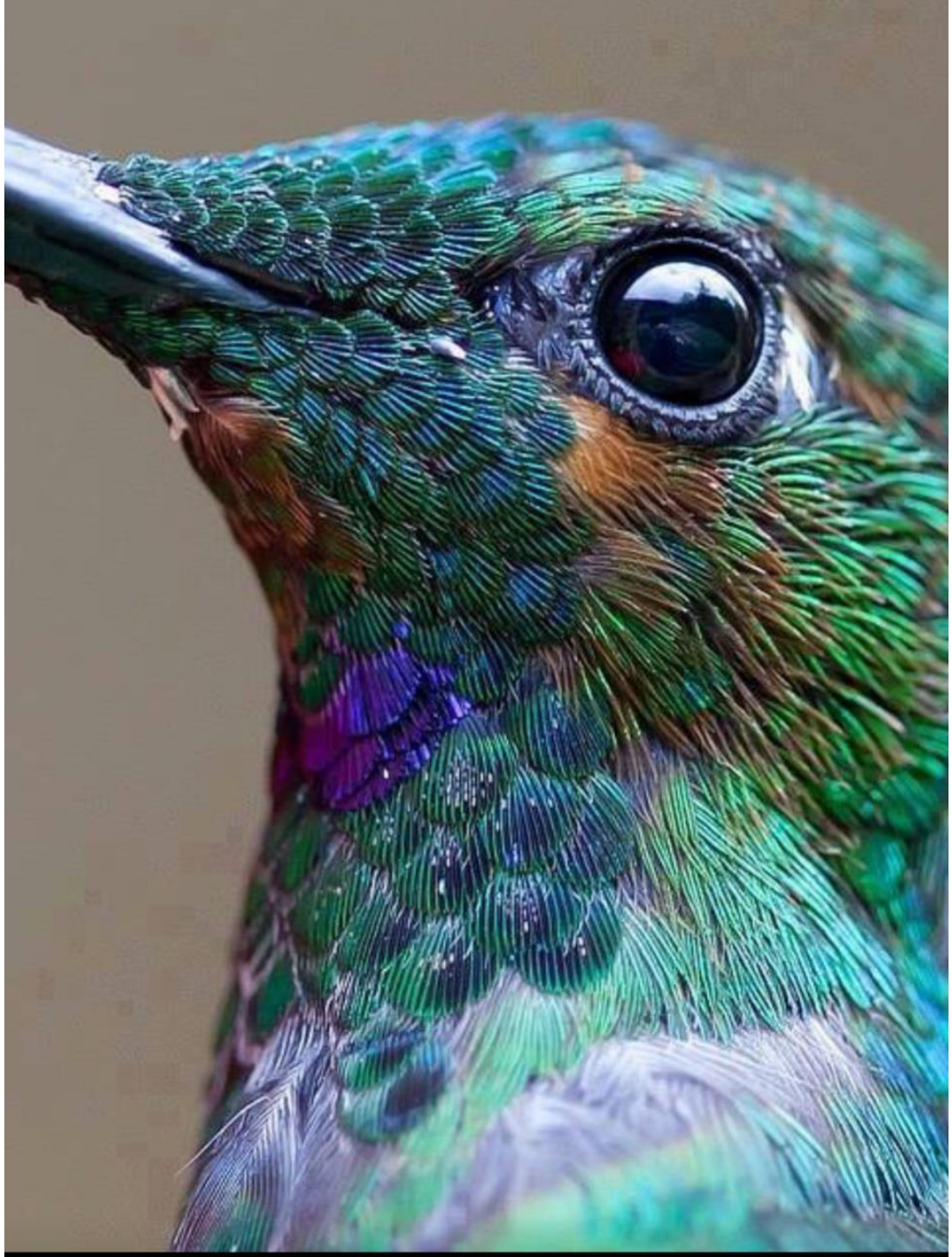
Calliope The first one has been recorded in Georgia during the winter of 1998-99. To this date, only one or two of them are reported each winter.



© Beth Kingsley Hawkins


© Beth Kingsley Hawkins

© Beth Kingsley Hawkins



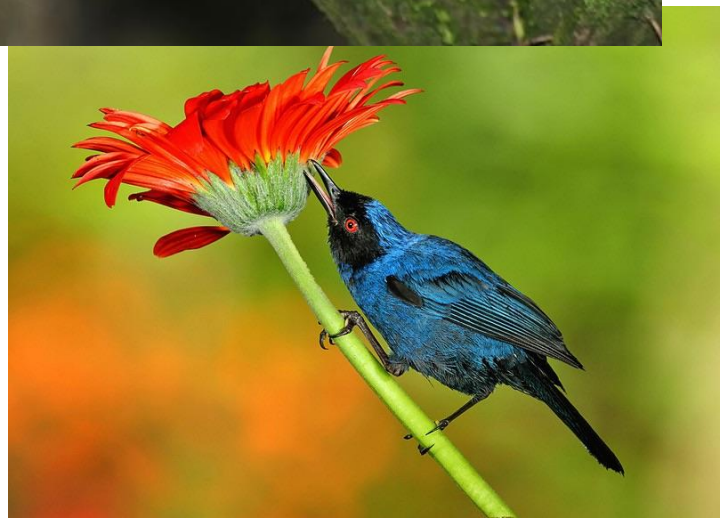
Produced and designed by
Georgann Schmalz

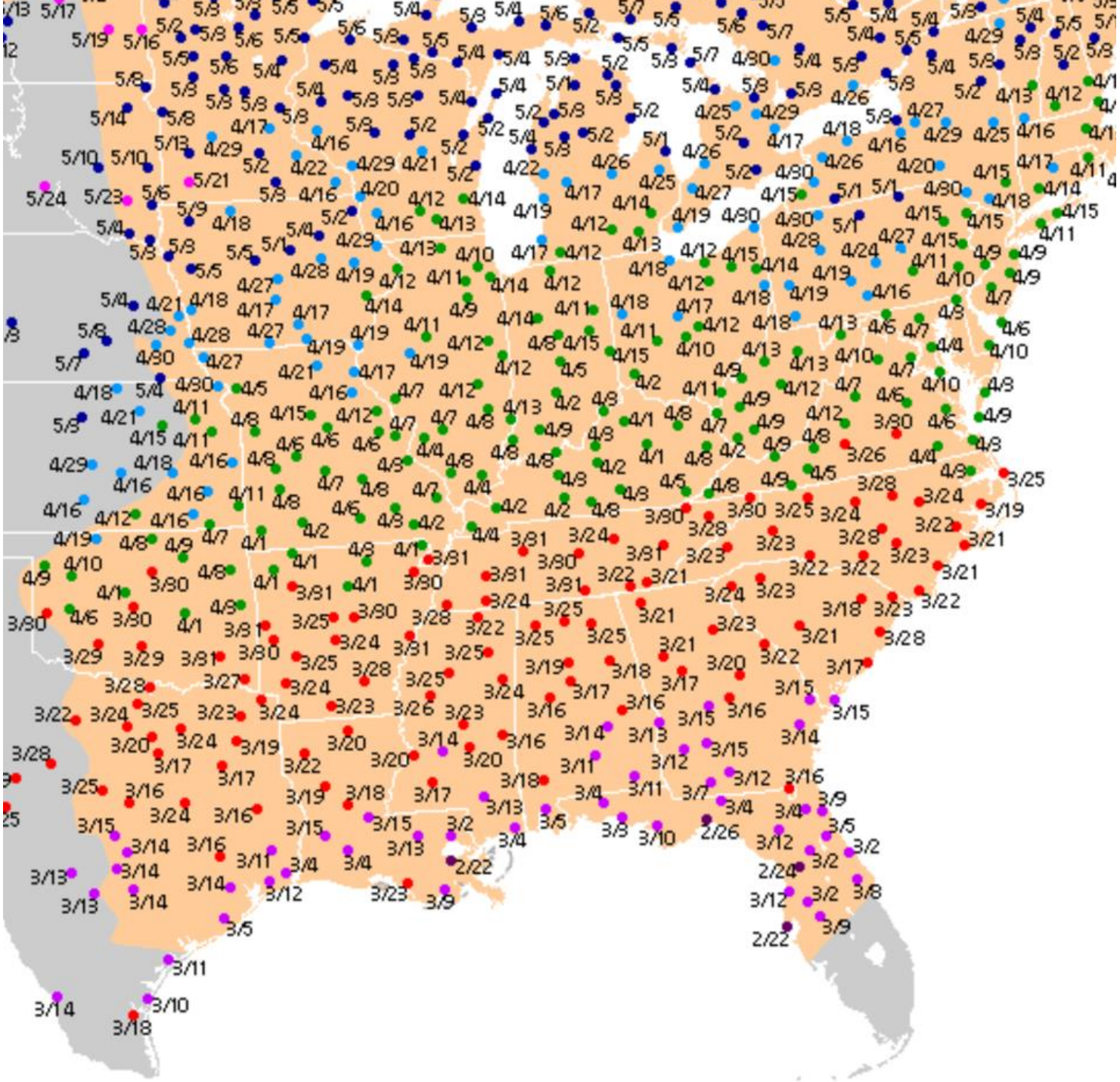
Choreography by
Georgann Schmalz

Photo credits

Robert Royse
Georgann Schmalz

Masked flowerpiercer

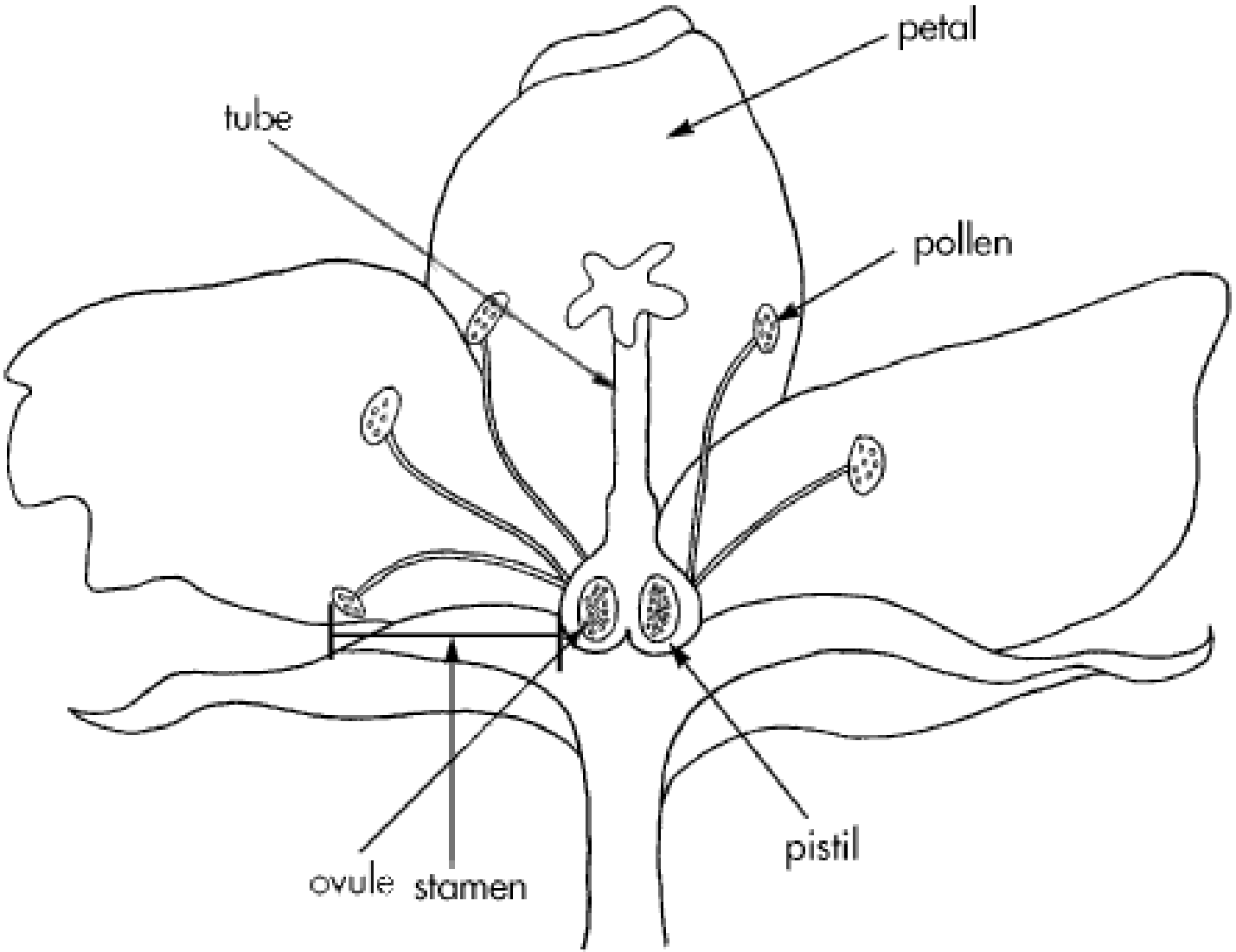




Low herbaceous plants may be pollinated by birds that perch on the ground, and they usually orient their flowers vertically erect.
Examples include *Lotus berthelotii* Masf. and its relatives in the Canary Islands and *Gastrolobium praemorsum* (Meisn.) in southwest of Western Australia).

Lotus berthelotii

Ruby-throated Hummingbird nest building



Plain-capped Starthroat

Despite the evocative name of "Starthroat," the throat color is very hard to see without perfect lighting, and the bird usually looks quite dull overall.

What flowers get pollinated by birds?

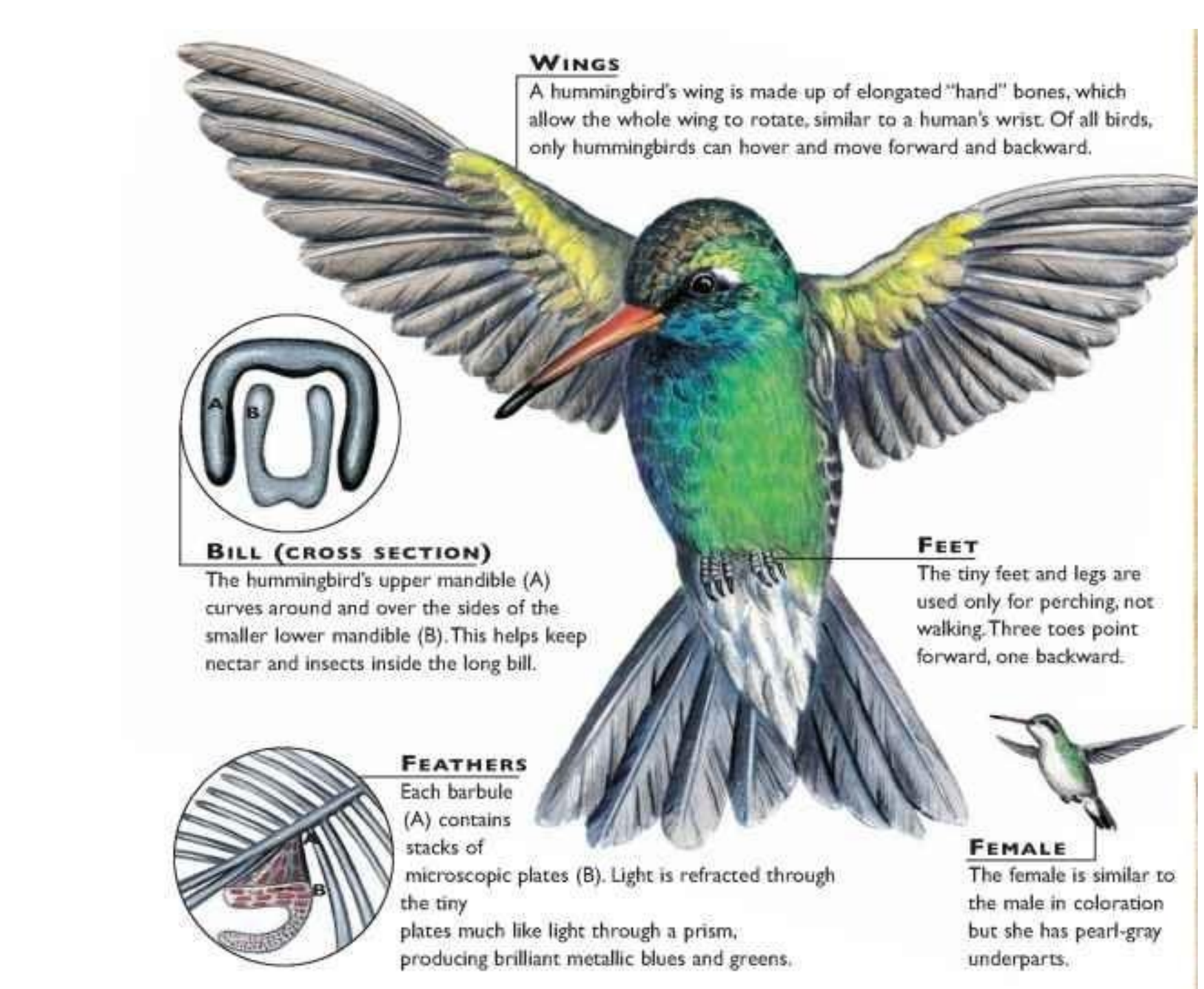
Bird pollination is widespread in the flowering plants and appears to have evolved many times. It is present in some 65 flowering plant families

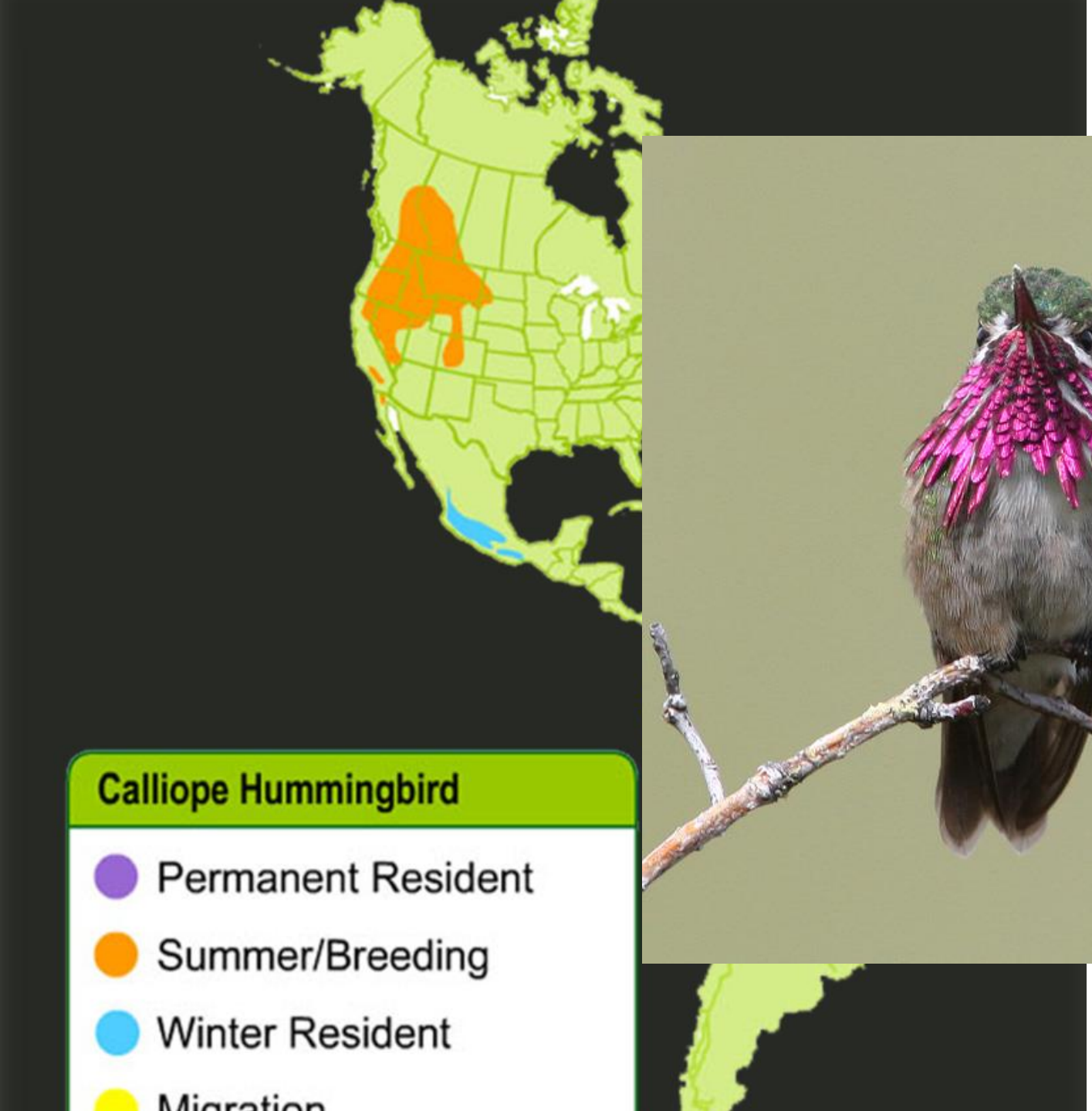
bird pollination is particularly common, such as in the monocot order Zingiberales. Families of this order are Cannaceae, Costaceae, Heliconiaceae, Lowiaceae, Marantaceae, Musaceae, Strelitziaceae, Zingiberaceae

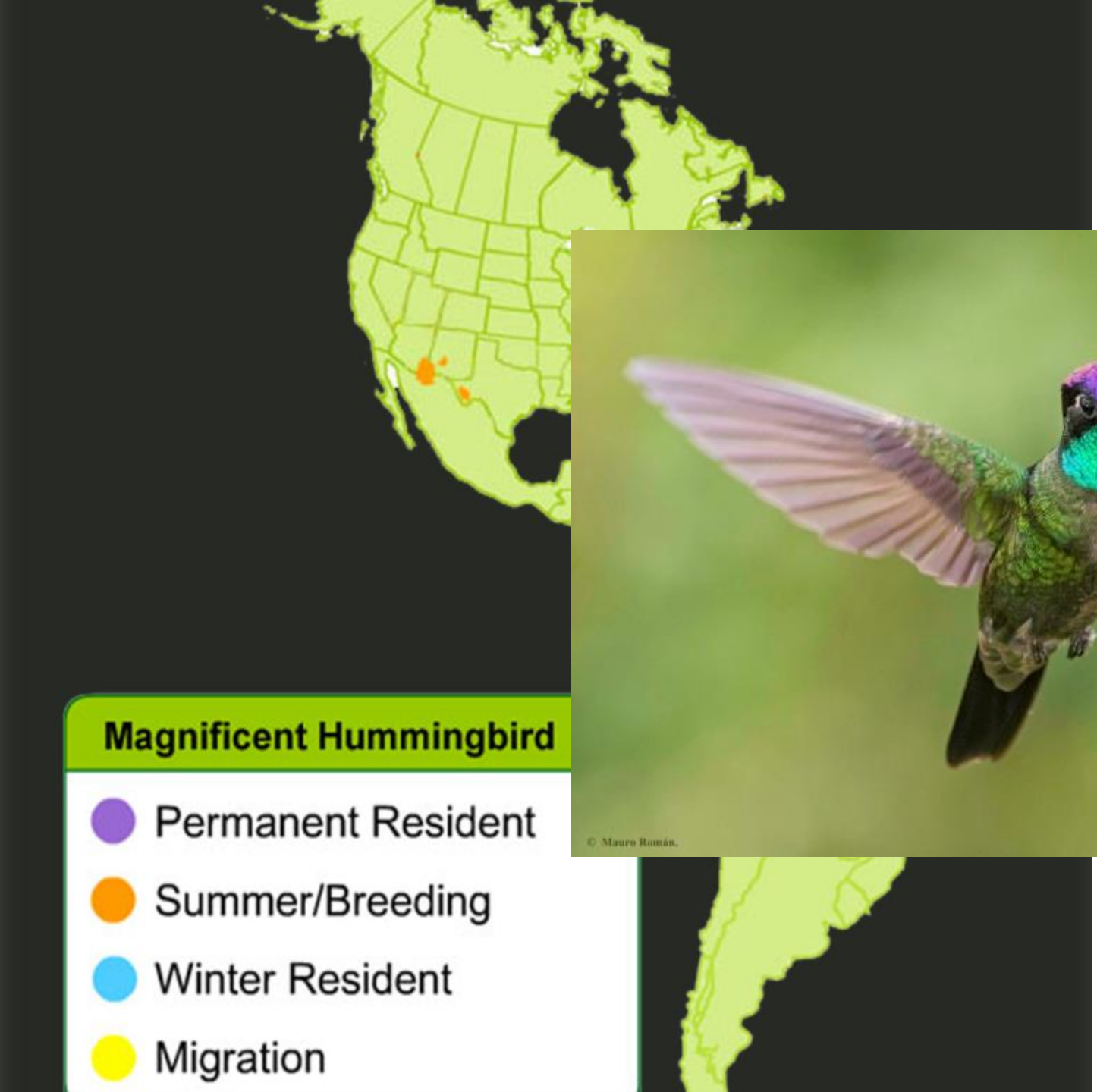
absent in some of the largest families of flowering plants. In Asteraceae

Canna (Cannaceae), *Strelitzia* (Strelitziaceae), *Heliconia*(Heliconiaceae), and *Costus* (Costaceae) are well known for their showy bird-pollinated species.

Ornithophily has also evolved several times, mainly from bee-pollinated ancestors,


WINGS
A hummingbird's wing is made up of elongated "hand" bones, which allow the whole wing to rotate, similar to a human's wrist. Of all birds, only hummingbirds can hover and move forward and backward.
A
B
BILL (CROSS SECTION)
The hummingbird's upper mandible (A) curves around and over the sides of the smaller lower mandible (B). This helps keep nectar and insects inside the long bill.
FEET
The tiny feet and legs are used only for perching, not walking. Three toes point forward, one backward.
FEATHERS
Each barbule (A) contains stacks of microscopic plates (B). Light is refracted through the tiny plates much like light through a prism, producing brilliant metallic blues and greens.
FEMALE
The female is similar to the male in coloration but she has pearl-gray underparts.

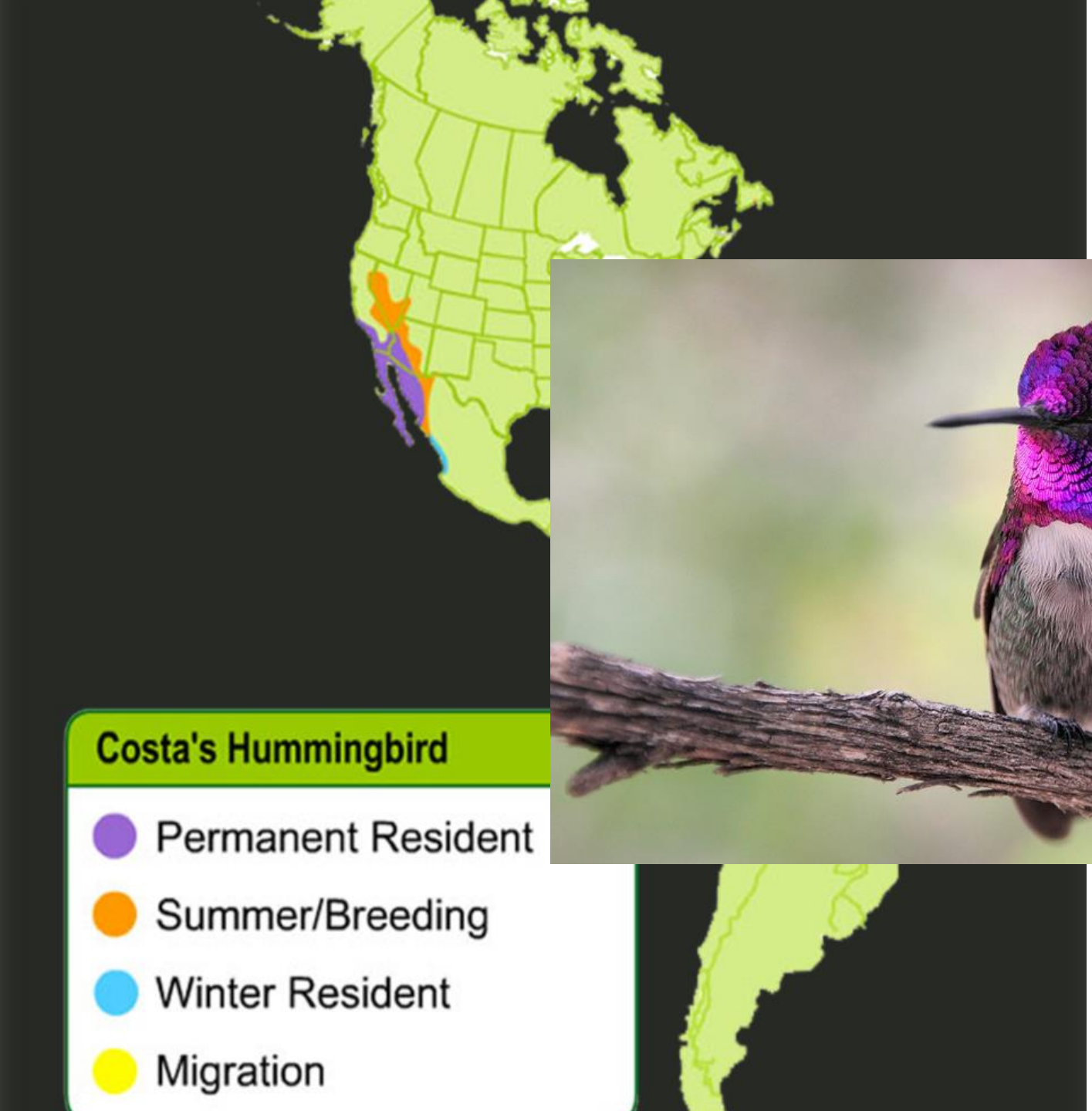

Calliope Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

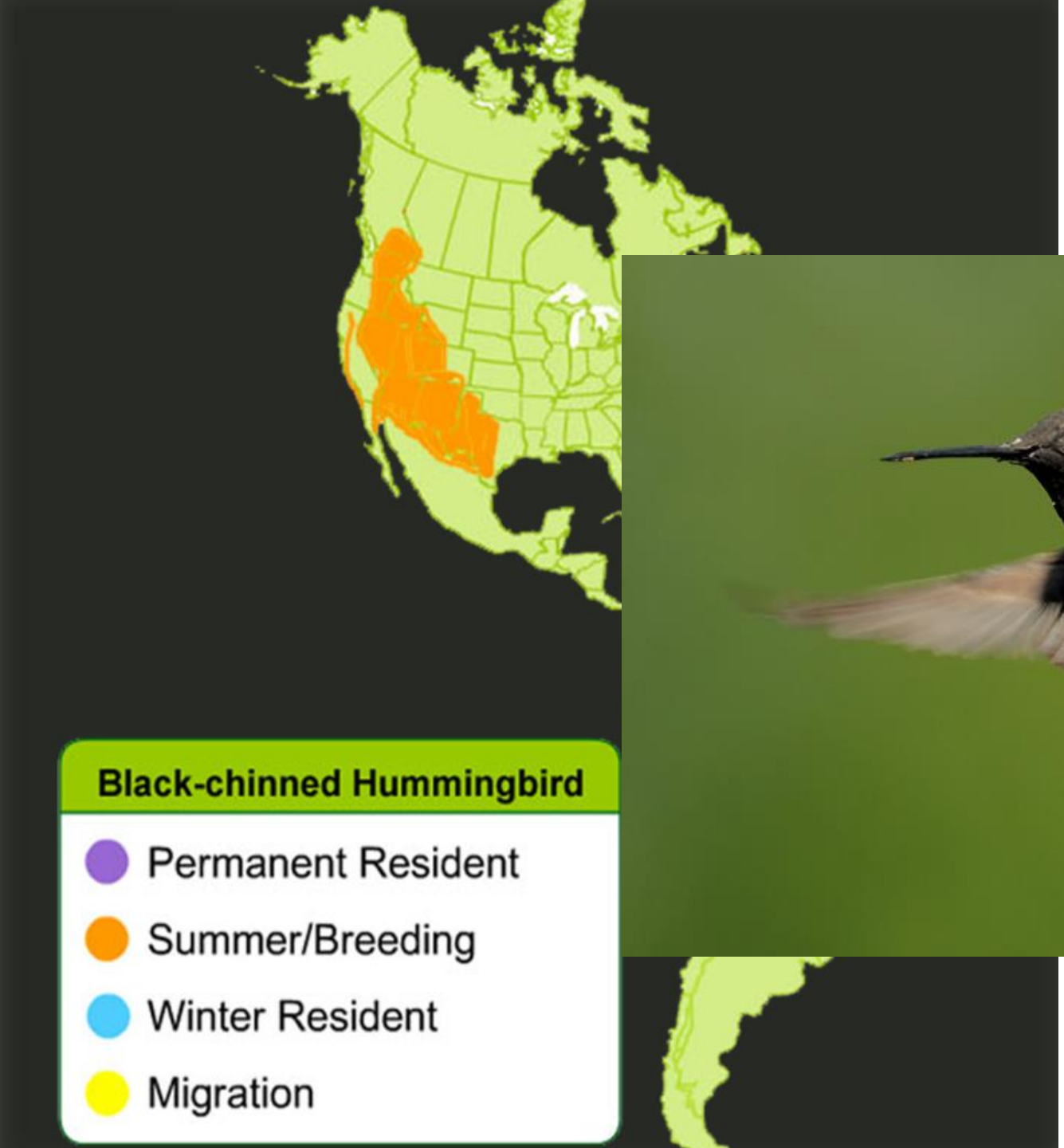

Magnificent Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

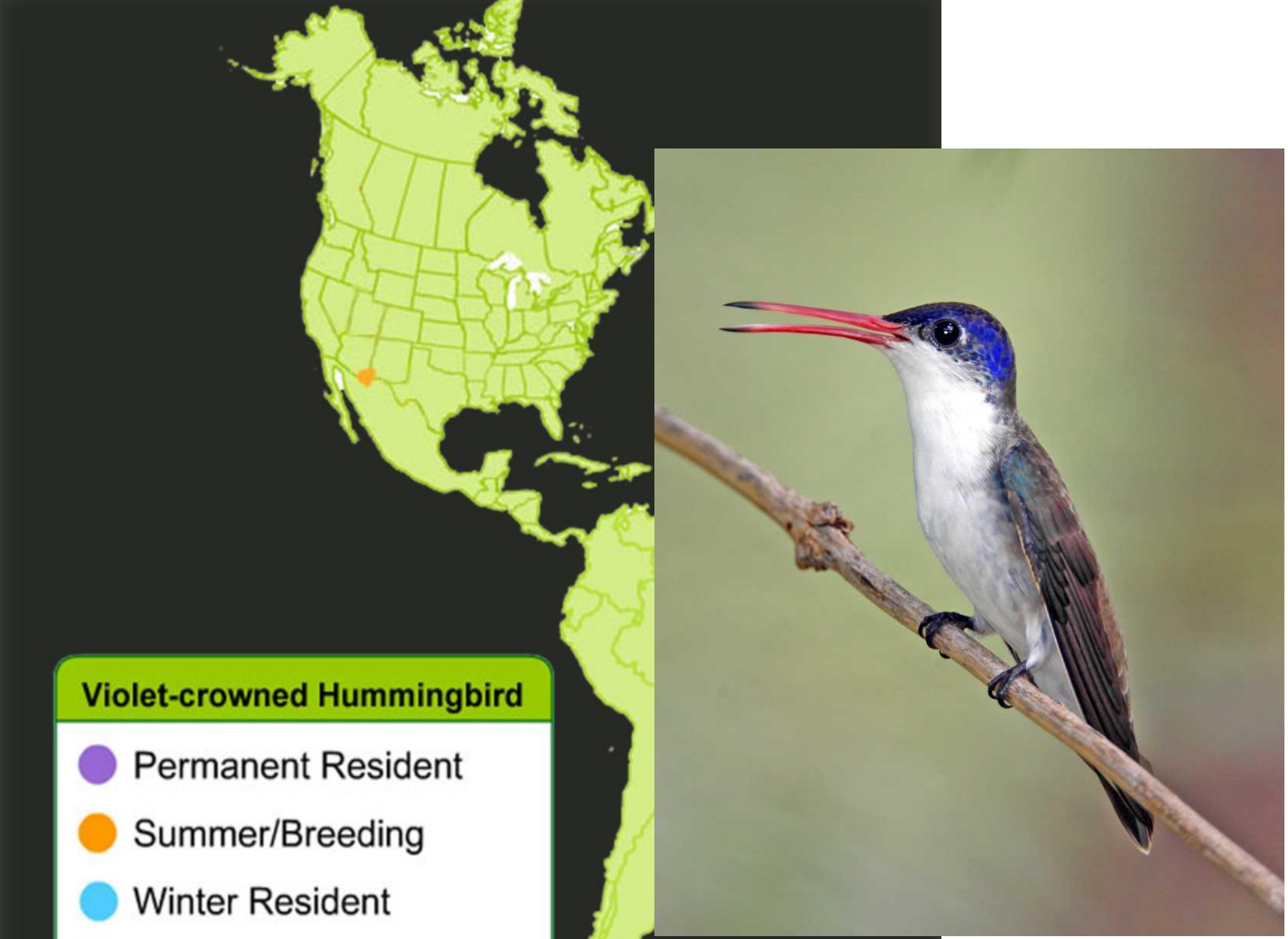
© Mauro Román.

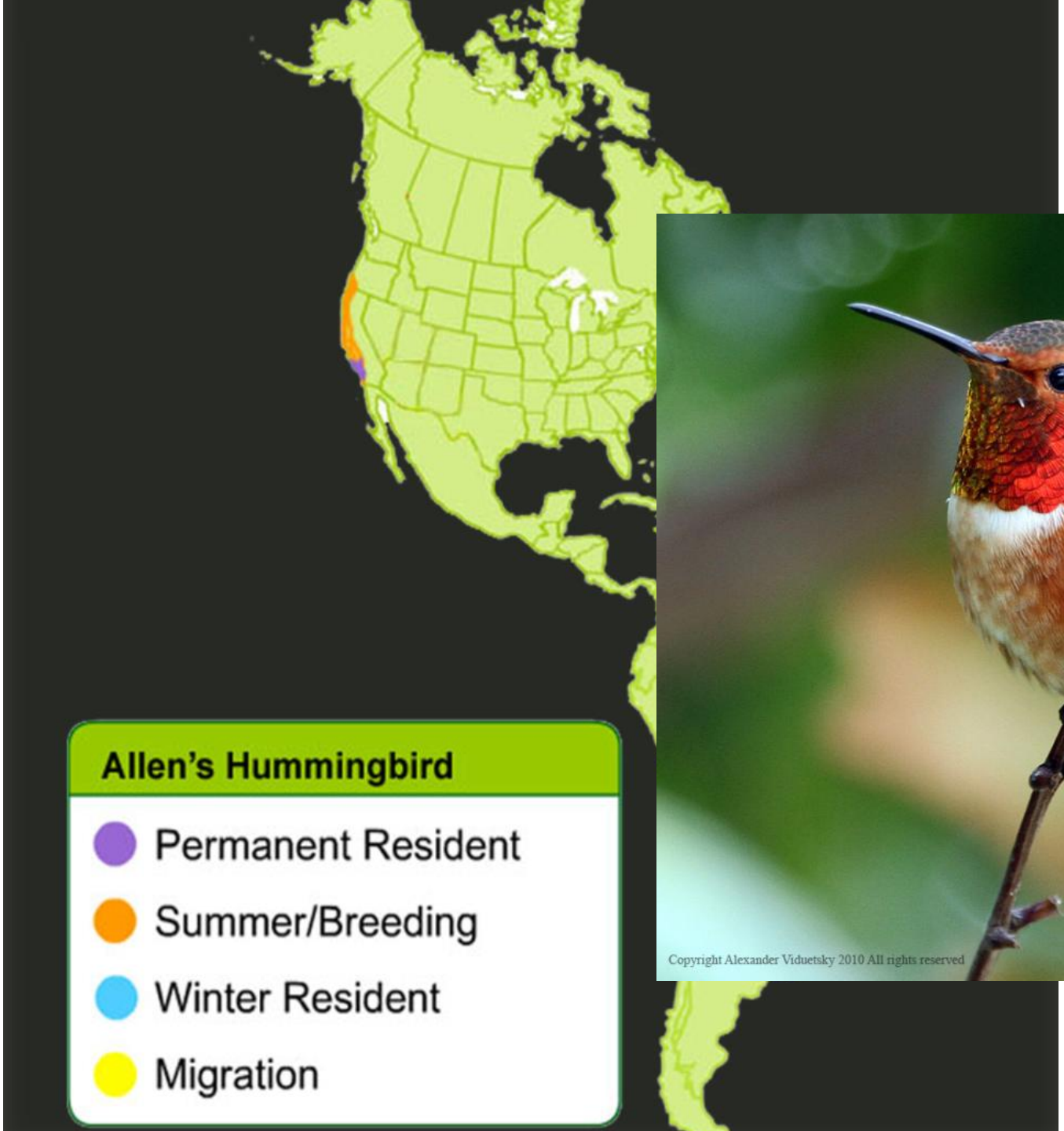
Lucifer Hummingbird

- Permanent Resident
- Summer/Breeding
- Winter Resident
- Migration

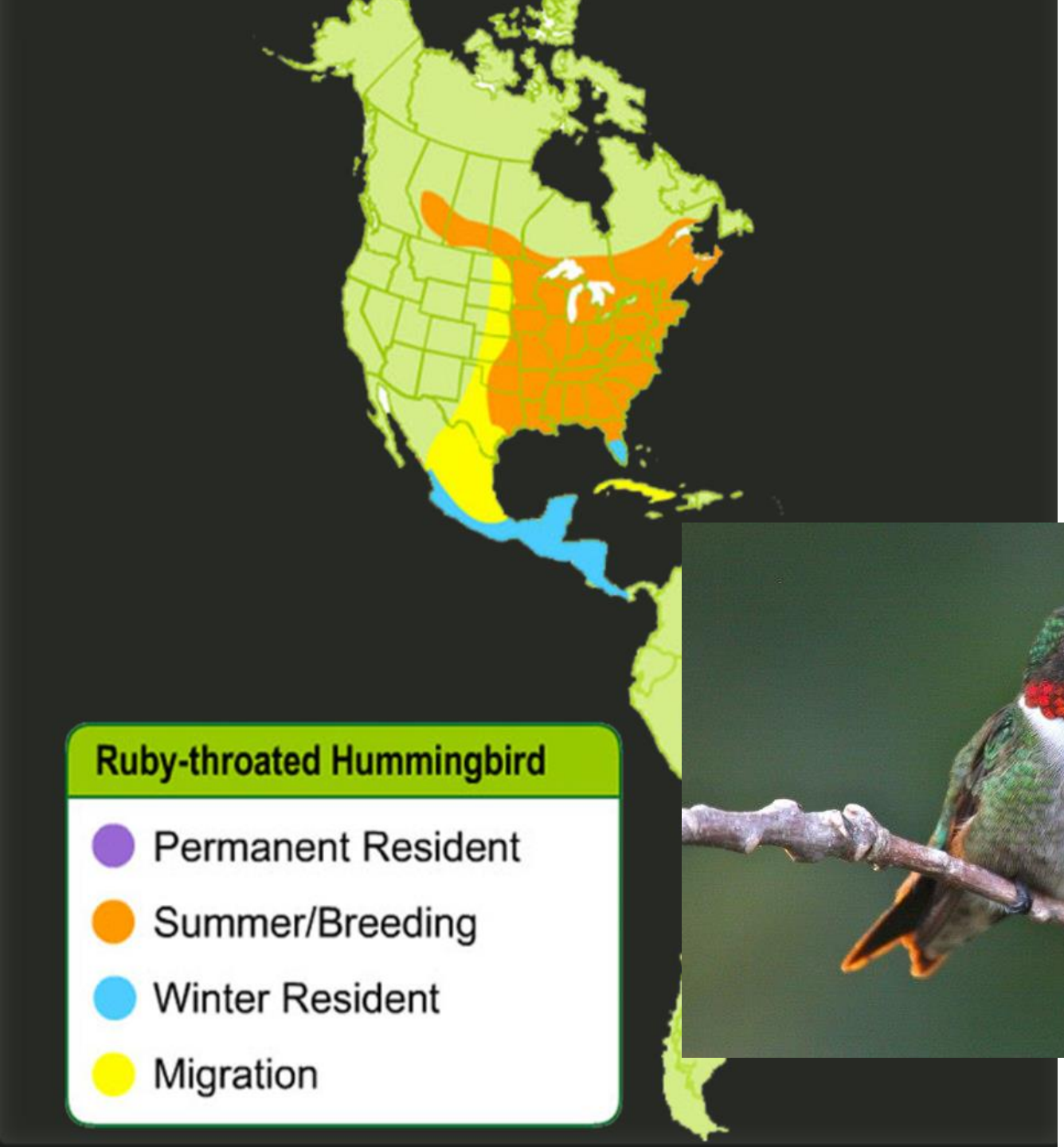

Costa's Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

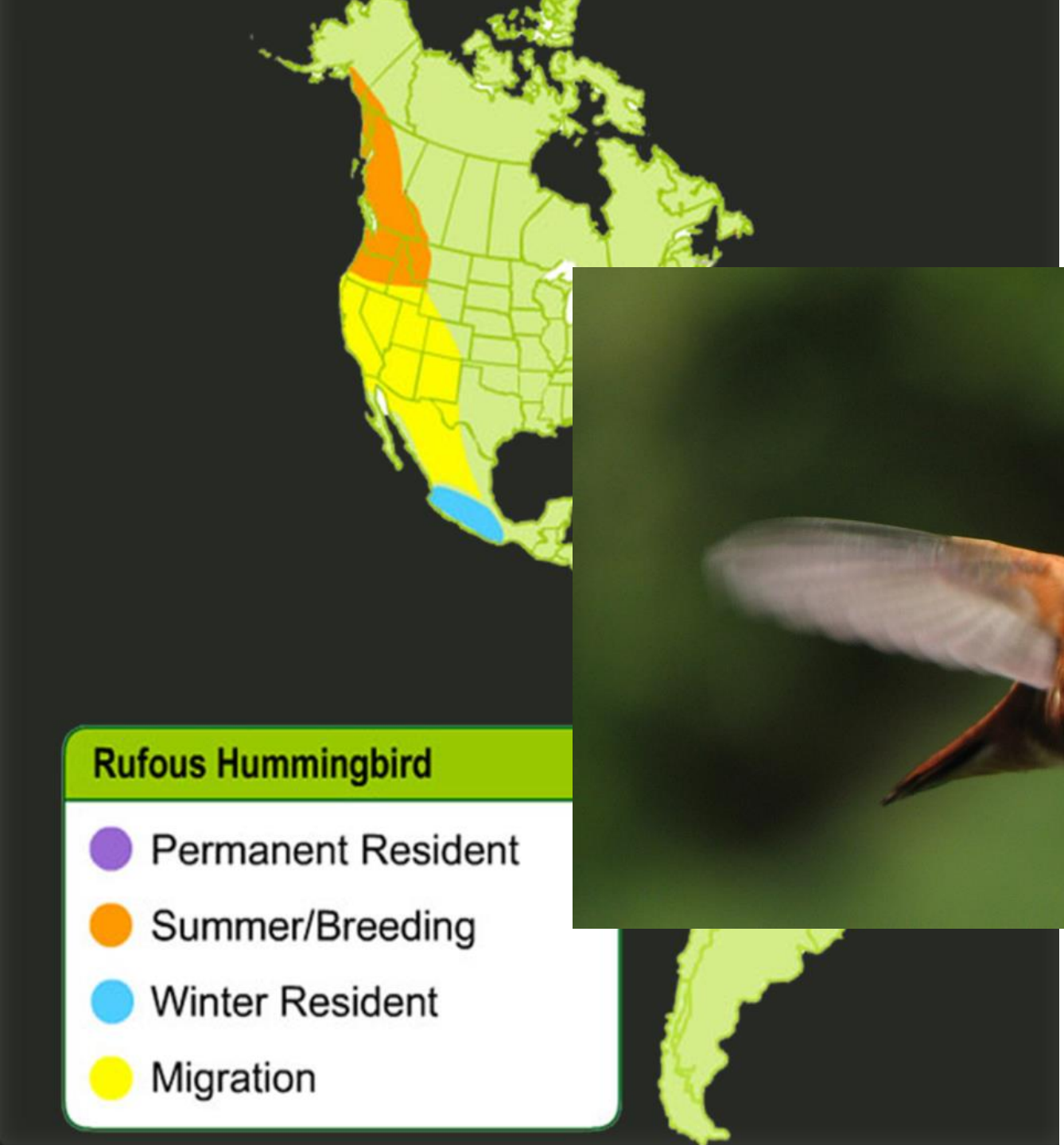

Black-chinned Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration


Violet-crowned Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration




Buff-bellied Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration


Ruby-throated Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration


Rufous Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

Broad-tailed Hummingbird

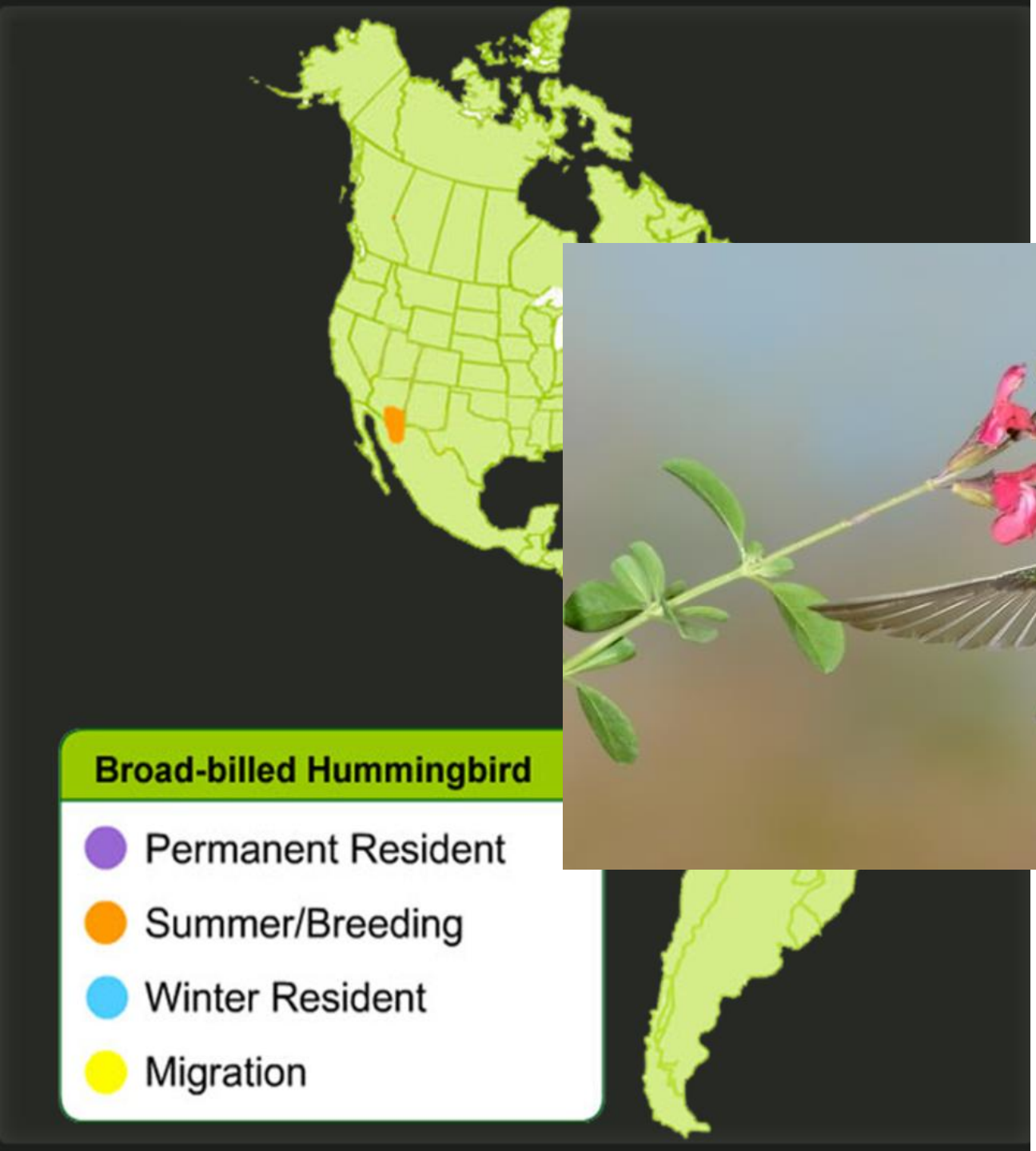
Broad-

Pe

Su

Winter Resident

Migration


Broad-billed Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

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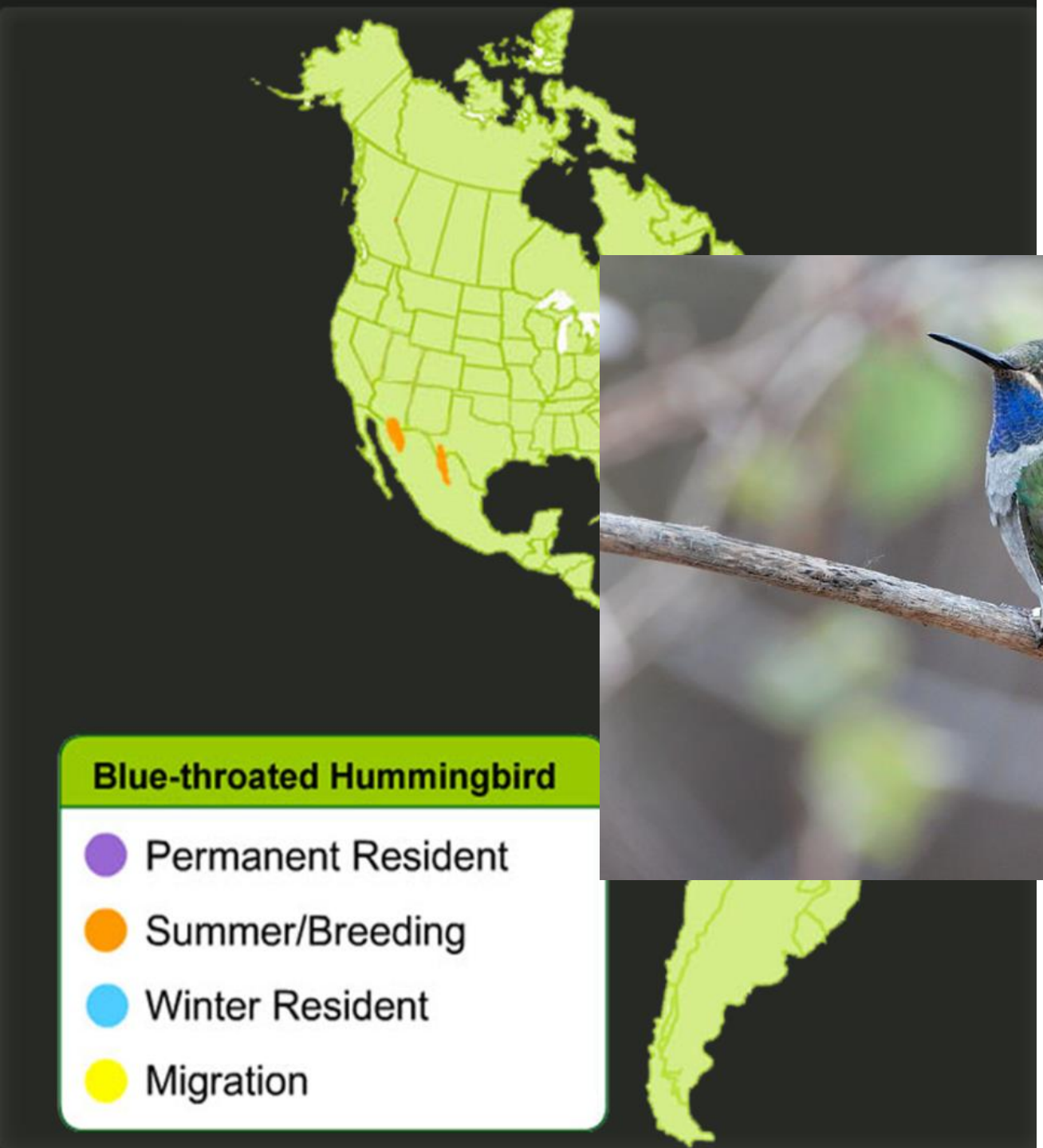
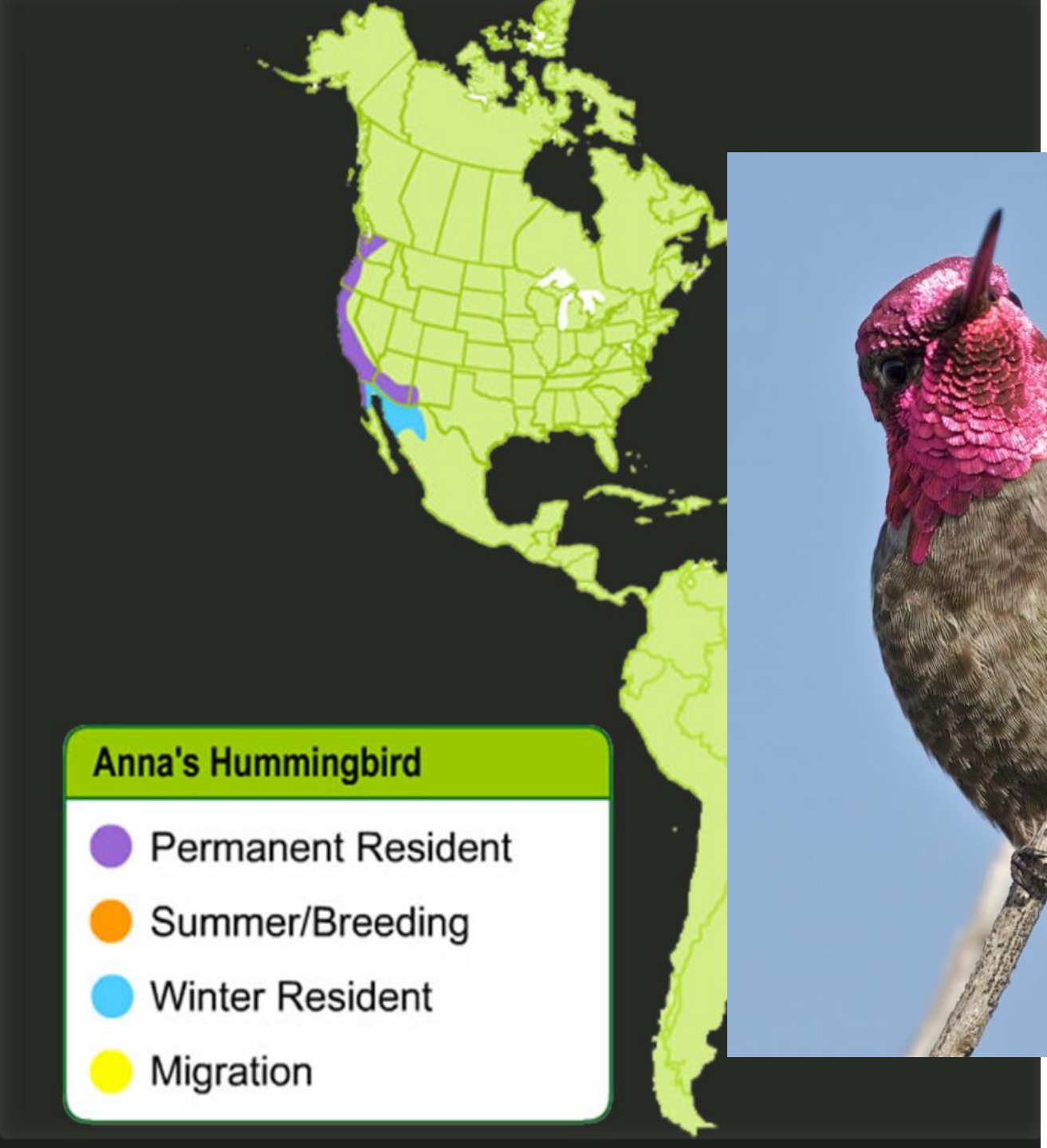
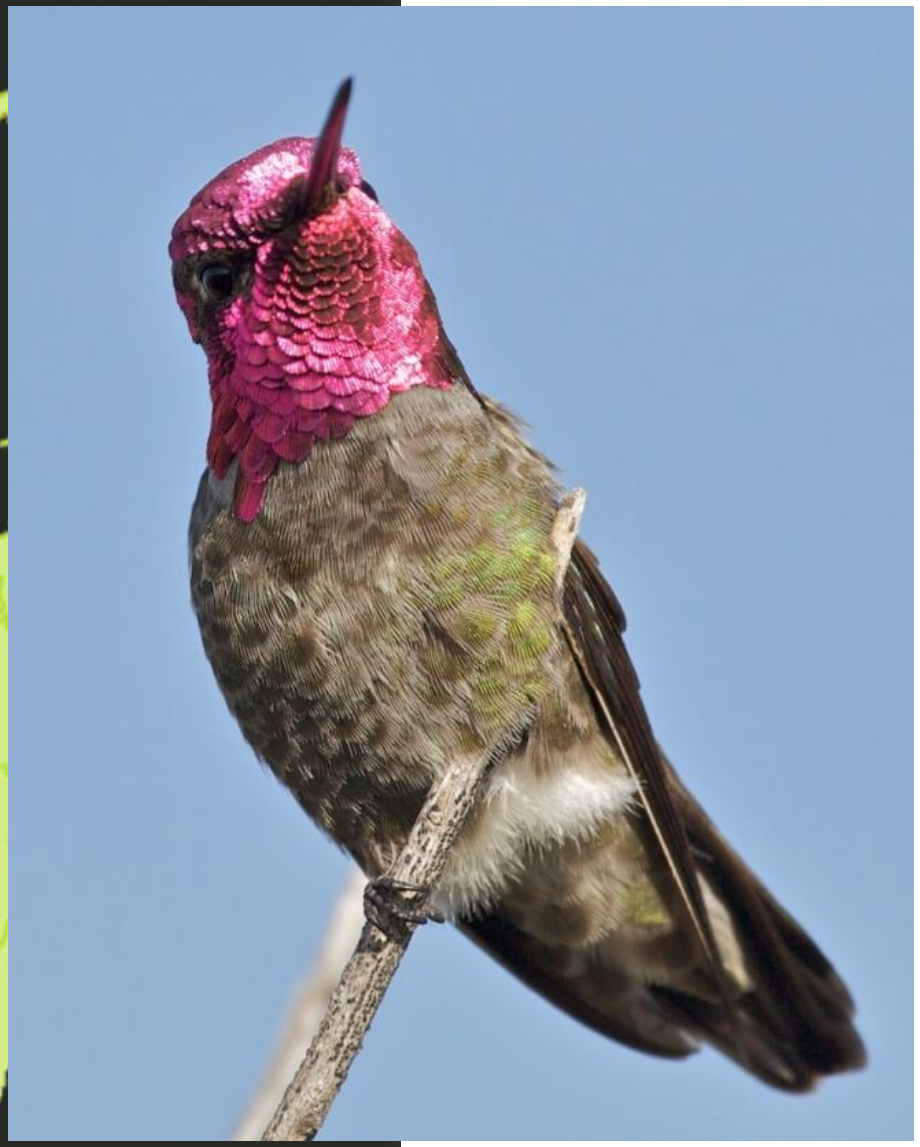
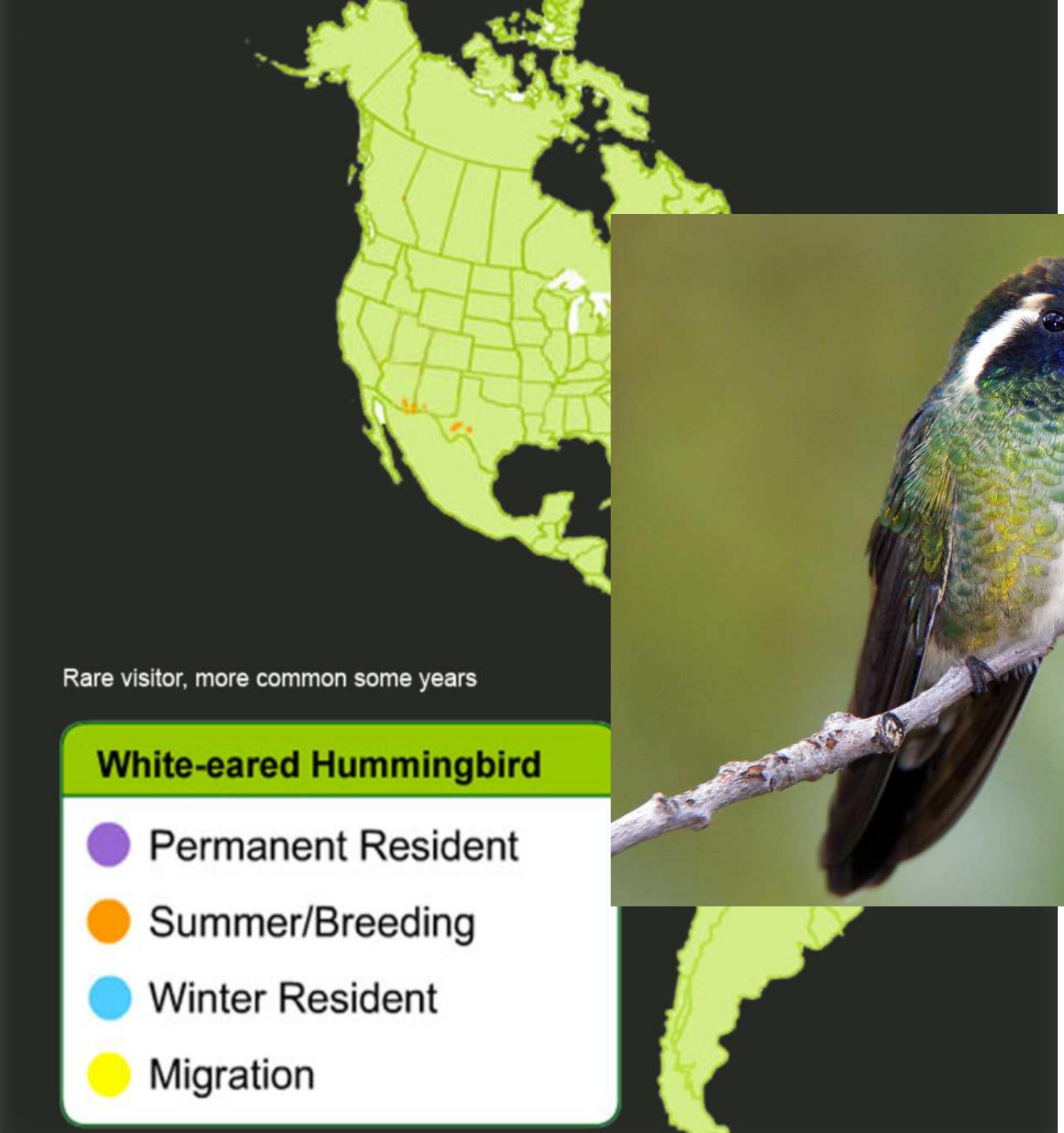

Blue-throated Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration


Anna's Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration




Rare visitor, more common some years
White-eared Hummingbird
Permanent Resident
Summer/Breeding
Winter Resident
Migration

Floral arrangement

Black-throated Mango

Green-breasted Mango