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Segment-based advanced optimum contribution selection alleviated the genetic introgression in Yuedonghei pig in a simulation study

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Yuedonghei Pig (YDH)

Ecological value

- a national local pig breed in Guangdong, China
- in government-funded conservation program

(Image by China Discovery)

Economic value

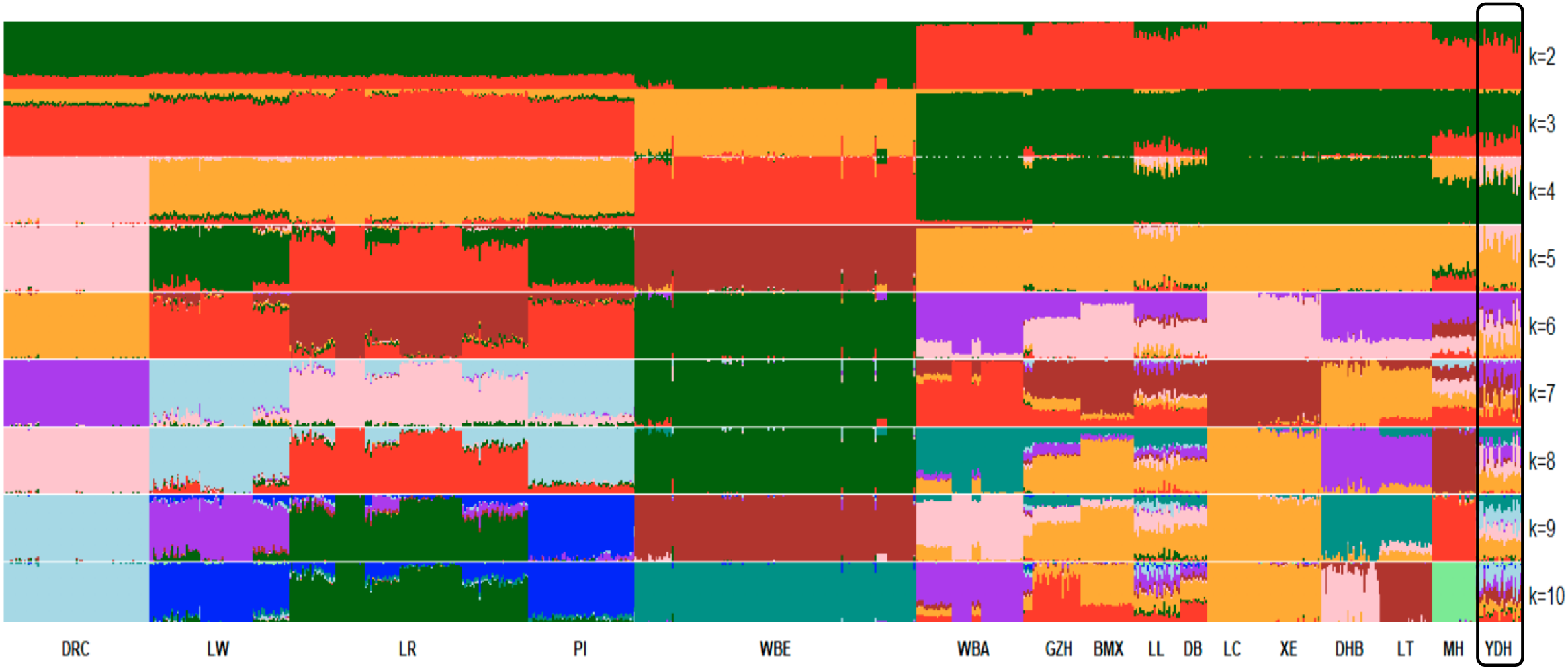
- excellent meat quality, black coat
- popular in the local market with a population of 128 million

(Image by Anyi via Tesegu)

Agroeconomic value

- tame, resistant to rough feeding, good performance in crossbreeding
- suitable for the agroeconomic development in local rural area

Genetic introgression (GI) is threatening YDH



YDH

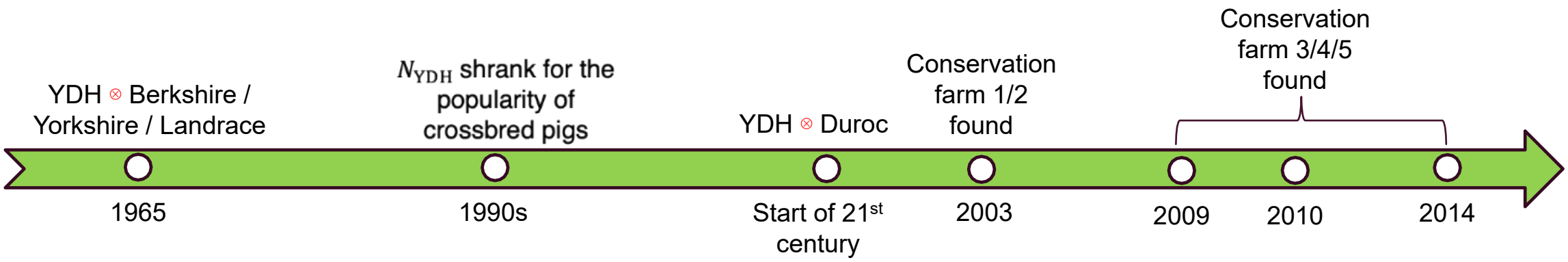
Fig. Results on ancestral structure of different pig breeds from Diao et al. (2019)

GI is threatening YDH's conservation

Fig & Table. The degree of GI and the conservation history of YDH

	Introgression proportion*	No. YDH	Herd	Sampling year	Data source
YDHa	19-35%	25	Farm 3	2015	Diao et al.(2019)
YDHb	32-42%	28	Farm 3	2019	
YDHc	30-41%	68	Farm 3	2020	Wang (unpublished)
YDHd	29-44%	168	Farm 5	2020	

- * refers to the proportion of the individuals' ancestral structures that represent Chinese local pig breeds at $K = 6$.
- This result was based on the ADMIXTURE analysis for 33,947 SNP in 1,060 individuals from 43 pig breeds.



（Animal Genetic Resources in China: Pigs, 2011）

Goal: mitigate YDH's GI while controlling inbreeding

- Data: only genotyping data of 360 YDH available! Plus 782 downloaded pigs of other 42 breeds as reference animals.
- In total 34,579 SNP after QC

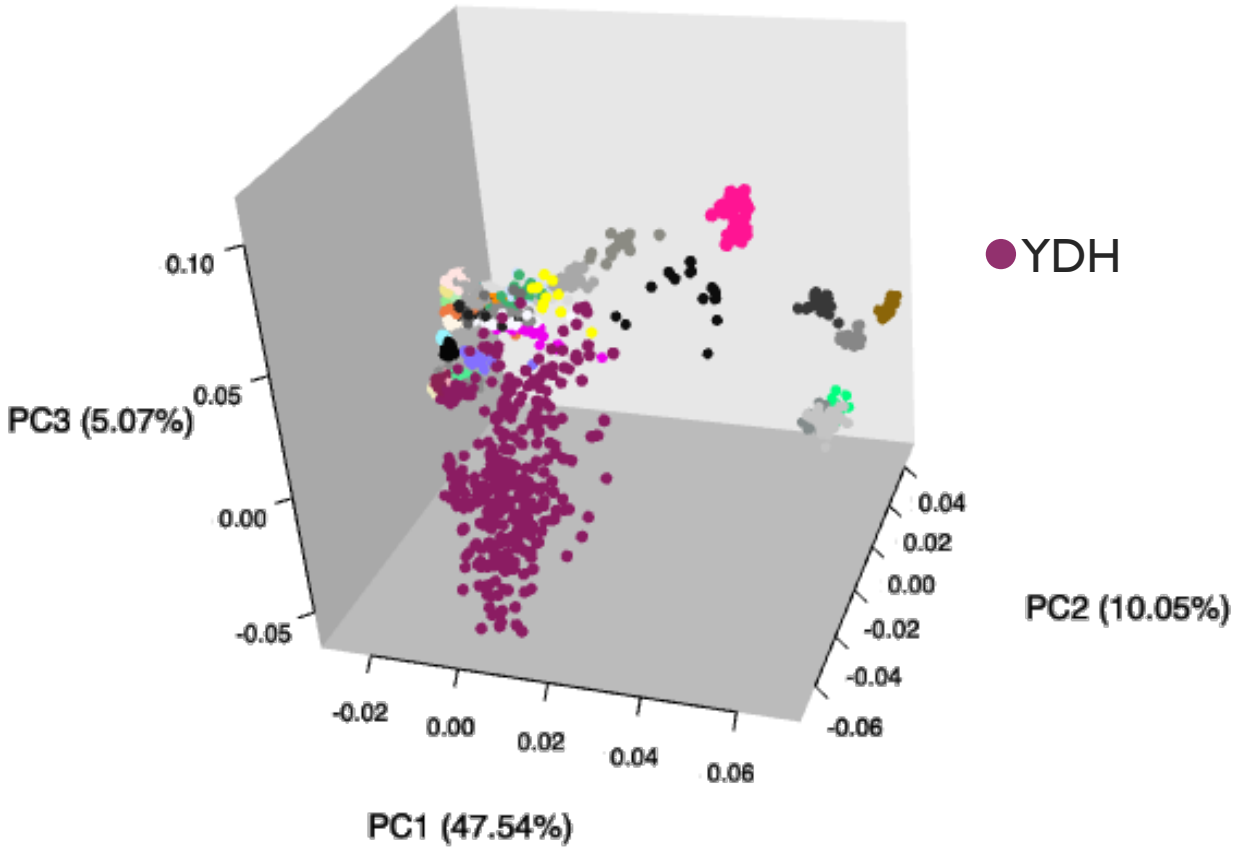


Fig. 3D PCA of 1142 pigs

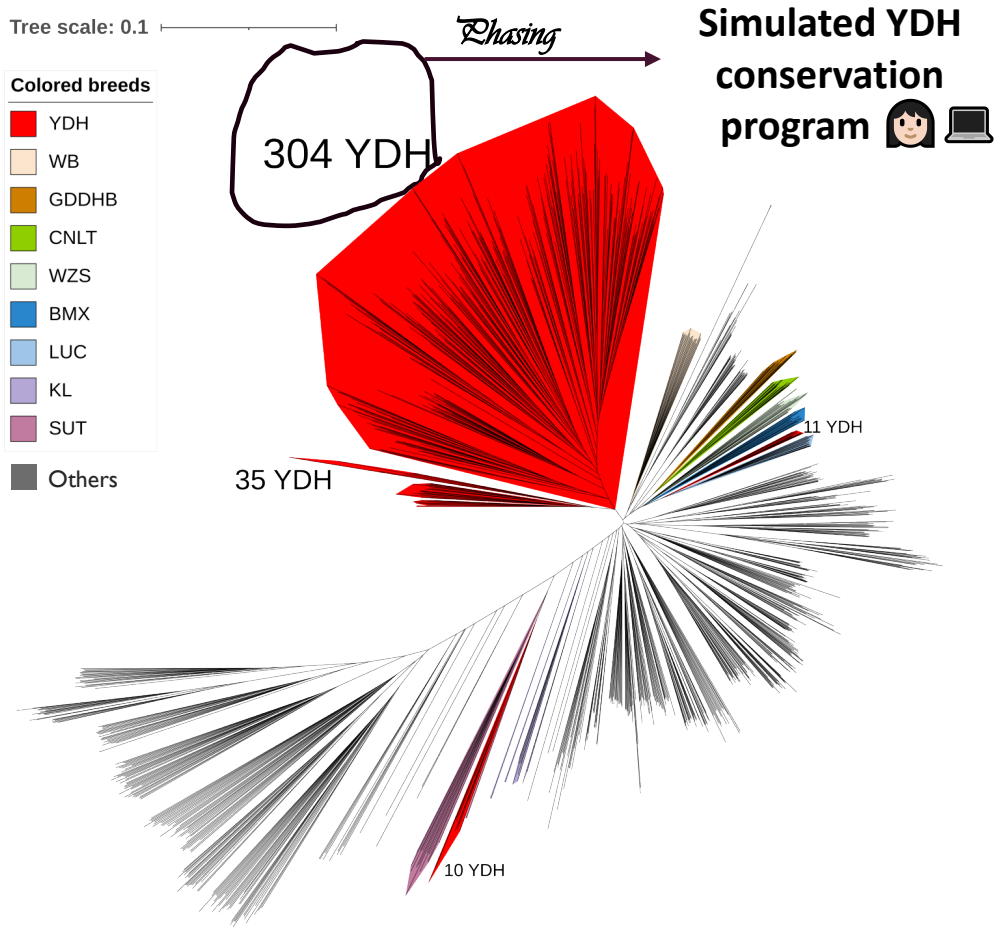


Fig. IBS genetic distance-based neighbor-joining tree

Segment-based aOCS is expected to improve YDH

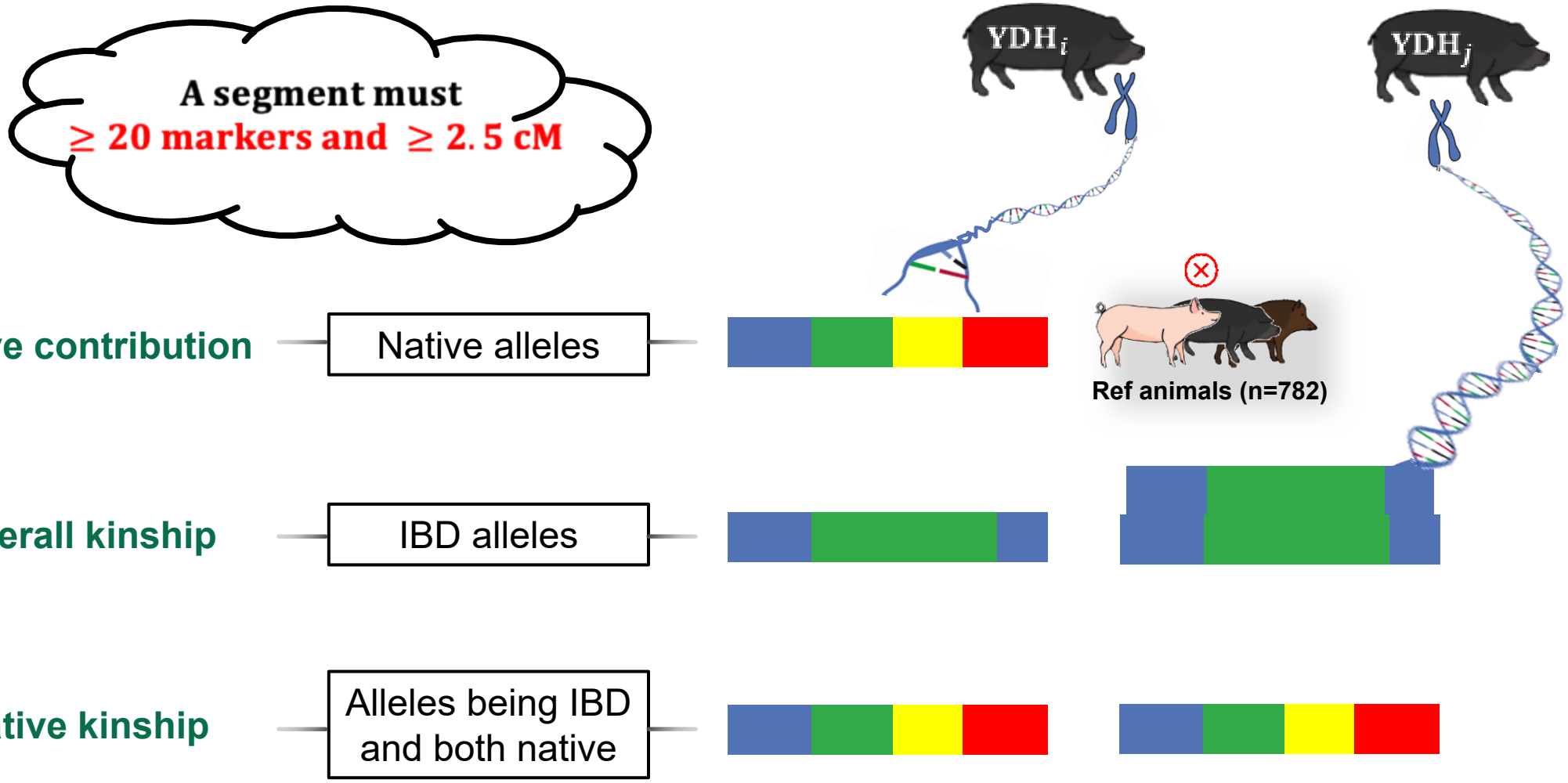
aOCS — **a**dvanced **O**ptimum **C**ontribution **S**election

Wellmann & Bennewitz (2019)

- **Maximize native contribution**
  - "i.e. maximize the proportion of genome that is native"
- **Restrict overall kinship**
  - "i.e. restrict the IBD probability between alleles at same loci of two individuals"
- **Restrict native kinship**
  - "i.e. restrict the conditional probability that alleles at same loci of two individuals are IBD given that they're native"
- **Support haplotype segment-based estimation & optimization**

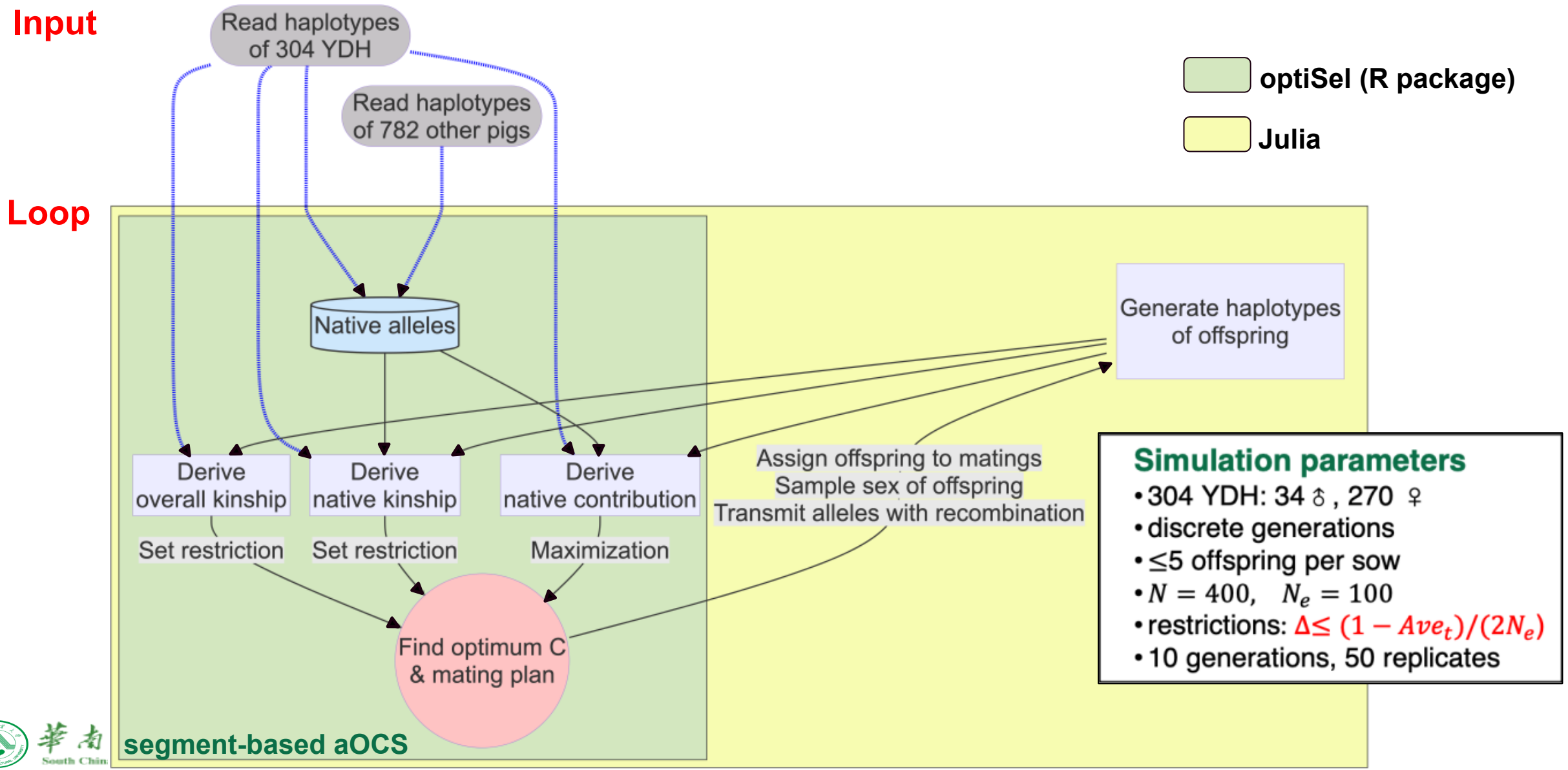
Basic idea of aOCS utilizing haplotype segments

A segment must
≥ 20 markers and ≥ 2.5 cM



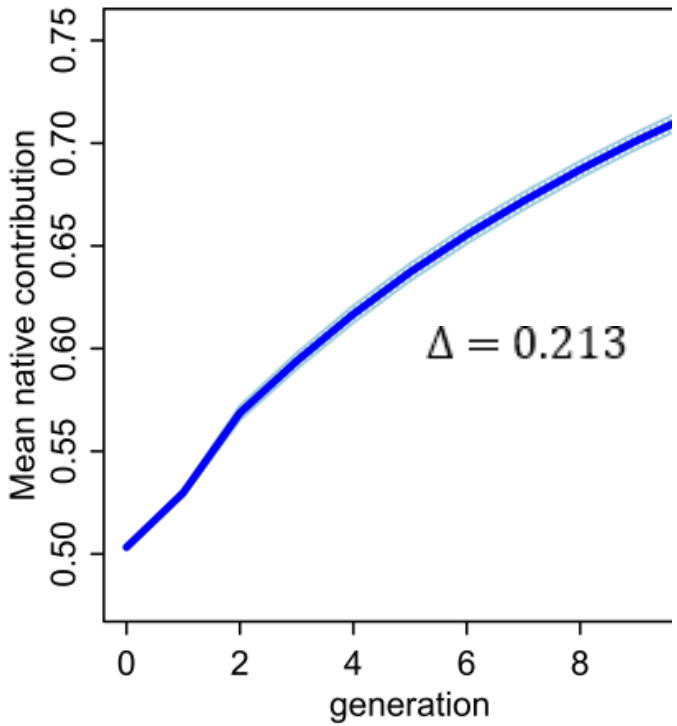
(Wellmann, 2019; Wellmann and Bennewitz, 2019)

Stochastic simulation of YDH conservation program using aOCS

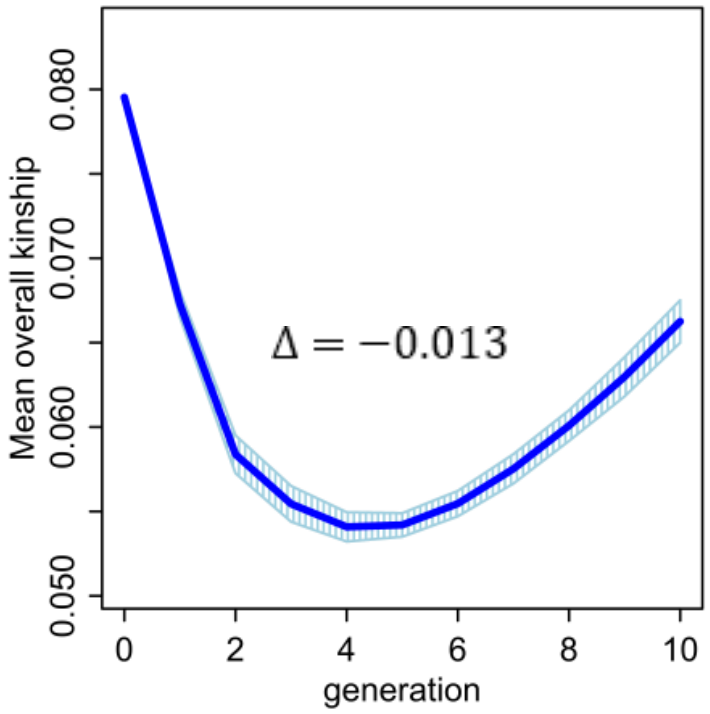


Results：mean native contribution, overall kinship, native kinship

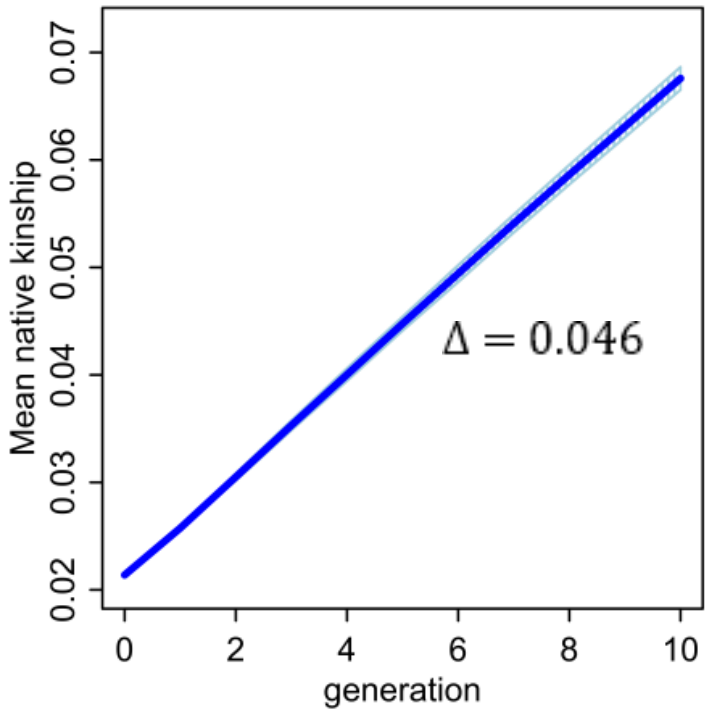
Native contribution



Overall kinship

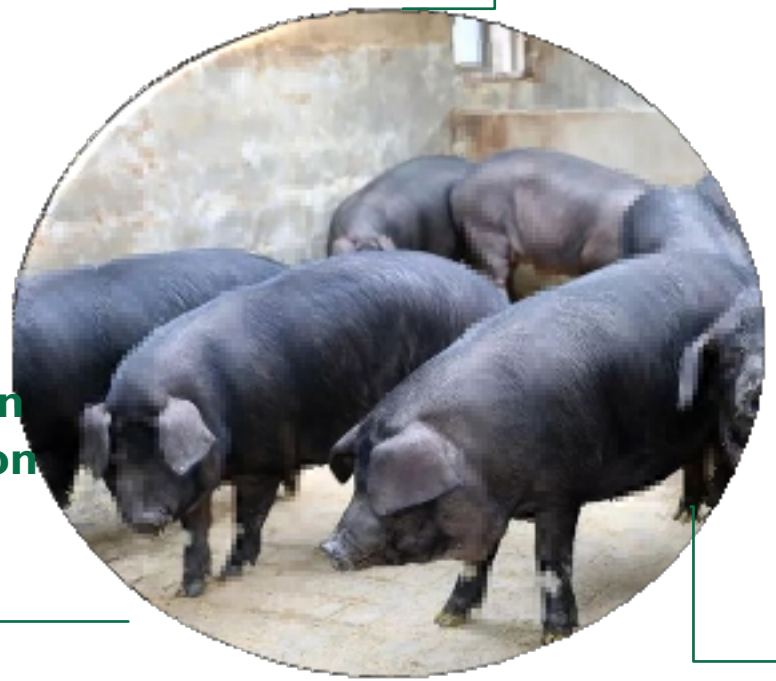


Native kinship



Conclusions

2. aOCS can help YDH alleviate GI while restricting the increase of overall kinship and native kinship.



(Image by Anyi via Tesegu)

1. Considerable GI exists in the current YDH population

3. Segment-based aOCS is easy-to-use for small breeds with GI and of very limited data availability

Acknowledgements

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