Apr 27th, 4:10 PM - 4:25 PM

# Comparing Genetic Diversity Along Populations of Rock Sandpipers (Calidris ptilocnemis)

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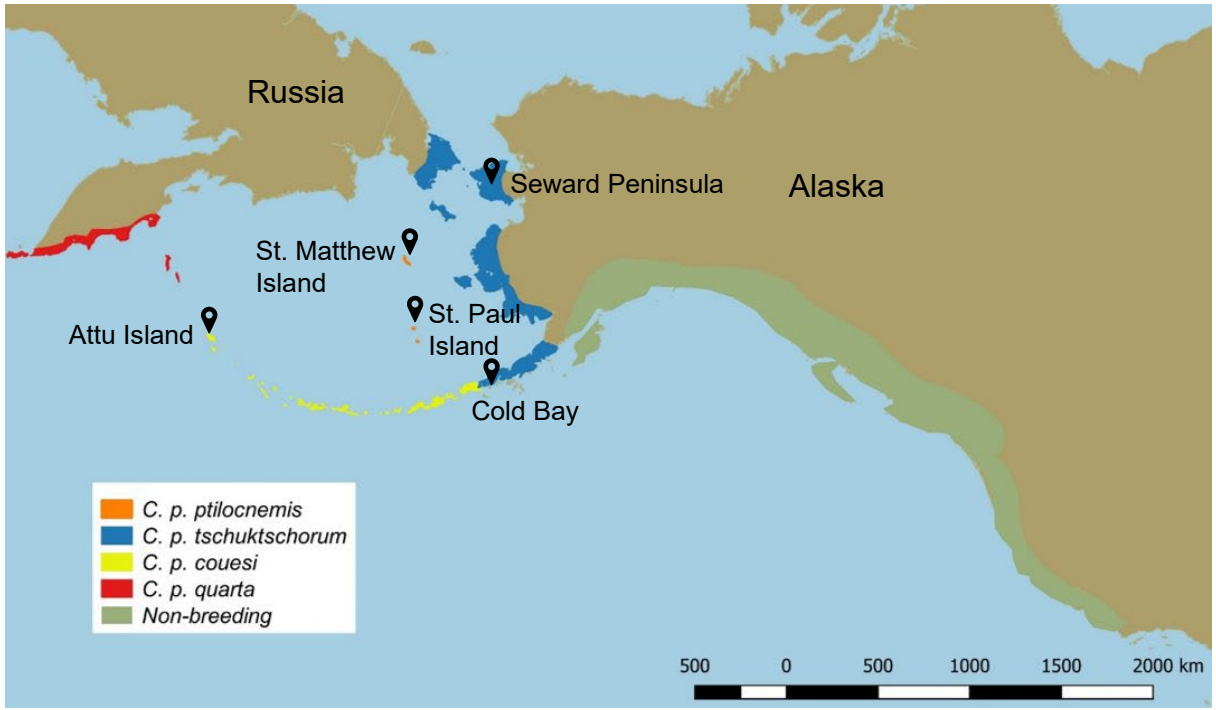
# ROCK SANDPIPERS

Adult Rock Sandpiper

- Shorebird only found in the North Pacific Basin
- Four subspecies of Rock Sandpipers
  - Three are endangered
- Assess genetic diversity between island and mainland populations
- Provide insight for conservation status

# North Pacific Basin



# Implications for Conservation

# Population Size of St. Matthew & St. Paul Islands

- C. p. ptilocnemis breeds on St. Matthew and St. Paul
- St. Matthew has a greater population than St. Paul
- Small population size affects extinction risk and inbreeding risk and overall loss of adaptive potential

*C. p. tschuktschorum* *C. p. cousei*

*C. p. ptilocnemis*

Gibson & Kessel. 1997. Western Birds 28:45-95
Gibson & Withrow. 2015. Western Birds 46: 94-185

# Genetic Diversity among North Pacific Birds

- Other species of birds with populations on the North Pacific islands have much lower genetic diversity than populations on the Alaska mainland
- Correlation between geographic distance and genetic diversity

Rock Ptarmigan

Song Sparrow

Pacific Wren

Common Raven

# Genetic Differences among North Pacific Birds

- Genetic differences show advantages through evolution
- Genetic differences are found among subspecies of North Pacific birds
    - Four of the five subspecies of Rock Ptarmigan were unique to one another and treated as separate conservation units
- Genetic differences found among Rock Sandpipers ‘ subspecies would improve its conservation plans and management

Rock Ptarmigan

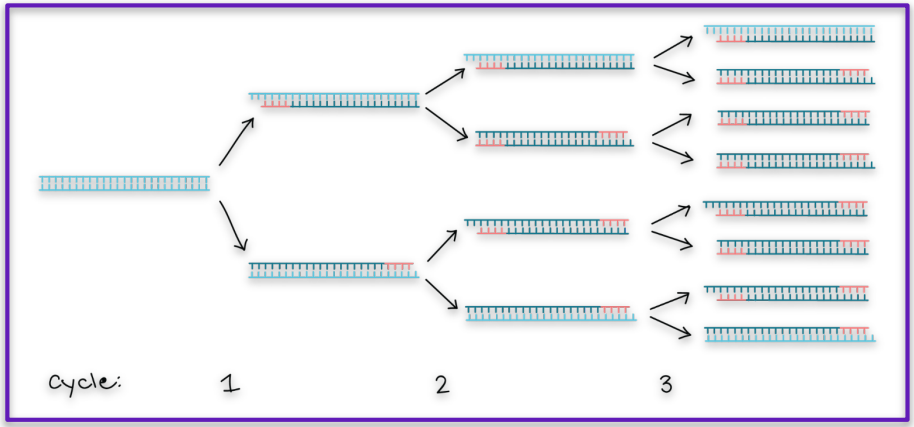
# DNA EXTRACTION

- Serves as the template DNA for polymerase chain reactions
- 84  samples
- Five populations
    - Two from C.p. ptilocnemis
    - One from C.p. couesi
    - Two from C.p. tschuktschorum


Qiagen DNA Extraction Kit

# POLYMERASE CHAIN REACTION

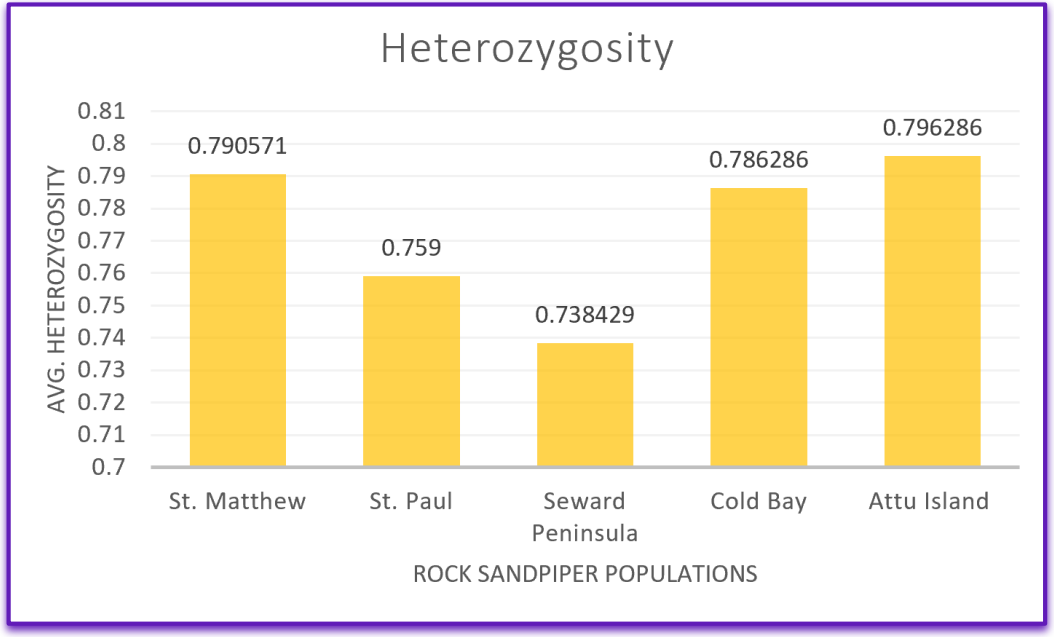
- Amplify targeted DNA sequences using specific primers
- Amplified DNA used for genotyping
- Able to assess genetic diversity between five populations
    - Heterozygosity
    - Allelic Richness
    - Genetic Clusters




Amplification from PCR

# ANALYSIS: HETEROZYGOSITY

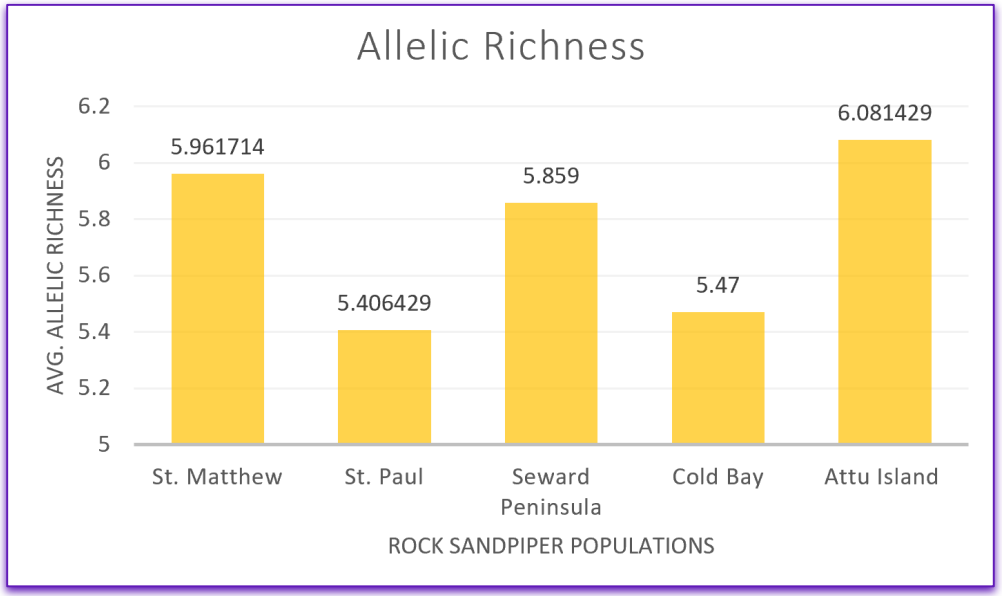
- Measures genetic variability (0-1.0)
- Low heterozygosity in a population leads to lower genetic diversity
- Similar heterozygosity found among five populations




Avg. Heterozygosity between Five Populations

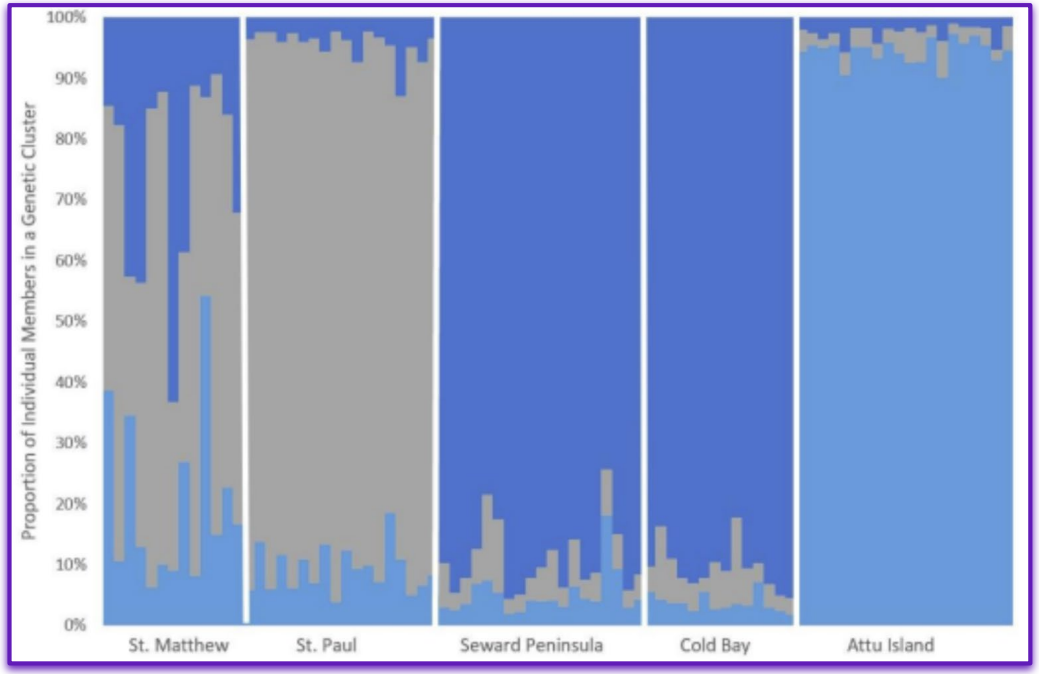
# ANALYSIS: ALLELIC RICHNESS

- Measures the allele frequency in a population or species
- Alleles passed on from the parent generation
- In small populations
- Similar allelic richness found among five populations




Avg. Allelic Richness between Five Populations

# ANALYSIS: GENETIC CLUSTERS




Three distinct genetic clusters for three Rock Sandpiper subspecies

- A group of two or more genes that encode similar polypeptides
  - Similar location
  - Shared genetic function
- Variation shows genetic advantages for a population or species

# 1. Hypothesis and Conclusion

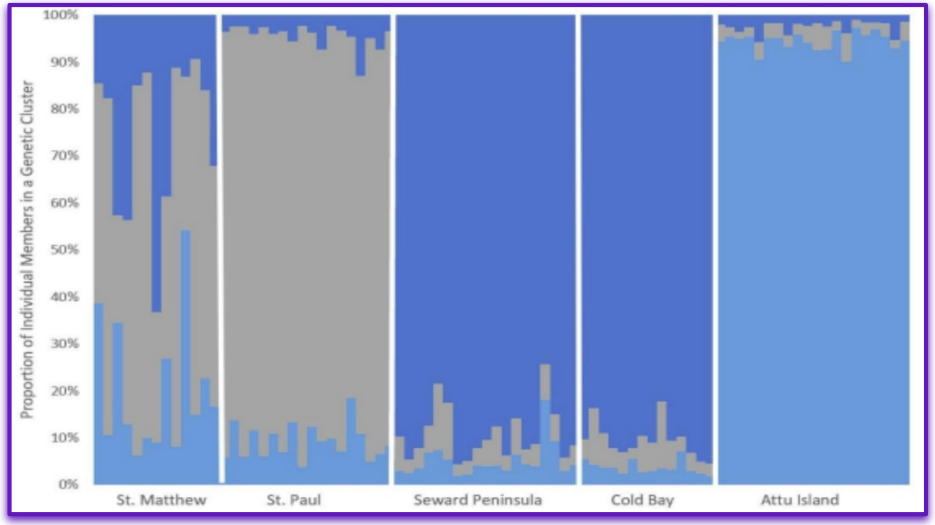
- The St. Matthew Island's population will have higher genetic diversity than the St. Paul Island's population
- St. Matthew and St. Paul islands have similar genetic diversity and are found in the same genetic cluster
- Gene flow is high enough to maintain diversity on St. Paul Island

# 2. Hypothesis and Conclusion

- Island populations of Rock Sandpipers will have a lower genetic diversity than the mainland populations
- From the heterozygosity and allelic richness results, the genetic diversity between island and mainland populations was not different
- Rock Sandpipers unique among North Pacific birds
- It is suggested that a large population size could have founded the island populations, reducing the risk of a loss of diversity

# 3. Hypothesis and Conclusion

- The subspecies of Rock Sandpipers will have genetic differences
- Each subspecies was found in a different genetic cluster
- The three endangered subspecies should be treated as separate conservation units




Three distinct genetic clusters for three Rock Sandpiper subspecies

# FUTURE DIRECTIONS

- Incorporate more microsatellite loci
- Increase targeted DNA sequences
- Increase sample number
- Compare additional populations

# ACKNOWLEDGEMENTS


- Dr. Christin L. Pruett & Dr. Kevin Winker
- University of Alaska Museum & Specimen Collectors
- Ouachita Baptist University, Patterson Summer Research Grant
- National Geographic Society, USFWS, NSF Alaska Epscor