

Theodosius Dobzhansky Center for Genome Bioinformatics

Parrots of the Caribbean

Comparative Genomics Project

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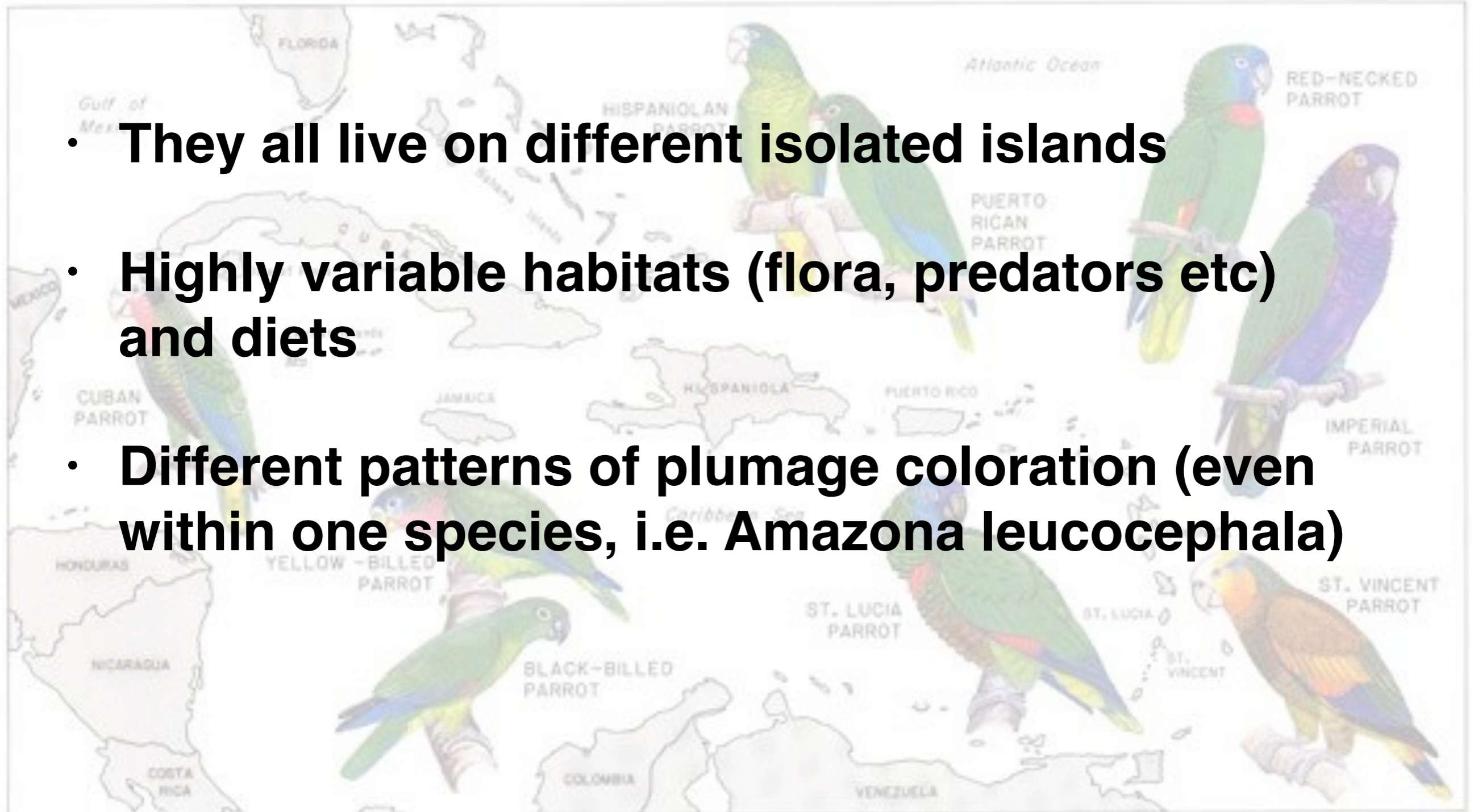


Caribbean Parrots

- ***Amazona sp.* (*A. vittata*, *A. leucocephala*, *A. ventralis*, *A. albifrons*, (?) *A. agilis*, *A. collaria*, *A. leucocephala ssp.*)**
- **all in all about 30 species, most distributed across Cuba, Bahamas and Cayman Islands**
- **Due to habitat loss and trapping for the wild parrot trade many of them are now endangered**

Amazona sp.

- They all live on different isolated islands
- Highly variable habitats (flora, predators etc) and diets
- Different patterns of plumage coloration (even within one species, i.e. *Amazona leucocephala*)





Lesson, 1830. "Traité d'Ornithologie", livr. 3 (Jul.), p. 189. (<http://www.aquahobby.com>)

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|----------------------------------|---------------------------------------|-------------------------------|
| 1. <i>Amazona collaria</i> | 11. <i>Amazona finschi</i> | 22. <i>Amazona kawalli</i> |
| 2. <i>Amazona leucocephala</i> | 12. <i>Amazona autumnalis</i> | 23. <i>Amazona amazonica</i> |
| 3. <i>Amazona ventralis</i> | 13. <i>Amazona brasiliensis</i> | 24. <i>Amazona mercenaria</i> |
| 4. <i>Amazona albifrons</i> | 14. <i>Amazona dufresniana</i> | 25. <i>Amazona farinosa</i> |
| 5. <i>Amazona xantholora</i> | 15. <i>Amazona rhodocorytha</i> | 26. <i>Amazona vinacea</i> |
| 6. <i>Amazona agilis</i> | 16. <i>Amazona festiva</i> | 27. <i>Amazona versicolor</i> |
| 7. <i>Amazona vittata</i> | 17. <i>Amazona barbadensis</i> | 28. <i>Amazona arausiaca</i> |
| 8. <i>Amazona tucumana</i> | 18. <i>Amazona aestiva</i> | 29. <i>Amazona guildingii</i> |
| 9. <i>Amazona pretrei</i> | 19/20/21. <i>Amazona ochrocephala</i> | 30. <i>Amazona imperialis</i> |
| 10. <i>Amazona viridigenalis</i> | | |



Why annotate and study them?..

- **Genome annotation provides information which is useful for fundamental studies of evolution and functioning of genes and gene families**
- **Interesting evolutionary and population demographics history: lots of unsolved questions**
- **Conservation of endangered species**



Amazona vittata

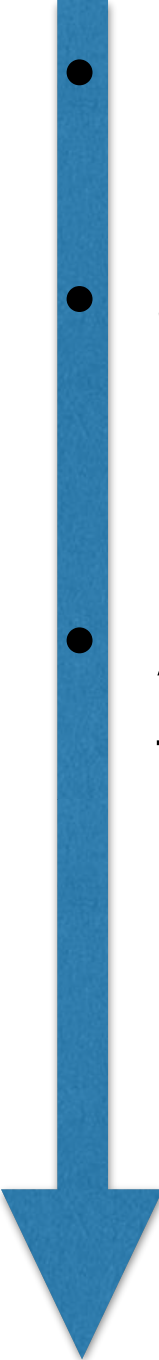
(the Puerto-Rican Parrot)


Also known as Iguaca,
Critically endangered

- Abundant in 1800
- 13 parrots in 1973
- Bred in captivity since 1976
 - Started with 3 couples
 - Current population: over 400



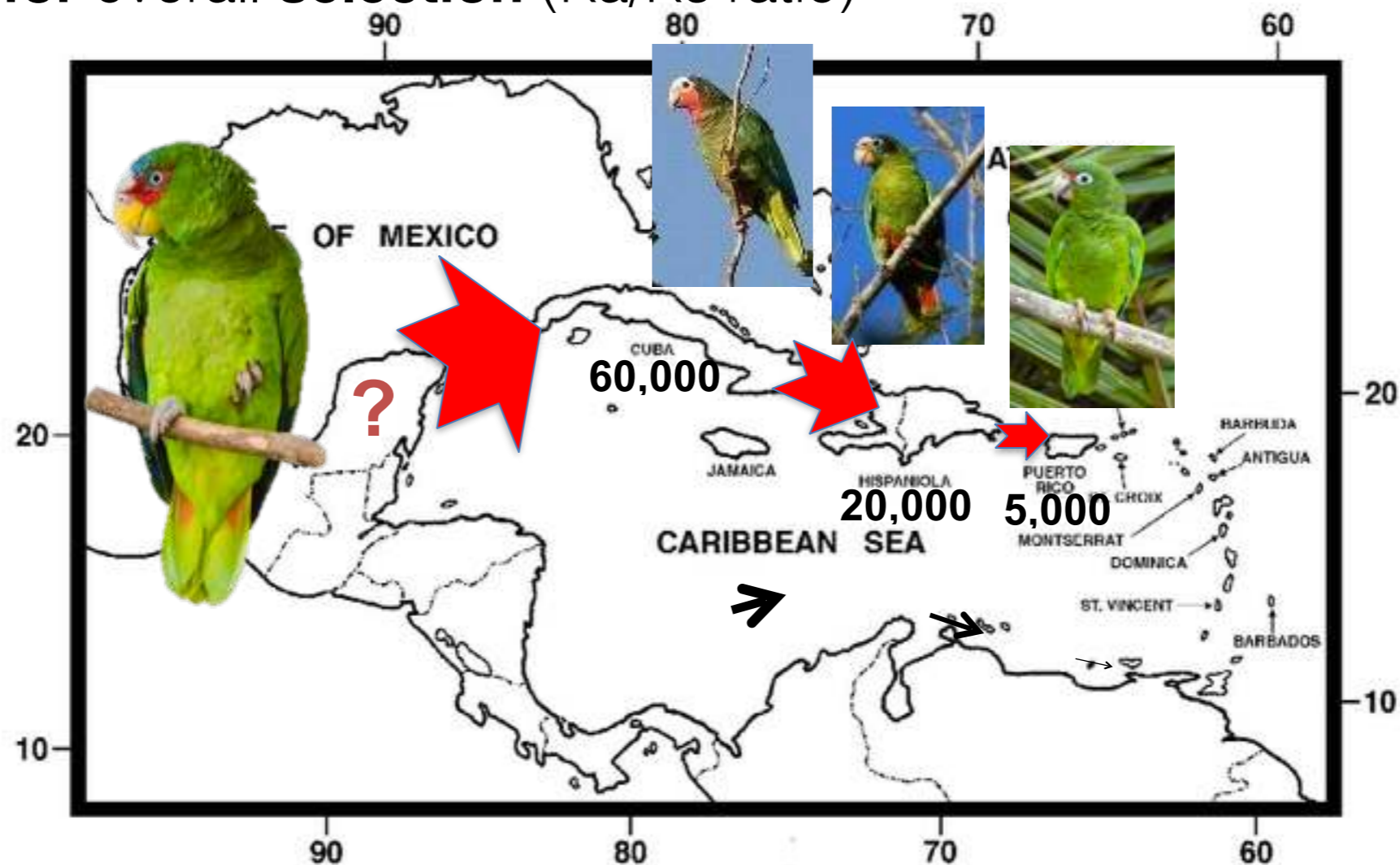
Project workflow

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- Find and **catch** a bird!
 - **Sequence** (Illumina, Ion Proton)
 - **Assemble** (genome and transcriptome)
 - de novo
 - based on reference

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- **Annotate**
 - genes
 - repeats
 - SNVs
 - **Interprete data**
 - see next slide

Interpretation and applications

- Transcriptome seq data was used to **improve** genome **assembly**
- Calculating Ancestral **Effective Population Sizes** with Single Genome Coalescence (PSMC)
- Infer **population size changes**: detect founder effects, bottlenecks
- **Testing for overall selection** (Ka/Ks ratio)



What's already done

- Sequenced and assembled an ~ 80 x genome of Puerto Rican parrot
- Annotated the genome (SNPs, repeats, genes)
- Developed tools for population diversity studies
- Sequenced two more species at 39 x
- Collected DNA from a dozen more species, waiting to sequence

What's our contribution :)

- **Genes annotation**: 3 tracks, merge
 - A. de novo prediction (Augustus)
 - B. use transcriptome
 - C. use proteins from reference genomes (BLAT, Scipio)
- **Repeats annotation** (TrfBig, RepeatMasker)
- **SNPs annotation, ERV**
- **Annotation quality assessment** (CEGMA)
- **Estimating variable effective population sizes** (PSMC)



References

- *Estimating Variable Effective Population Sizes from Multiple Genomes: A Sequentially Markov Conditional Sampling Distribution Approach* <http://www.genetics.org/content/194/3/647.short>
- *Use of Endogenous Retroviral Sequences (ERVs) and structural markers for retroviral phylogenetic inference and taxonomy* <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1224870/>
- *L_RNA_scaffolder: scaffolding genomes with transcripts* <http://www.biomedcentral.com/1471-2164/14/604>
- *Sequencing, assembly and comparative genomics analysis of Cuban amazon parrot genome (Amazona leucocephala)* Dobrynin, P., Rivera, I., and Oleksyk T.K.

