

FROM TRADITION TO
RECOGNITION: CHARACTERIZING
THE MALTESE HUNTING DOG
(KELB TAL-KAĊĊA TA' MALTA) IN
SUPPORT OF ITS PRESERVATION

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# History

# **Historical roots**

Order of St. John (1530-1798): hunting common among knights and nobility

#### **Hunting Edicts**:

- 1660 De Clermont: banned unauthorized hunting with "guns, nets, or dogs"
- 1773 Ximenes: mentioned the use of *Braque-type dogs* distinct from sighthound *Cernechi (Kelb tal-Fenek)*

**Architecture**: Many hunting lodges built (e.g., Verdala Palace)















Hunting with dogs remained a widespread tradition even after the era of the Order of St. John, and this local canine population continued to play a vital role in sustaining this cultural practice.

# The breed today

Morphology: Medium-sized, orange-and-white coat, drop ears, braque-type

**Population size**: about 600 dogs (2019)

Function: Versatile—used for flushing and retrieving small game (quail & turtle doves)

**Status:** Not yet recognized by FCI, but local associations

created a voluntary registry













# Materials

# Morphology

36 adult dogs

16 M, 20 F 1-12 yo

Measures taken three times by two canine morphologists



Weight (n. 13 dogs)



Chest circumference (ChC)



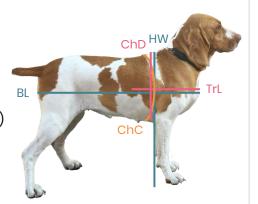
Height at withers (HW) Chest depth (ChD) Trunk length (TrL) Body length (BL)



Muzzle length (MzL) Cranial length (CrL) Bizygomatic width (BzW)

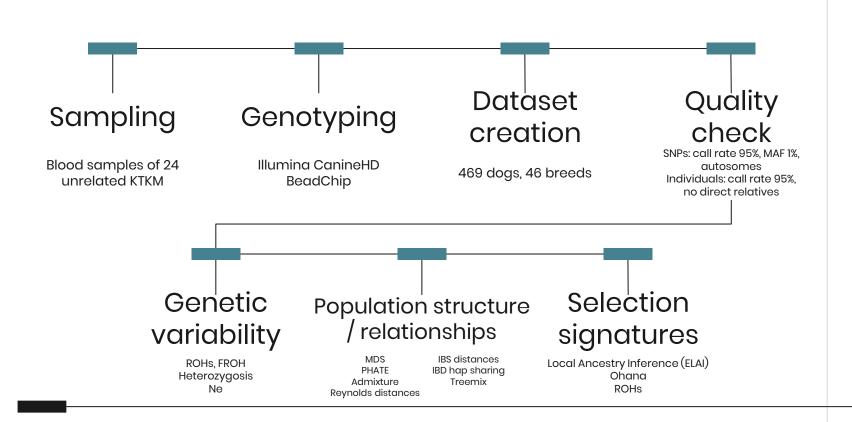


Cephalic Index (CI) = (BzW / CrL) × 100 Body Index (BI) = (BL / ChC) × 100





### **Genomics**



# **Genomics**

| Breed code | Breed name                  | n  | 11                         |
|------------|-----------------------------|----|----------------------------|
| KTKM       | Kelb tal-Kaċċa ta' Malta    | 24 | Hunting:<br>Spaniels/Water |
| BASS       | Basset Hound                | 10 | sparileis/water            |
| BEAG       | Beagle                      | 10 |                            |
| DALM       | Dalmatian                   | 9  |                            |
| FOXH       | Fox Hound                   | 10 | Pharaoh/                   |
| OTTR       | Otter Hound                 | 9  | Cirneco                    |
| REDB       | Red Bone Coonhound          | 2  |                            |
| SIPF       | Segugio Italiano Pelo Forte | 16 |                            |
| SIPR       | Segugio Italiano Pelo Raso  | 16 |                            |
| BRAC       | Bracco Italiano             | 12 |                            |
| BRIT       | Epagneul Breton             | 10 |                            |
| ESET       | English Setter              | 15 | Shepherd                   |
| GORD       | Gordon Setter               | 9  | Shophora                   |
| GSHP       | German Shorthaired Pointer  | 10 |                            |
| GWHP       | German Wirehaired Pointer   | 2  |                            |
| ISET       | Irish Setter                | 9  |                            |
| KMUN       | Large Munsterlander         | 3  |                            |
| SPIN       | Spinone Italiano            | 23 |                            |
| VIZS       | Viszla                      | 7  | Terriers                   |
| WEIM       | Weimeraner                  | 10 | remers                     |
| WHPG       | Wirehaired Pointing Griffon | 6  | Wild                       |

| Breed code Breed name |                          | n  |
|-----------------------|--------------------------|----|
| ACKR                  | American Cocker Spaniel  | 10 |
| ECKR                  | English Cocker Spaniel   | 9  |
| ESSP                  | English Springer Spaniel | 10 |
| FIEL                  | Field Spaniel            | 4  |
| IWSP                  | Irish Water Spaniel      | 10 |
| LAGO                  | Lagotto Romagnolo        | 23 |
| PTWD                  | Portuguese Water Dog     | 10 |
| CIRN                  | Cirneco dell'Etna        | 20 |
| PHAR                  | Pharaoh Hound            | 17 |
| MANN                  | Mannara Dog              | 12 |
| MARM                  | Maremma Sheepdog         | 16 |
| MAAB                  | Mastino Abruzzese        | 2  |
| AUCD                  | Australian Cattle Dog    | 10 |
| AUSS                  | Australian Shepherd      | 10 |
| BERD                  | Bearded Collie           | 3  |
| BMAL                  | Belgian Malinois         | 6  |
| BELS                  | Belgian Sheepdog         | 10 |
| BERG                  | Bergamasco               | 11 |
| BORD                  | Border Collie            | 10 |
| COLL                  | Collie                   | 10 |
| OES                   | Old English Sheepdog     | 10 |
| SSHP                  | Shetland Sheepdog        | 10 |
| TYFX                  | Toy Fox Terrier          | 4  |
| WFOX                  | Wire Fox Terrier         | 10 |
|                       | Appenine Wolf            | 8  |

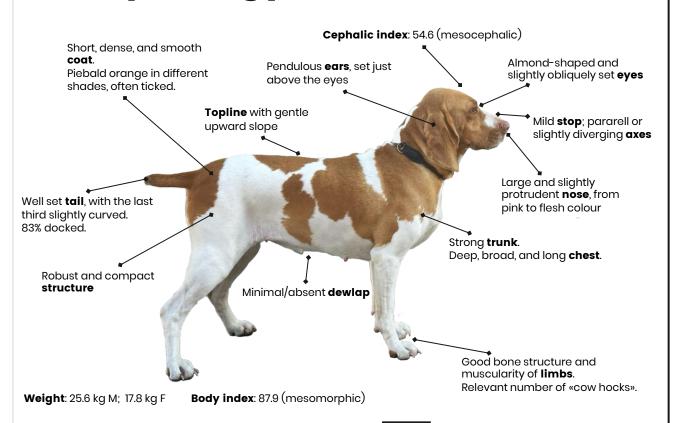
Hunting: Pointers

Hunting: Hounds



# Morphology

# Morphology



#### **RESULTS**

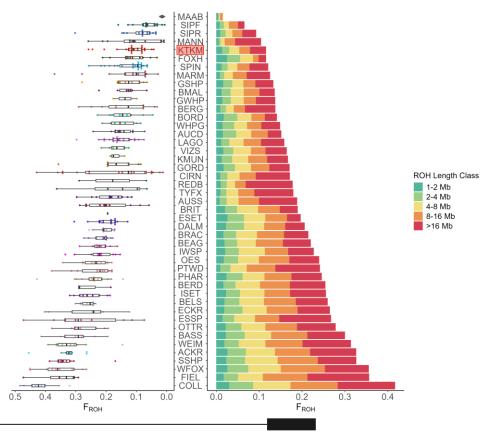
#### **Morphology and Draft Standard**

- Medium-sized, mesomorphic dog with a mesocephalic, braque-type head. Pendulous ears and almond-shaped, obliquely set eyes. Short coat, piebald in shades of orange, sometimes with ticking.



# Genomics

# **Heterozygosity and ROHs**



# **Genetic diversity**

#### **RESULTS**

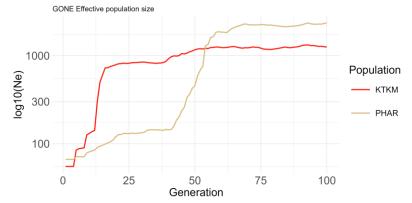
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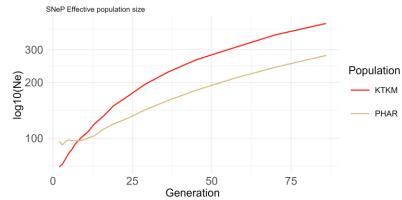
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#### **Good Levels of Genetic Variability**

- Froh: 11.6  $\pm$  5.4%; balanced lenghts

# **Effective Population Size**





# **Genetic diversity**

#### **RESULTS**

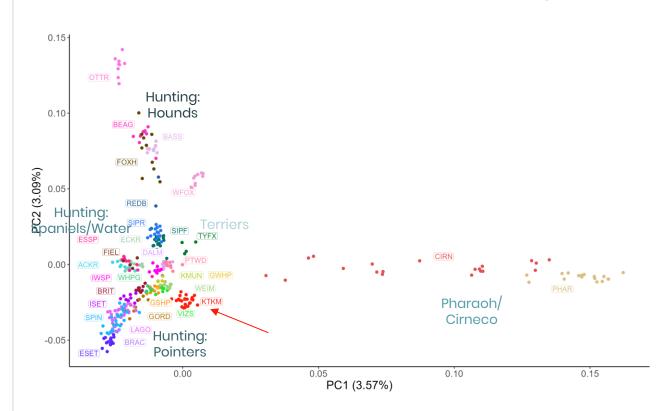
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#### **Good Levels of Genetic Variability**

- Froh:  $11.6 \pm 5.4\%$
- Ne: 55 70

# **Multidimensional Scaling**



# Population structure & relatioships

#### **RESULTS**

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# Originality and Within-Population Similarity

- Well-defined cluster in MDS

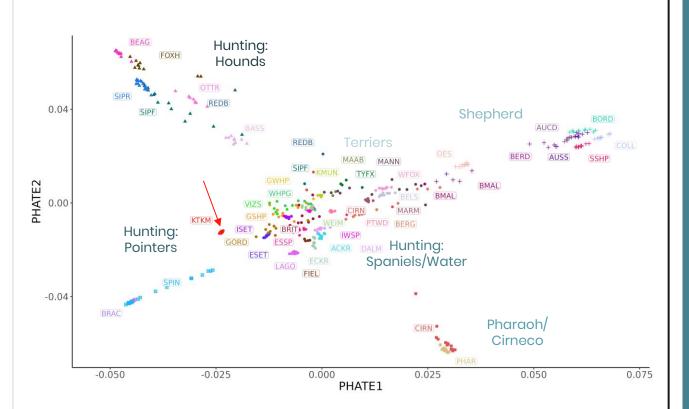
#### **Closer to Pointing Dogs**

- Proximate to pointing dogs in MDS and PHATE

#### Likely Ancient Shared History with Maltese Pharaoh Hound and Spaniels

- Slight displacement toward CIRN/PHAR in MDS

### **PHATE**



#### **RESULTS**

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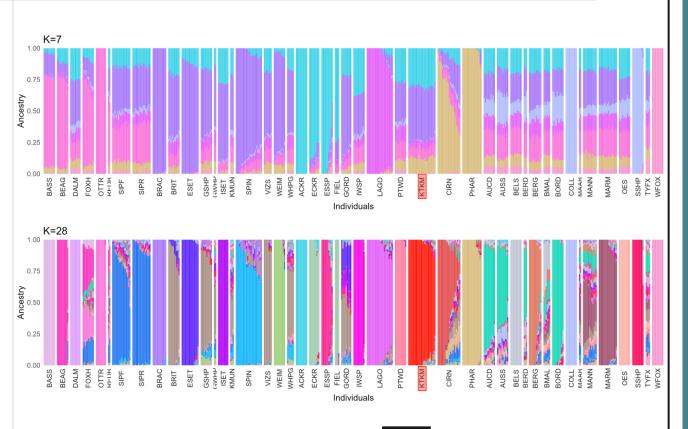
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### Population structure & relatioships

### **Admixture**



#### **RESULTS**

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### Population structure & relatioships

Reynolds and IBS distances APWF

### Population structure & relatioships

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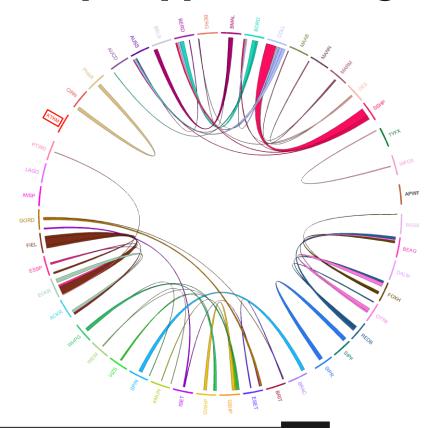
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# **IBD Haplotype Sharing**



### Population structure & relatioships

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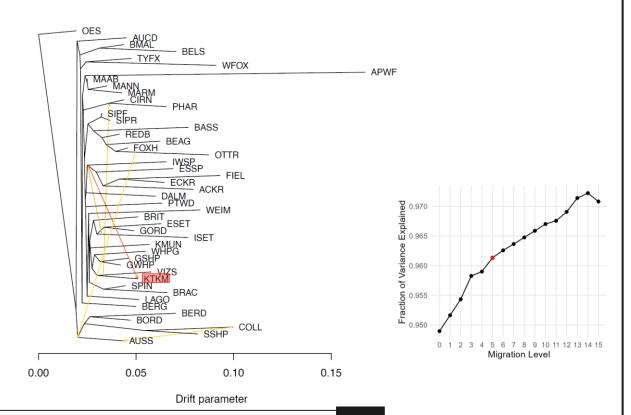
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### **Treemix**



### Population structure & relatioships

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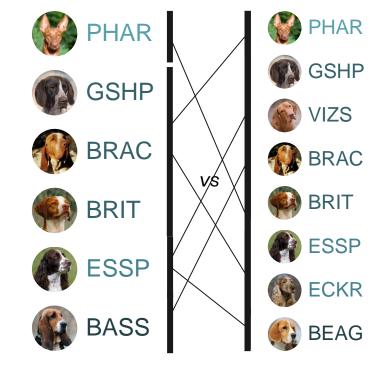
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# **Local Ancestry Inference**



# Selection signatures and introgression

**KTKM** 

VS

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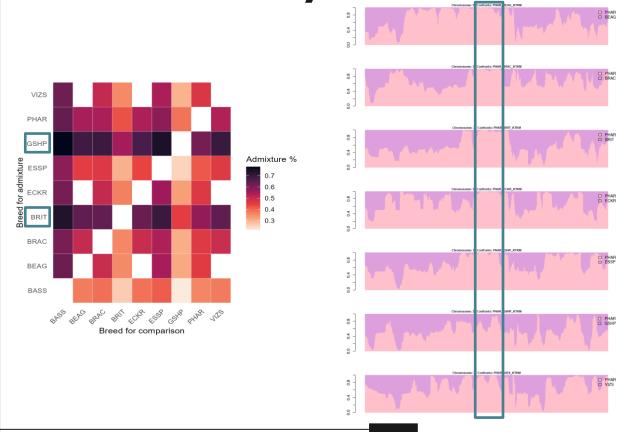
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Local ancestry and selection signatures

**Local Ancestry Inference** 



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# **Local Ancestry Inference**



Pharaoh

Genes on several chr. includina a region on CFA 6 (28-39kb) and 30 (21-23kb)

Genes selected in sighthounds

FGF5

# Pointers

Genes dentified in at least three pointer breeds: ACDY9. CACNAIH, MMP25, CREBP, TRAP1 (CFA 6:37-40kb); ABLIM2, AFAPI (CFA 3)

**CACNA1H** selected in pointer-spaniel lineage

In all breeds, we found

genes selected in pointer-spaniel lineage: FGF5 found in GSHP and BRAC: Region on CFA 3 selected in sporthunting dogs found in **BRAC** and BRIT

BRAC: **DOK7** and **RGS12** related to size

**BRIT: KCNQ5** related to large ears



found in both breeds: both are related to large ears and are selected in sport-hunting dogs KCNQ5 is also related to

RIMS1 and KCNQ5

inhibitory control

Spaniels

RIMS1 in both breeds.

KCNQ5 in Beagle only

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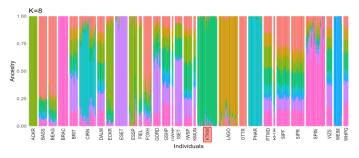
Local ancestry and selection signatures

# Selection signatures and introgression

# Selection signatures

#### Ohana

- Only groups of interest (no shepherds and terriers)
- K=8 (first appearance of KTKM's cluster)
- SNPs under selection in the cluster maximised in KTKM



#### **ROHs**

- H-score > 0.4 in KTKM
- H-score in KTKM significantly higher than average of other breeds (t-test, adjusted p-value)

# Selection signatures and introgression

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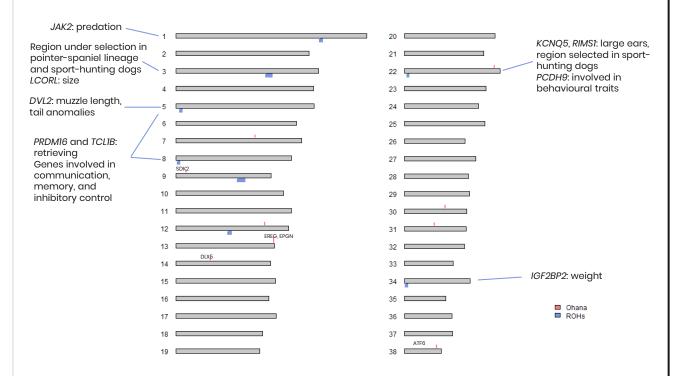
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# Selection signatures



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# Conclusions

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### Selection signatures and introgression

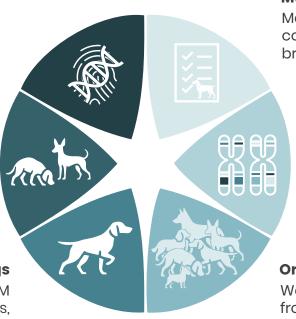
Introgression
Preliminary analyses identified
genomic regions shaped by
introgression by KTKM breedspecific selection.

#### Relationship with Pharaoh Hound and Spaniels

Likely shared history with the other Maltese breed and Spaniels (KTKM also used for retrieving).

#### Closeness to pointing dogs

Genomic analyses place the KTKM among other pointing breeds, consistently with its hunting style and appearance.



#### Morphology

Measures and descriptions were collected to draft a provisional breed standard.

#### Good levels of genetic variability

Relatively low inbreeding and Ne comparable with other recognized breeds.

#### Originality and within-breed uniformity

Well-clustered, clearly distinguishable from other breeds, and no excessive variability among subjects.

# THANKS!

Do you have any questions?

Arianna.Bionda@unimi.it

We extend our sincere gratitude to all the breeders and owners who participated in our research.

