The Importance of Understanding Population Connectivity Throughout The Annual Cycle

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science for a chan

Connectivity

Examines relationships among locations of individuals:

- Over a pre-determined spatial and temporal scale
- Regardless of their migratory status

Why Study Connectivity ?

Benefits to research are enormous. Scientists can make better assessments of:

- Population structure
- Mating systems
- Estimates of survivorship
- Migration pathways
- Habitat needs
- Assess the relative significance of threats

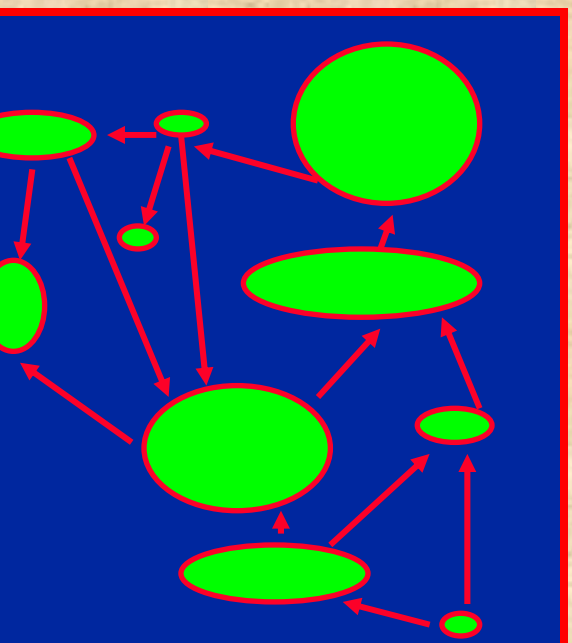
Why Study Connectivity ?

Benefits to conservation are enormous.

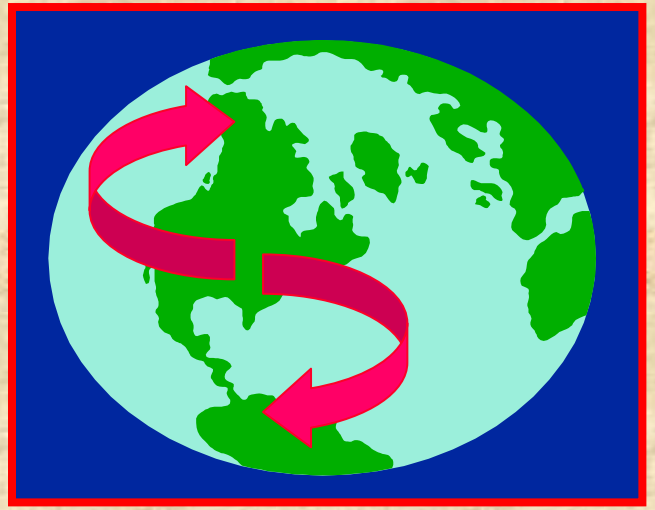
Scientists can make better assessments of:

- Habitat needs
- Locations of threatened pops
- How to build stable metapopulations

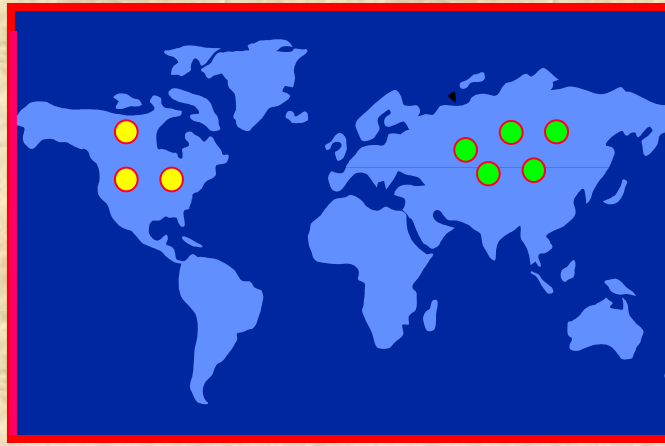
Issues of Connectivity: Depends on Scale



Within Season



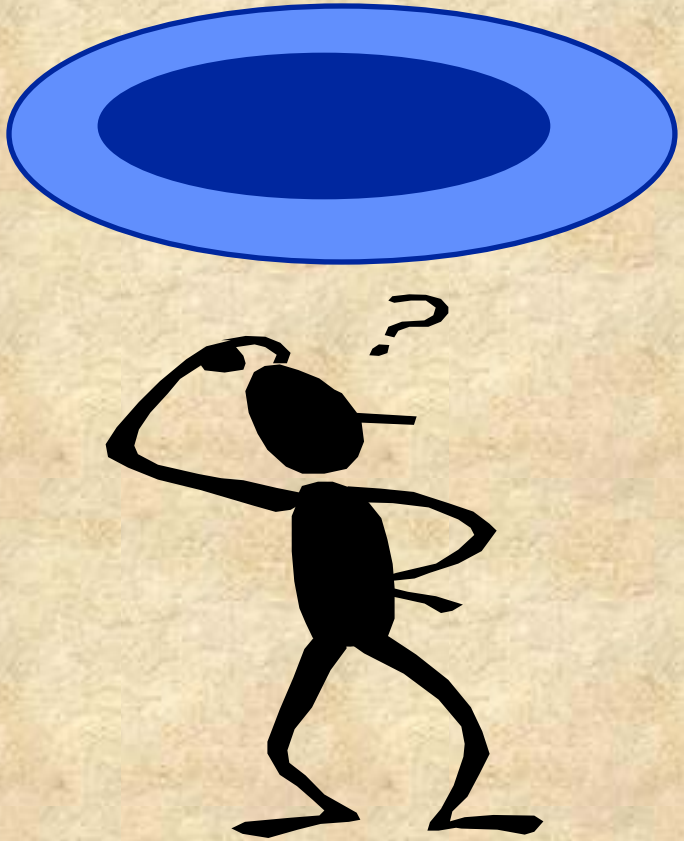
Among Seasons



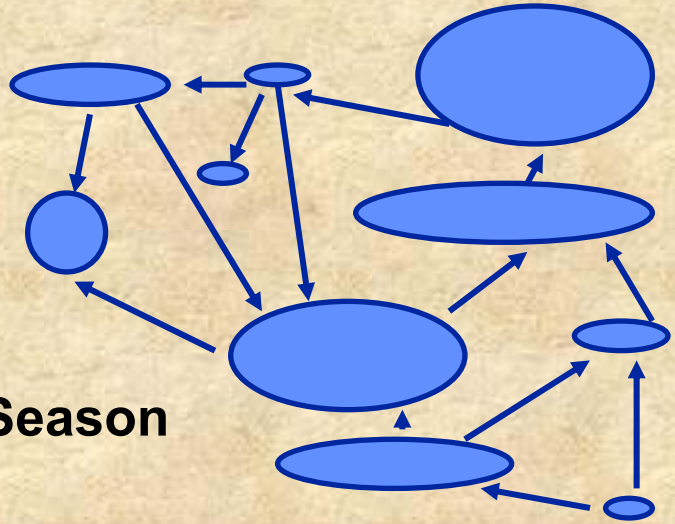
Among Pops,
Species, Subsp

Whose Scale??

Scientist:

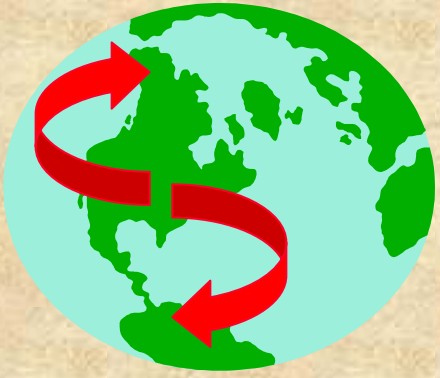


Bird



Within Season

Between Seasons



To Dream the Impossible Dream??

Monitoring Bird Movements On Multiple Temporal and Spatial Scales

Molecular Tools

Elemental Analyses

^{13}C ^{15}N ^{87}Sr

Population Identification

	Pop A	Pop B
1.	10	0
2.	10	0
3.	0	10
4.	0	10
5.	10	0
6.	0	10

Population/Taxon specific markers

	Pop A	Pop B
1.	8	4
2.	10	2
3.	7	8
4.	2	8
5.	1	10
6.	3	8

Prob (A): 0.8
Prob (B): 06

Assignment Test

Bird Genetics SUCKS!!

Challenges to Avian Population ID With Genetic Markers

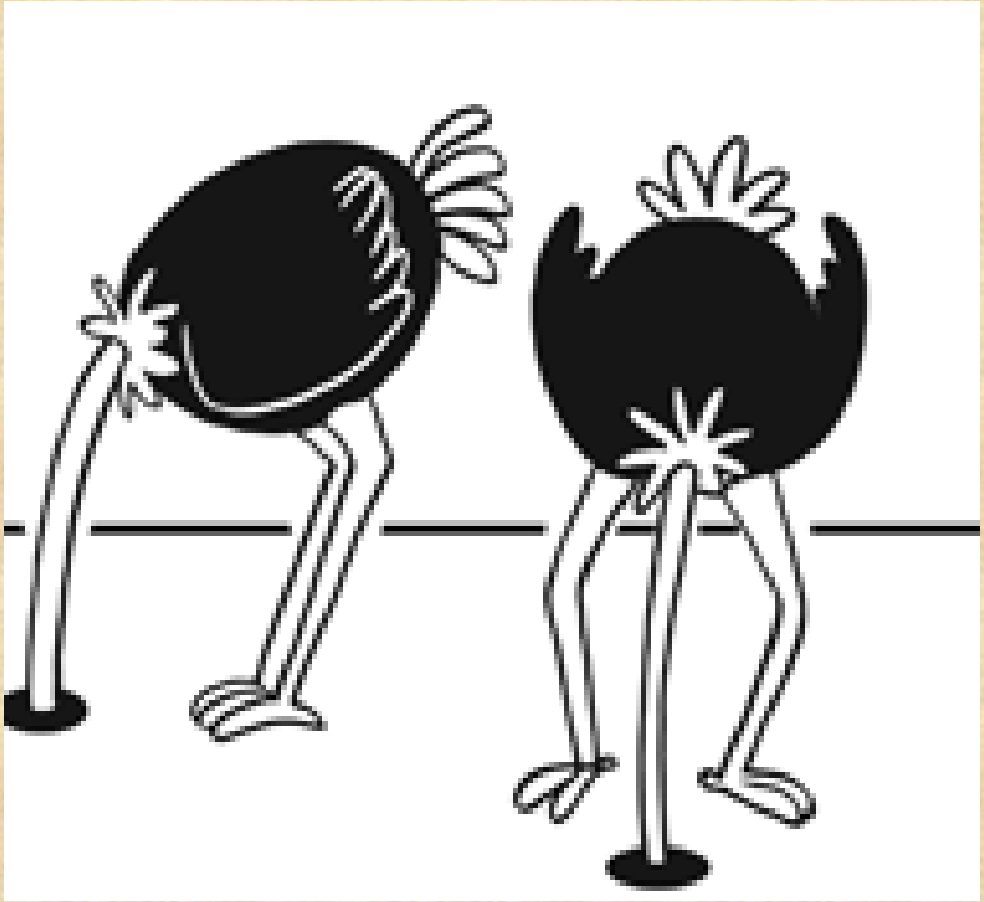
Birds fly: high dispersal among populations

- Don't expect much differentiation

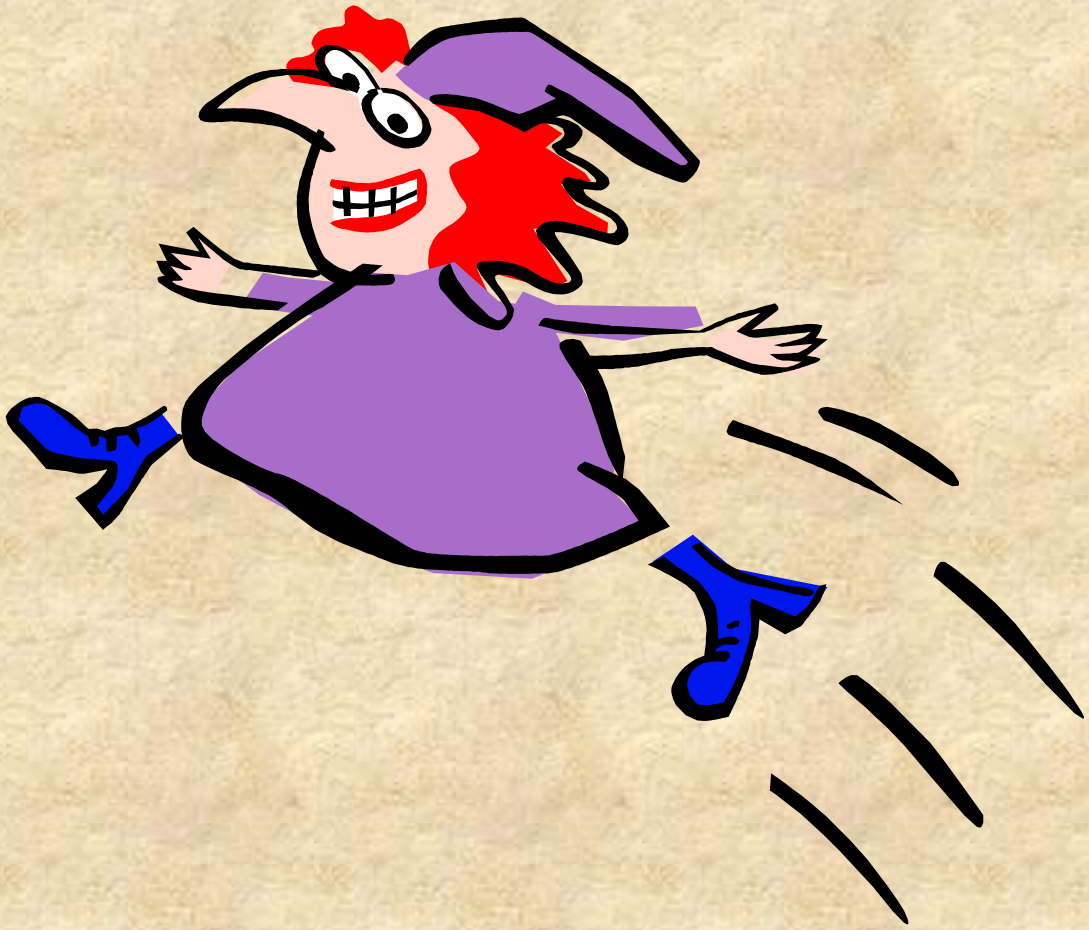
North American birds greatly affected by the Pleistocen

- Not enough time for divergence

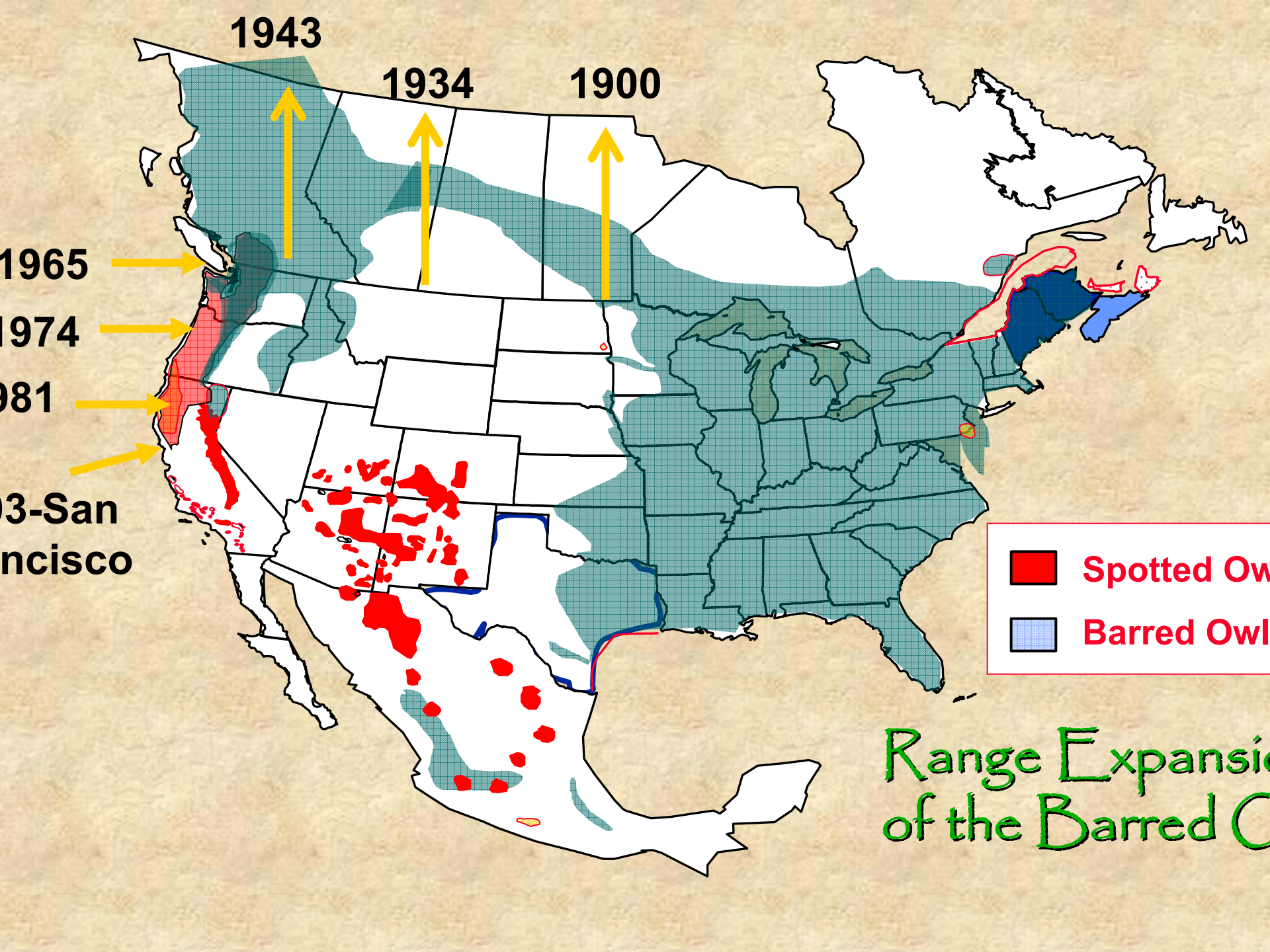
Avian Geneticists Approach to Monitoring Populations Using Molecular Markers



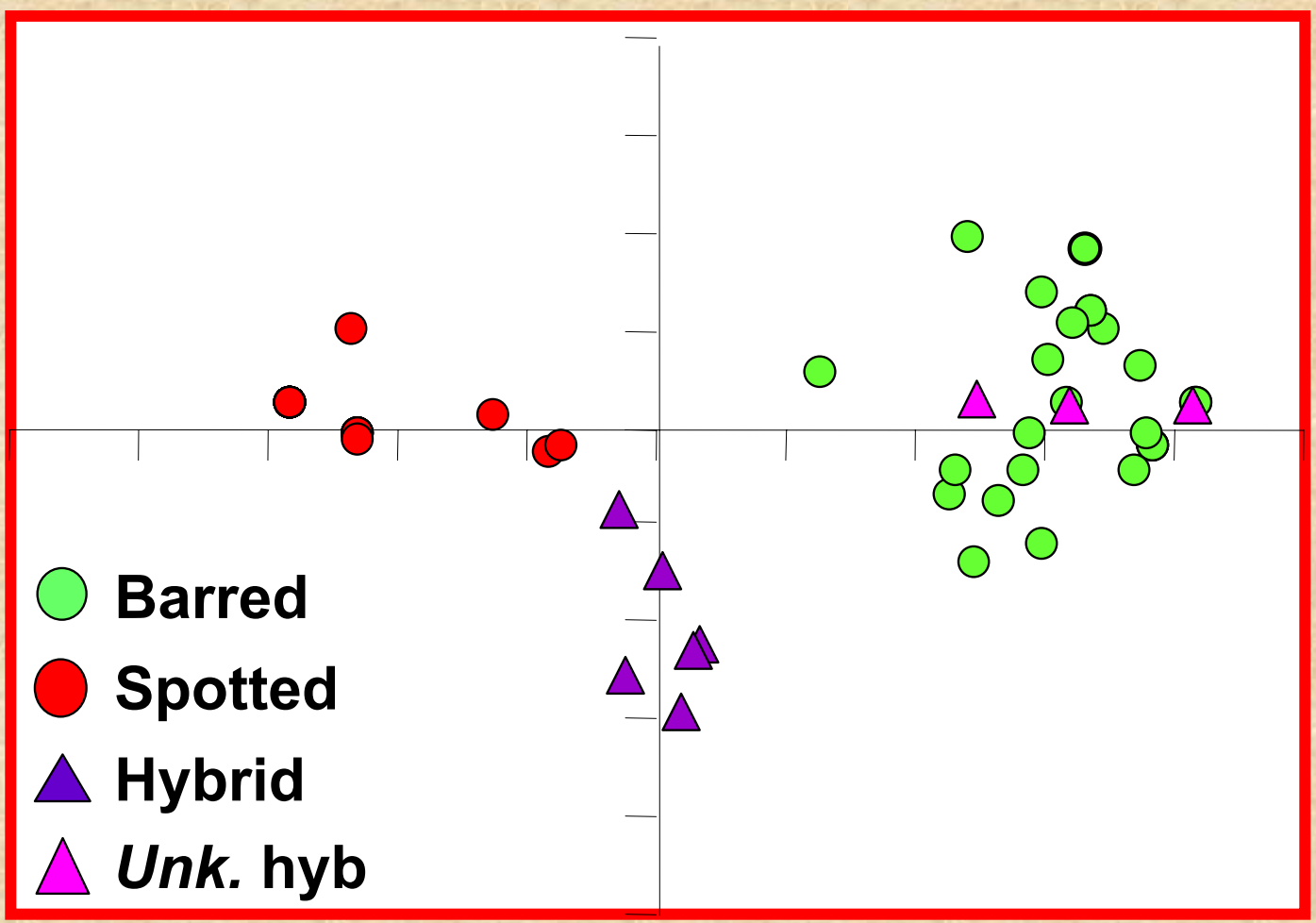
However.....
We Are Making Some Progress!



Hybrids:
SPARRED OWLS


1943
1934
1900
1965
1974
981
3-San
ncisco
Spotted Ow
Barred Owl
Range Expansi
of the Barred C

AFLP Analysis Of Spotted, Barred, and Hybrid Owls



What To Do About Sparred Owls?

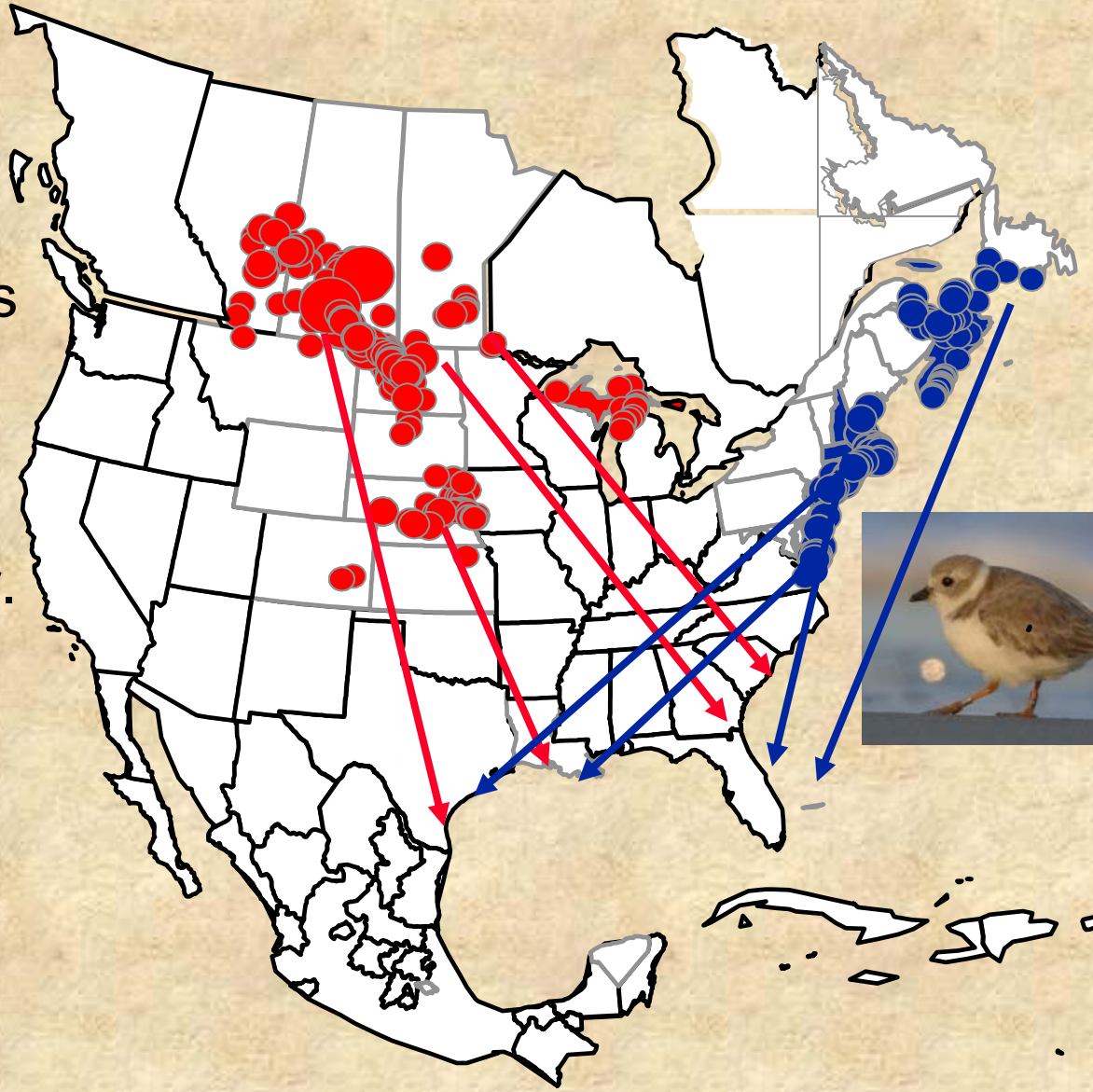
Tracking Among Subspecies and Major Populations: Piping Plovers

Piping Plover Movements in Winter

irds are site faithful in
inter.

opulations and subspecies
ix in winter.

Ve needed to know where
reeding populations winter.



Piping Plover Population Differentiation (F_{ST})

mtDNA	PC	NGP	GL	A-C	A-US
Prairie Canada (1)	-				
U.S. Great Plains (2)	0.018	-			
Great Lakes (3)	0.040	0.038	-		
Atlantic Canada (4)	0.493	0.534	0.532	-	
Atlantic U.S. (5)	0.476	0.519	0.480	0.203	-

Shorebird Movements And Population Connectivity

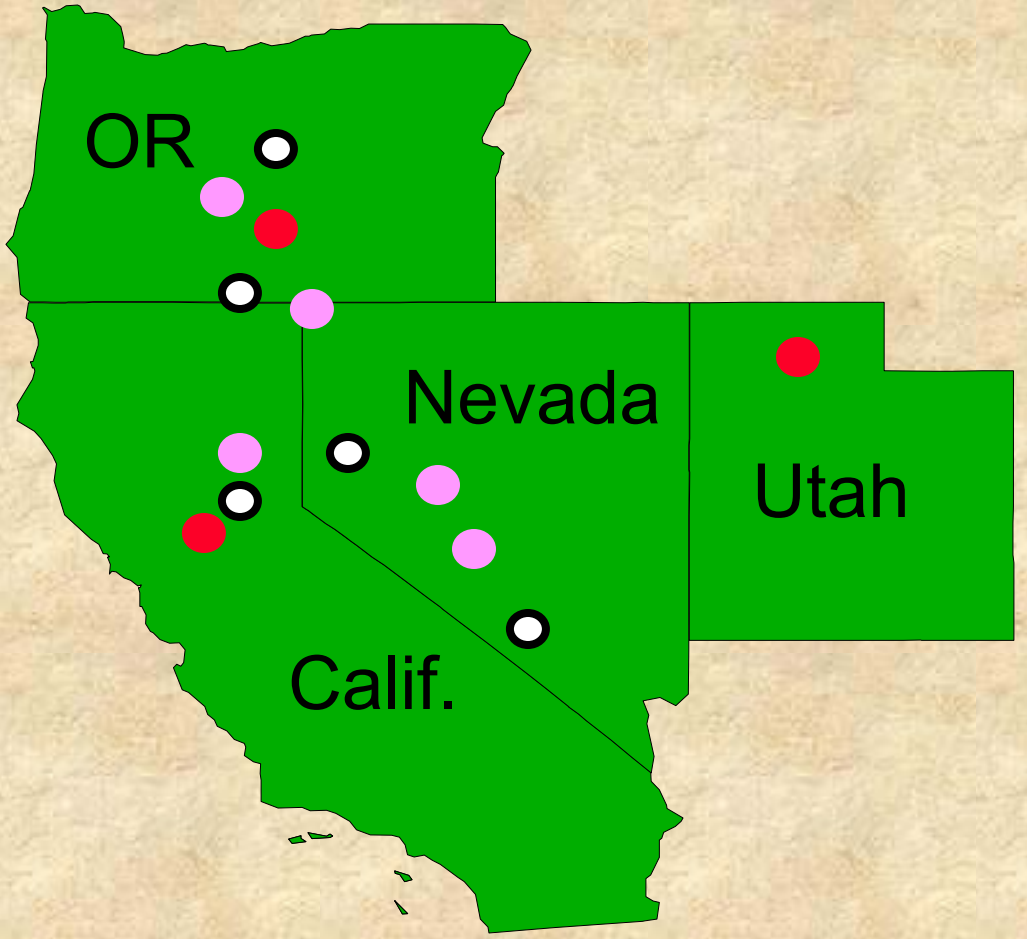
Multi-species Population Connectivity

We took a nested approach to addressing issues of connectivity in Great Basin Shorebirds:

- Within seasons
- Between micro-phases of the annual cycle.
- Between major phases of the annual cycle.

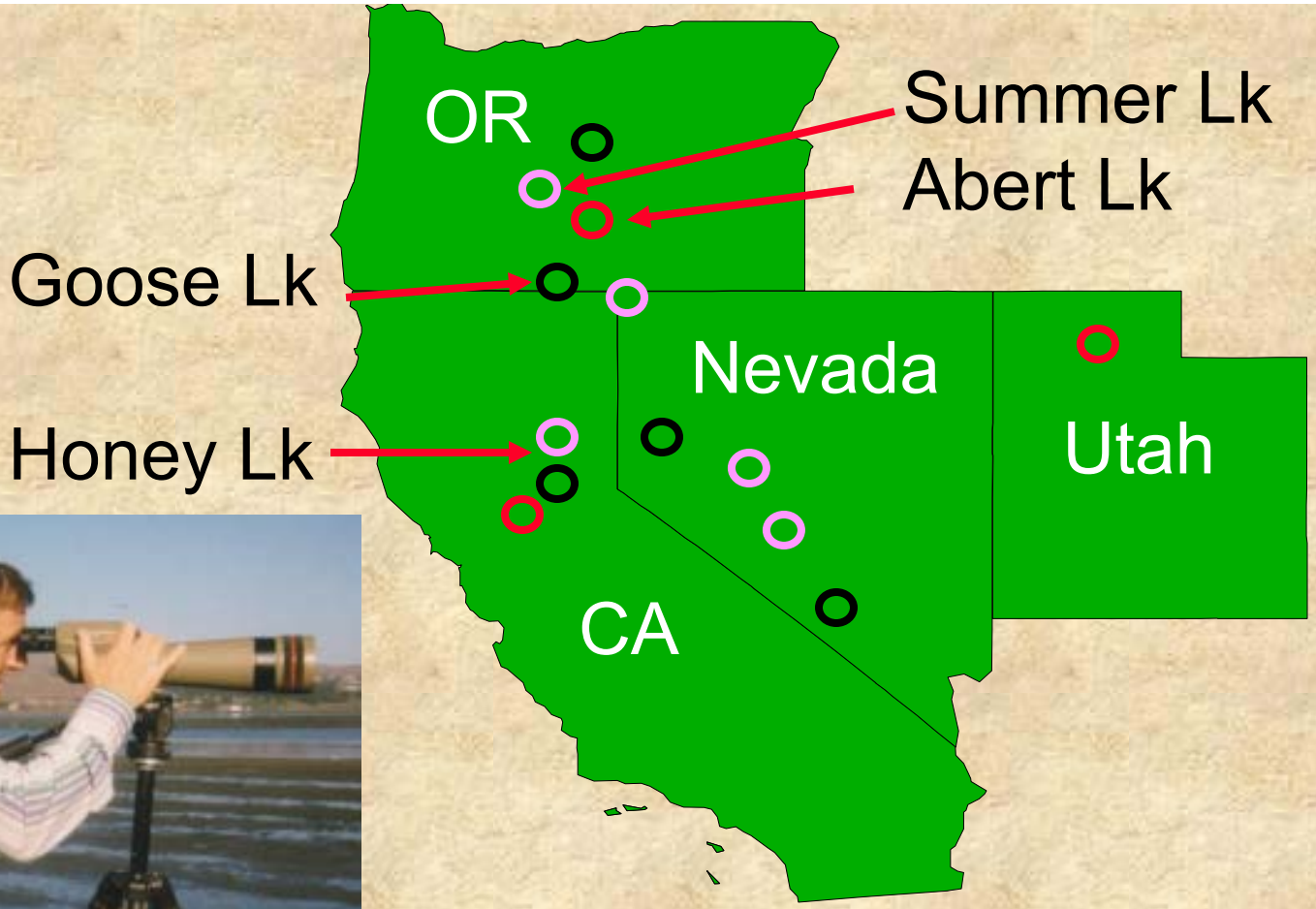

Great Basin
Seattle
Mt. Rainier
Mt. St. Helens
Chicago
Great Lakes
Denver
St. Louis
Ohio
San Francisco
Mt. Whitney
Death Valley
Los Angeles
San Diego
Mt. Mitchell
New Orleans
Miami

Major Great Basin Wetlands



Hypersaline
Saline
Fresh

Monitoring Breeding Shorebirds



Focal Species

Killdeer Space Use in the Great Basin

- All adults (n = 106) were found at 1 site only.
- Adults used an average of 6 ha over 6-10 mo.
- 27% of 106 birds moved more than 1km during season.
- Breeding females moved sig. further than males (<500 m)

Willet Space Use in the Great Basin

- Willets arrived synchronously and were found at one site only.
- There were daily movements from upland nests to wetlands.
- Female postbreeding home ranges were larger than males.
- Willets were only in the Great Basin for a short time.

American Avocet Movement in the Great Basin

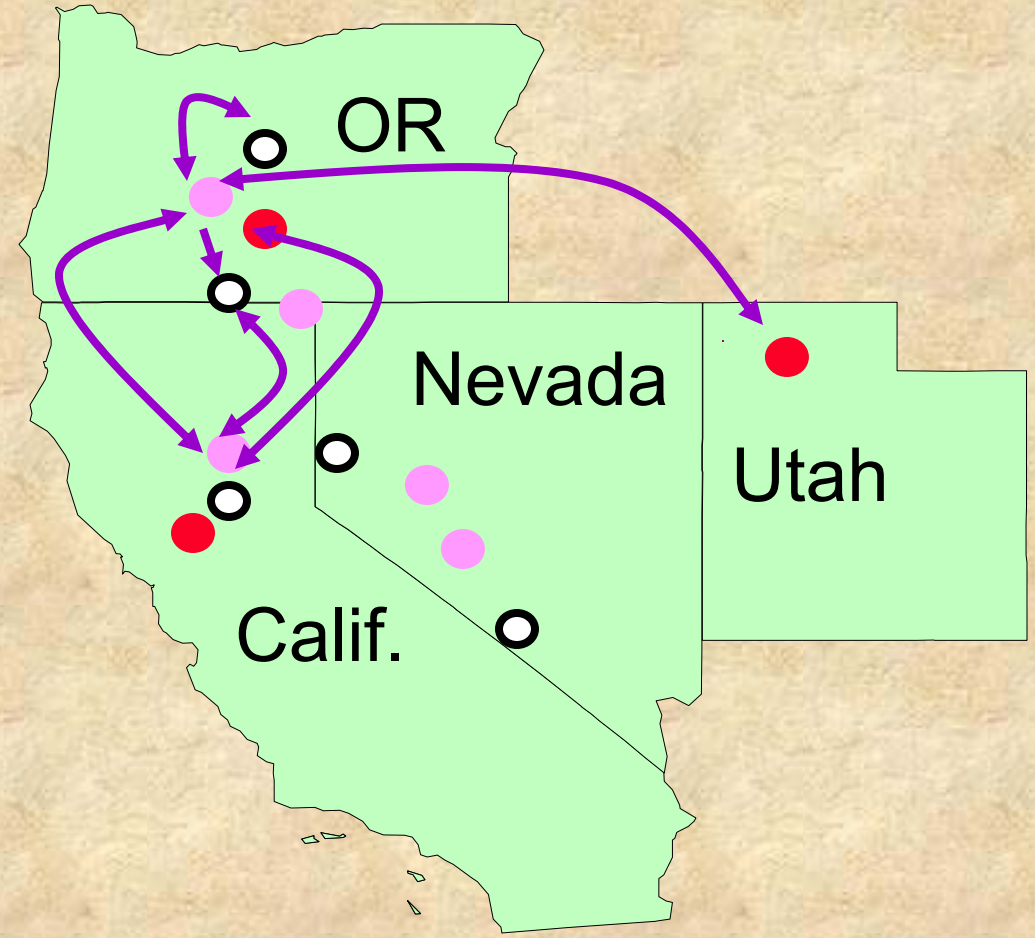
Average adult was detected at 2.1 sites (r: 0-6).

74% of adults were found at more than 1 site.

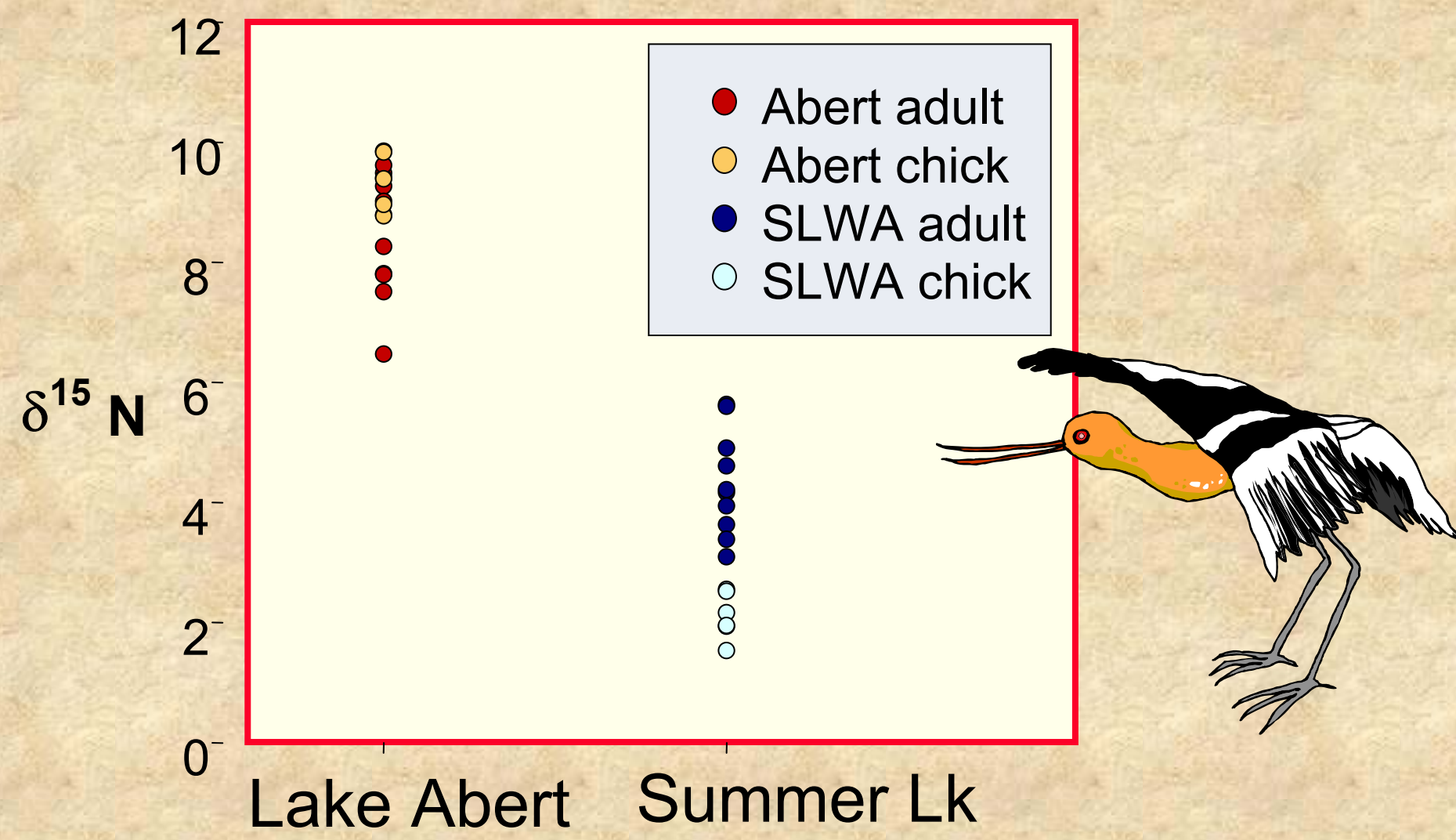
22% of 185 radioed birds moved (north) more than 200 km.

Males and females did not differ in movements.

Movements of Breeding American Avocets In the Great Basin

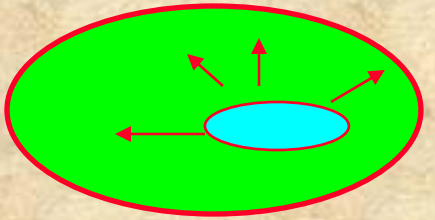


Isotopic Identification of American Avocet

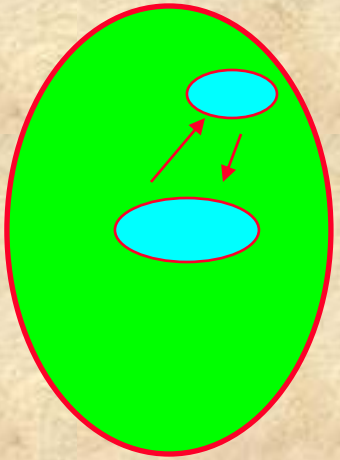


Breeding Space Use in Great Basin Shorebirds

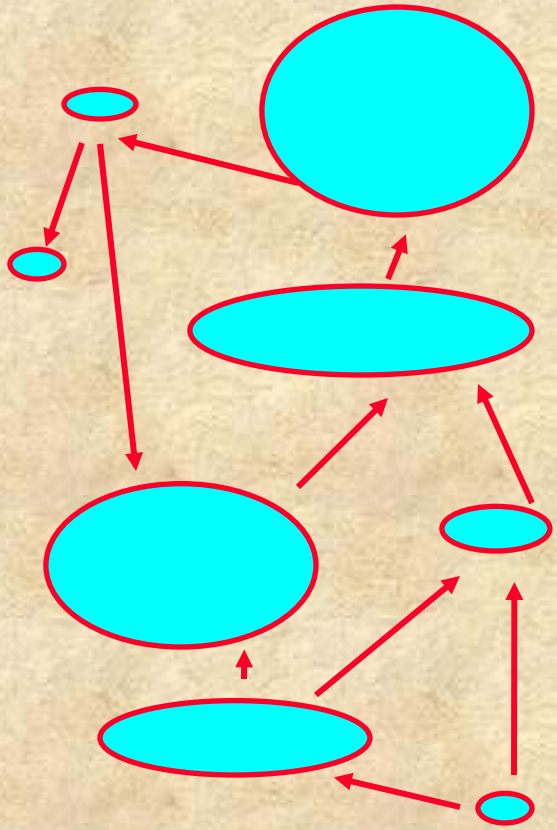
Killdeer



Willets

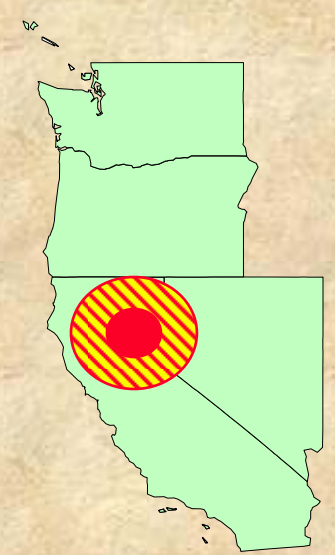


Avocets

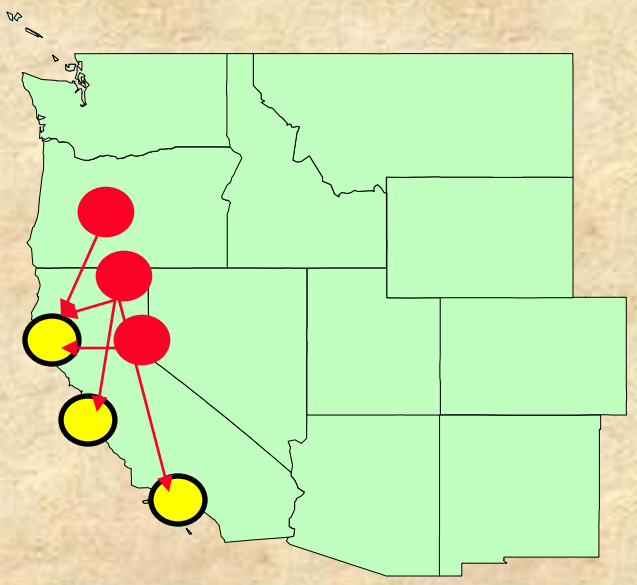


Winter and Migratory Connectivity

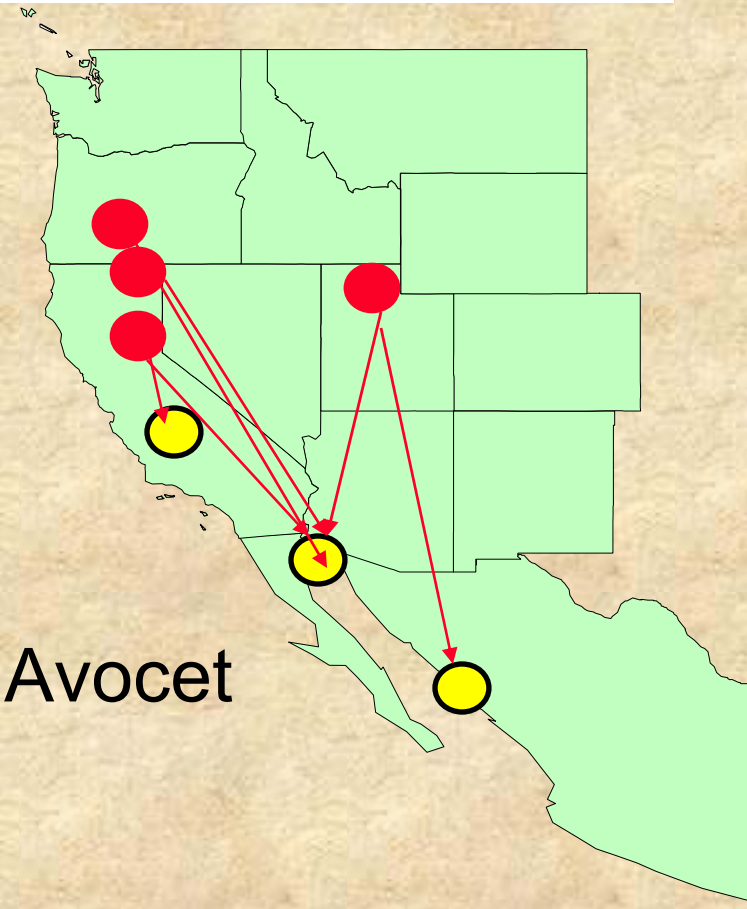
Dispersal from Breeding to Winter Sites In Great Basin Shorebirds



Killdeer



Willet



Avocet

Willet Dispersal to Winter Sites

Summer Lk

Lk Abert

Goose Lk

Arcata

Honey Lk

King's Range

N

100 0 100 Km

San Francisco Bay

Morro Bay

Santa Barbara

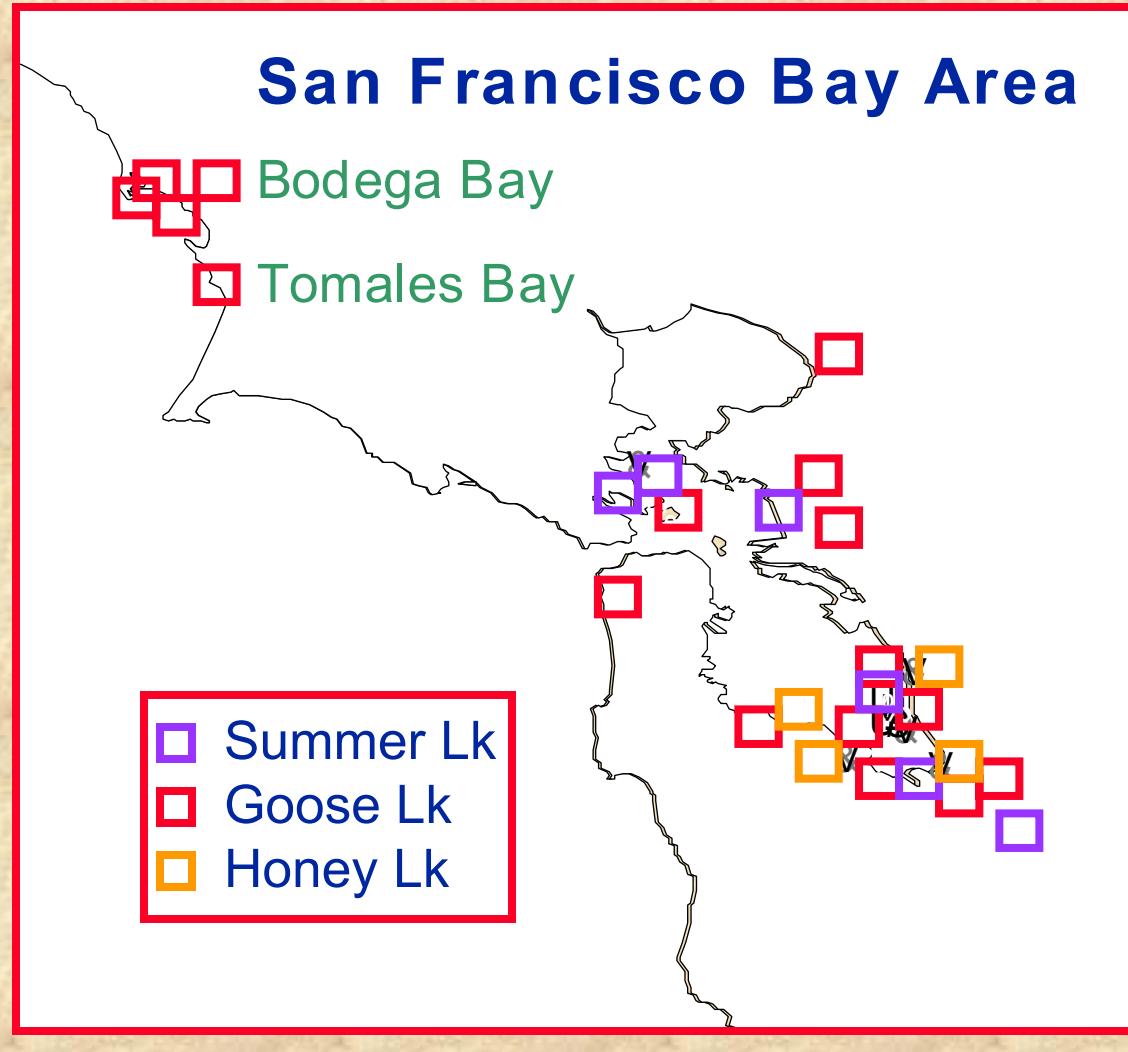
San Diego

Winter Home Range in Willets

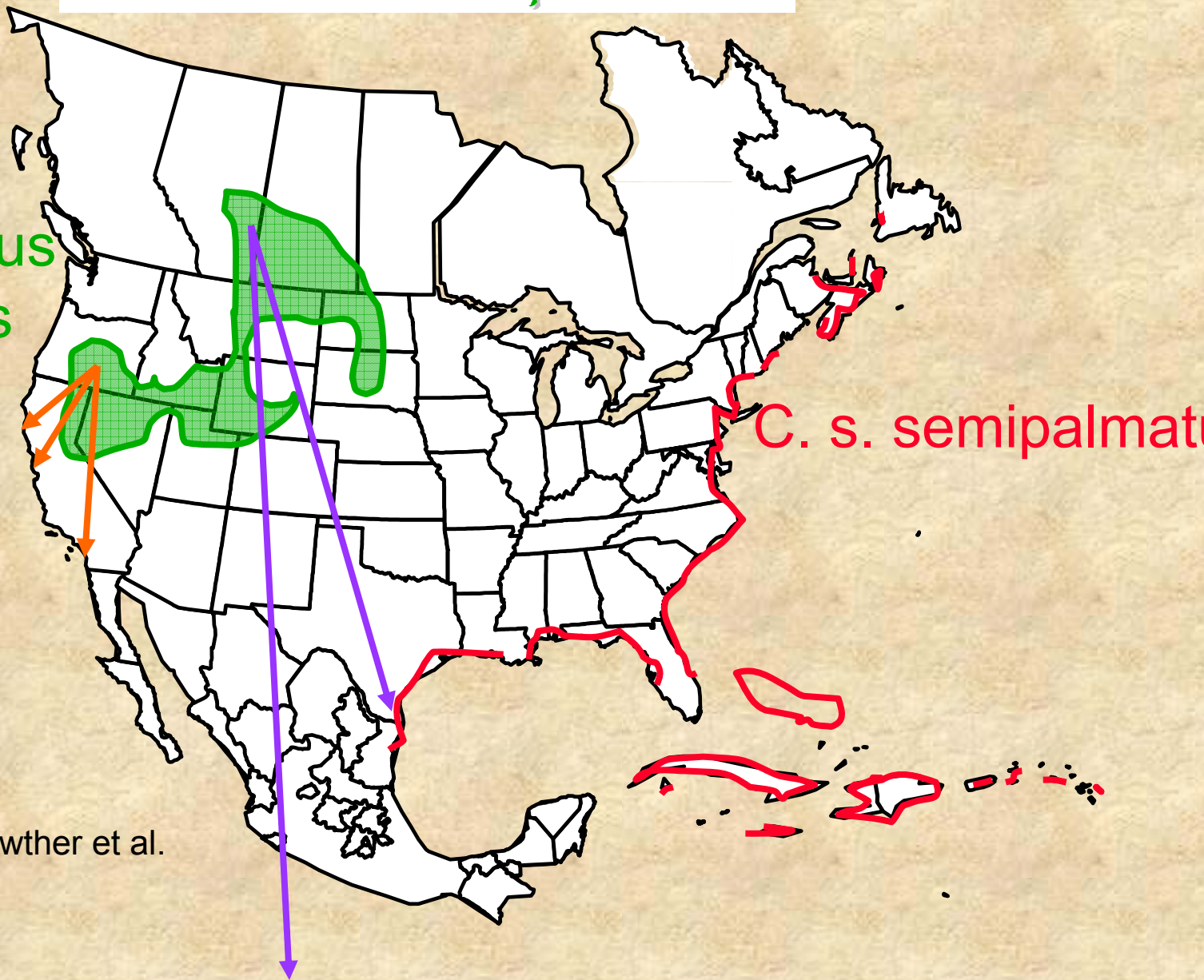
Among 34 adults, 4 juv., no segregation based on: sex, age, breeding site, mate location.

Small home range: no general movement out of local area. 80% (55/69) of movements were less than 10 km from origin.

Philopatric among years.



Willet Subspecies



Range map after Lowther et al.
Willet BNA.

Summary

- Shorebird movement within and among seasons can be quite dynamic.

- Wetlands can also be highly dynamic within and among seasons and years.

- A seasonally-nested, comparative approach provides a more complete picture of population and landscape connectivity.

Conclusions

- Information gained from studies of bird movement throughout their annual cycle is invaluable.
- Often multiple types of technology are needed to understand annual movement.
- Studies of annual movement are of paramount\importance given current conservation concerns, particularly with respect to climate change.