



Year Round Activity

- Hibernation and dormancy require suspending activity
- Non-migrating species in seasonal environments must face:
 - Extreme temperatures
 - Food scarcity
- Migration has dangers also

Migration Dangers

- Requires large food reserves
- Weather can be dangerous
- Refueling necessary for most species

Migrants

- Estimated 5 billion individuals of ~200 species
 - In both Eastern and Western Hemispheres
- Many bird groups migrate
 - Raptors
 - Songbirds
 - Waterbirds (ducks, pelicans, etc.)
 - Hummingbirds




Migration

- Seasonal, predictable movements
- Altitudinal
 - Up and down mountains
- Long-distance
 - e.g., Wood Thrush


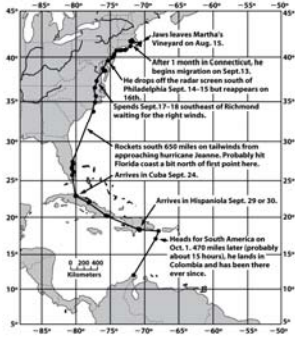


Radar Ornithology

- Birds can be detected on weather radar




Satellite Tracking.

John leaves Martha's Vineyard on Aug. 15.
 After 1 month in Connecticut, he begins migration on Sept. 13.
 He drops off the radar screen south of Philadelphia Sept. 14-15 but reappears on 16th.
 Spends Sept. 17-18 southeast of Richmond waiting for the right winds.
 Rockets south 650 miles on tailwinds from approaching hurricane Joanne. Probably hit Florida coast a bit north of first point here.
 Arrives in Cuba Sept. 24.
 Heads for South America on Oct. 1, 470 miles later (probably about 15 hours), he lands in Colombia and has been there ever since.
 1,200 mph kilometers


Feather Chemistry

- Different ratios of $^{13}\text{C}:^{12}\text{C}$
- Allows determination of latitude





Migration Routes

- Americas
 - North/South
- Europe and Asia
 - East/West



Migration Routes



- Circular Migration
 - Sooty Shearwater

Alan Wight


Migration Timing

- Raptors: Day
 - Use thermals
- Most Songbirds: Night
 - Calmer air, lower predation
- Swifts and Swallows: Day
 - Feed on insect prey while flying






Migration Altitude



- 700 to 800 m
- Bar-headed Goose: 9,000 m
- Ruppell's Vulture: 12,000 m



David Blank



Blackpoll Warbler

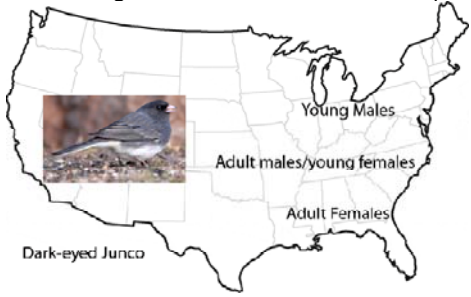
- 86 hours
- Spring migration not as extreme

Why Migrate?

- Benefits
 - Long days
 - Abundant resources
 - Dispersed, low-density breeding
 - Reduced predation
 - Immediate breeding opportunities
 - Much reduced energy expenditure during winter

Differential Migration


- There are age and sex differences for some species



Dark-eyed Junco

Migratory and Non-migratory Populations

- Some species have sedentary and migratory populations
 - Genetically determined
 - Selection can rapidly change proportions
- Populations can change
 - New colonizations
 - Establish resident breeding colonies on wintering grounds



Zugunruhe

- Migratory Restlessness
- Genetically determined
- First noticed in captive birds
 - Wakes shortly after dark, jumps or flutters in its cage until midnight
 - Oriented in the direction of migration
 - Lasts as long as the migration would