

Biotechnology Tools Used For MetaPopulation Analysis of *Podocnemis unifilis* of the Amazon Basin

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Photo by T. Escalona

ABSTRACT

Biotechnology has revolutionized the study and understanding of biological organisms. One way these genetic tools are applied is in understanding populations of different organisms and how they are distributed within their natural ecosystems. This is called Metapopulation Genetics. Therefore, the discussion to follow will focus on the different technologies used for specific research of the population genetics of the Yellow-Spotted Amazon River Turtle.



BACKGROUND

Analyzing common genes to the species potentially can show genetic isolation and dispersal changes across populations. These genetic changes can be mapped based on locations in their natural ecosystem and analyzed for dispersal patterns.

This has implications for conservation and management of the species. The techniques for this analysis currently used are not unique to metapopulation studies. The techniques used in the lab are used in crime labs, hospitals as well as academic research at the university level.

RESEARCH QUESTION

What is the relationship (genetically) between different populations of *Podocnemis unifilis* distributed throughout the Amazon River Basin?

METHODS

1. Obtain Turtle tissue Samples from South America



2. Extract DNA, Run PCR, Run Electrophoresis



3. Compare the # of alleles of 6 loci between and within sub populations

Compare # of individuals = alleles/locus-Homozygous

Compare # of individuals ≠ alleles -Heterozygous

Compare # of combinations of alleles across loci (genotypes)

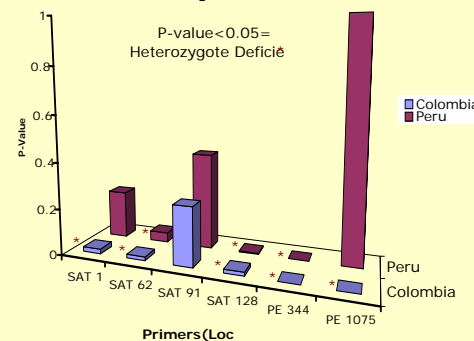
4. Analyze statistical data.

5. Write conclusions

Results

Fst is a measure of allele frequency variation among subpopulations. When comparing allele frequency of our two sub-groups the **Fst = 0.10110** with a **P value of < 0.000001**.

Hardy Weinberg Results Colombia (Caqueta River) and (Pacaya-Samiria River)



DISCUSSION

Podocnemis unifilis are found throughout the rivers and tributaries of the Amazon basin. As this species of turtles and others are declining in number. It is important to understand the reproductive patterns and needs so as to create effective conservation techniques.

When comparing the six loci from the Peruvian samples with the Colombian samples it showed a significant Fst population difference of 0.10. One would expect to see genetic differences in sub populations with significant geographic distance and barriers between each sub-group.

The Colombian turtles had heterozygote deficiency for five of the six loci. The Peruvian turtles showed this deficiency for three of the six loci. Both groups showed significant deficiency. This could indicate that the turtles of both areas have had a dramatic population decline and are inbreeding more often leading to more homozygosity within the population. However it seems that the Caqueta River turtles have a greater population decline based on the lack of genetic diversity within the population.

ACKNOWLEDGEMENT

I gratefully acknowledge Nicole Valenzuela for allowing me to be part of her lab and research. I also acknowledge the incredible patience of Tiby Escoban as she taught me the protocols and techniques used in the lab. Thanks also to Claudia Ceballos for bailing me out on a number of occasions.

I also would like to thank the Plant Genomics Outreach Program including Adam Leshem, Ackerman and Jonathan Wendel for their support. Finally, thanks to the NSF for funding this excellent program.



REFERENCES

- Devon C. Peabire et al. (2006) Estimating population structure under non-equilibrium conditions in a conservation genome. *Molecular Ecology* 16
- Valenzuela, N. 2003. Multiple origins in south-west turtles *Podocnemis expansa*: evidence from mitochondrial DNA data. *MZ* 23(4): 989-1001
- Valenzuela, N. 2004b. Maternal effects on life history traits in the Amazonian giant river turtle *Podocnemis expansa*. *J. Herpetol.* 38:309-313
- Valenzuela, N. 2007a. Genetic differentiation among nesting beaches in the highly migratory giant river turtle (*Podocnemis Expansa*) from Colombia. *Herpetologica* 57:48-57