

Move, Adapt, or Die: The genomic diversity of *Gypaetus barbatus* and the impacts of climate change

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GENERAL INFORMATION

Taxonomy¹

Common name: Bearded Vulture (In Greek: Γυπαετός, Κοκκαλάς)

Scientific name: *Gypaetus barbatus* (Linnaeus, 1758)

Distribution and habitat¹

Mountainous regions of Europe, Asia, and Africa

In Europe (extant): Pyrenees, Corsica, Alps (reintroduced) and Crete

Habitat: rocky cliffs, gorges, and high-altitude habitats

Morphology²

Distinctive orange/rust-colored breast (due to iron-rich dust bathing)

Long, narrow wings and diamond-shaped tail

Wingspan: up to 2.8 meters

Body length: 95–125 cm

Weight: 5–7 kg

Feeding ecology²

Specialized bone eater. Diet consists of up to 90% bone material

Drops large bones from height to break them

Reproduction²

Breeding season: October – July

Lays 1–2 eggs, but typically only one survives due to cainism

Nests on remote cliff ledges in mountainous areas

Conservation status¹

IUCN Red List: Near Threatened (NT) globally, Critically Endangered (CR) in Greece

Main threats: Poisoning (intentional or secondary), Collisions (wind turbines, power lines), Habitat degradation

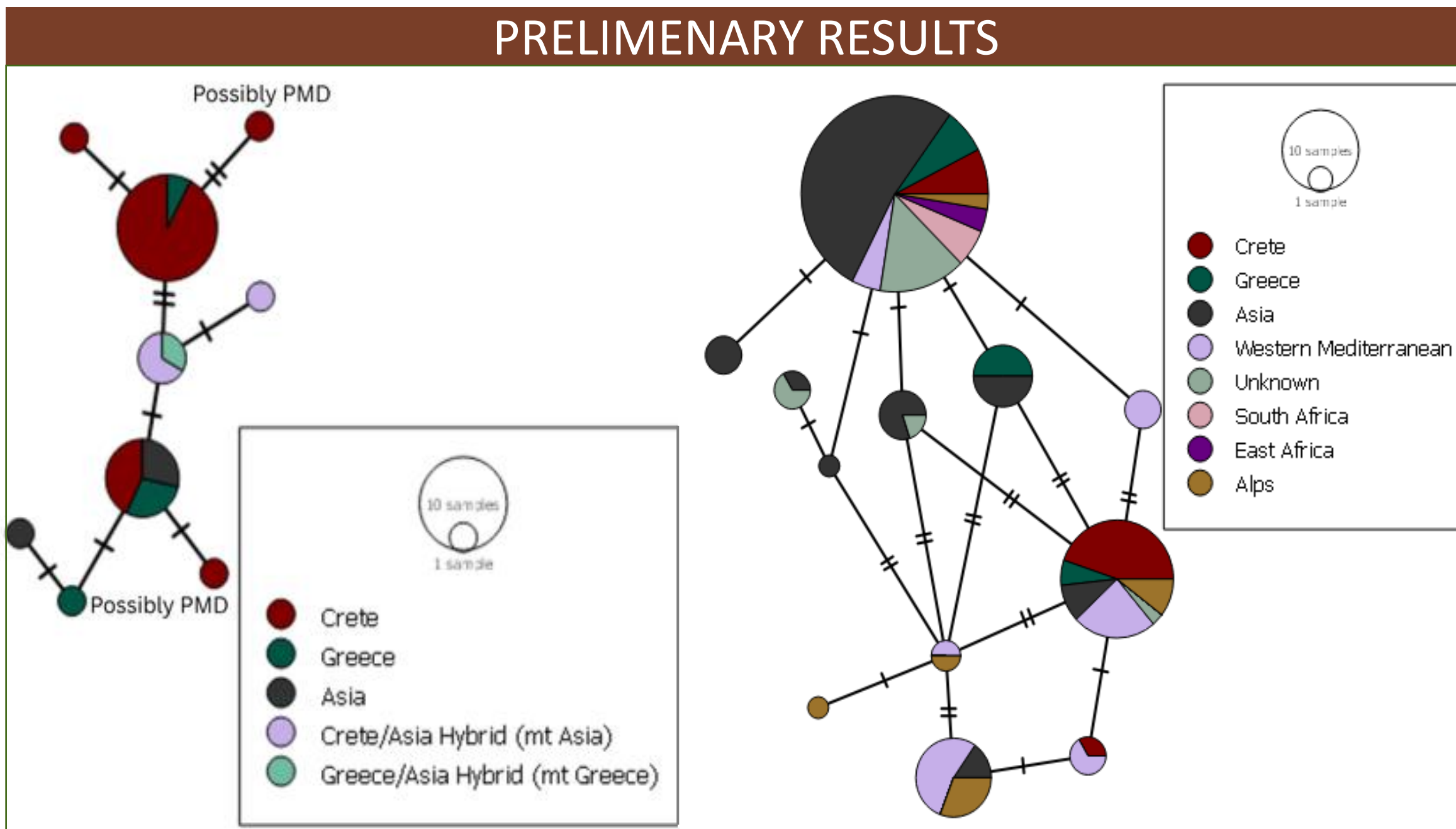


Global distribution of *Gypaetus barbatus*.



Distribution of samples (current study).

METHODS				
27 historical and modern samples from Crete and Central Greece (1971–2023). 6 samples from captive individuals in Austria (originating from Greece and Asia).				
Samples	Toe Pads (Historical)	Feathers (Historical)	Feathers (Modern)	Blood (Modern)
Procedure				
Sampling	Museum specimens (aDNA cleanroom)	Museum specimens or field-collected (aDNA cleanroom)	Molted from captive birds	From alive individuals
Lysis	Qiagen Lysis buffer	EZNA Lysis buffer + DTT	EZNA Lysis buffer + DTT	NEB Lysis buffer
DNA Extraction	Silica columns			
Library Preparation	dsDNA libraries, ancient DNA protocol ³	dsDNA libraries, ancient DNA protocol ³	dsDNA libraries, standard protocol (NEB)	dsDNA libraries, standard protocol (NEB)
Sequencing	Low-Coverage Whole Genome Shotgun Sequencing (IcWGS)			
Bioinformatics	Raw data processing, mapping to mtDNA genes, authentication of hDNA, phylogenetic analysis, haplotype network			



Haplotype networks of the mitochondrial control region of *G. barbatus*. Left: Samples from current study. Right: Samples from current study and public data. PMD: postmortem damage

OBJECTIVES

Assess the genetic diversity and structure of the Cretan population of bearded vulture.

Explore the evolutionary relationships between the Cretan and other populations to better understand their phylogenetic background.

FUTURE PERSPECTIVES

Use whole genome wide SNPs to examine the objectives at genomic level.

Examine the potential of current genomic variation to enable future adaptation to environmental and climate change.

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