

Using genomic information to monitor diversity of the Australian honeybee genetic resources

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Industry

- More than 48,000 registered bee keepers
 - Only 4% of beekeepers with more than 50 hives
 - Accounting for more than 80% of
 - Total honey production and
 - Honey bee related products
 - Pollination services
- Australian honey bee industry produces > 39,000 tonnes of honey annually

Commercial beekeeping

- High variability of flowering, pollen and nectar yields for bees
- Mostly nomadic
 - Hives can be moved up to 20 times a year
- Pollination contracts or honey production

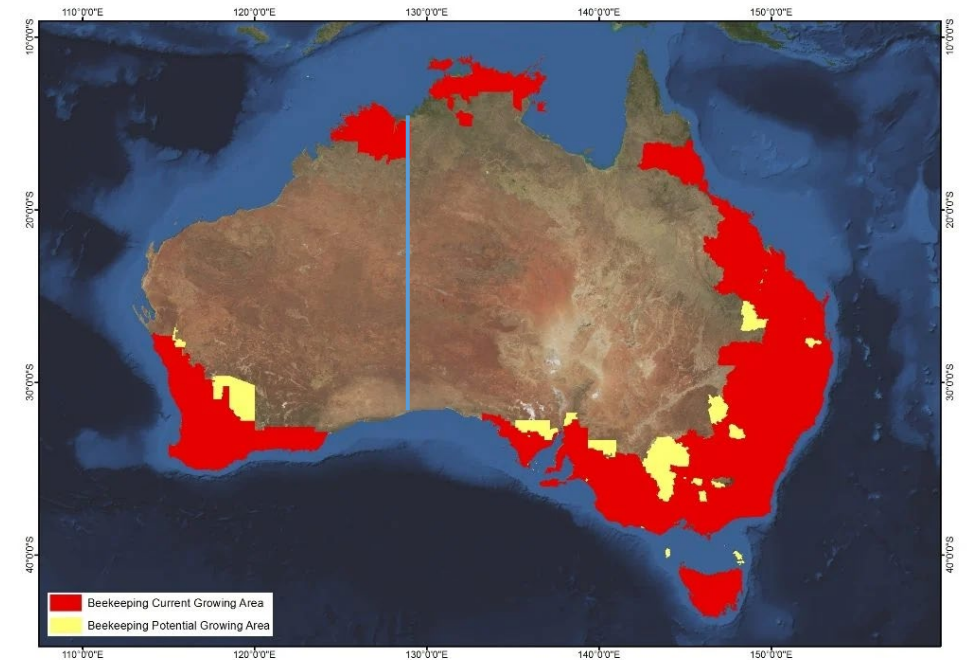


Image credit: AgriFutures Australia

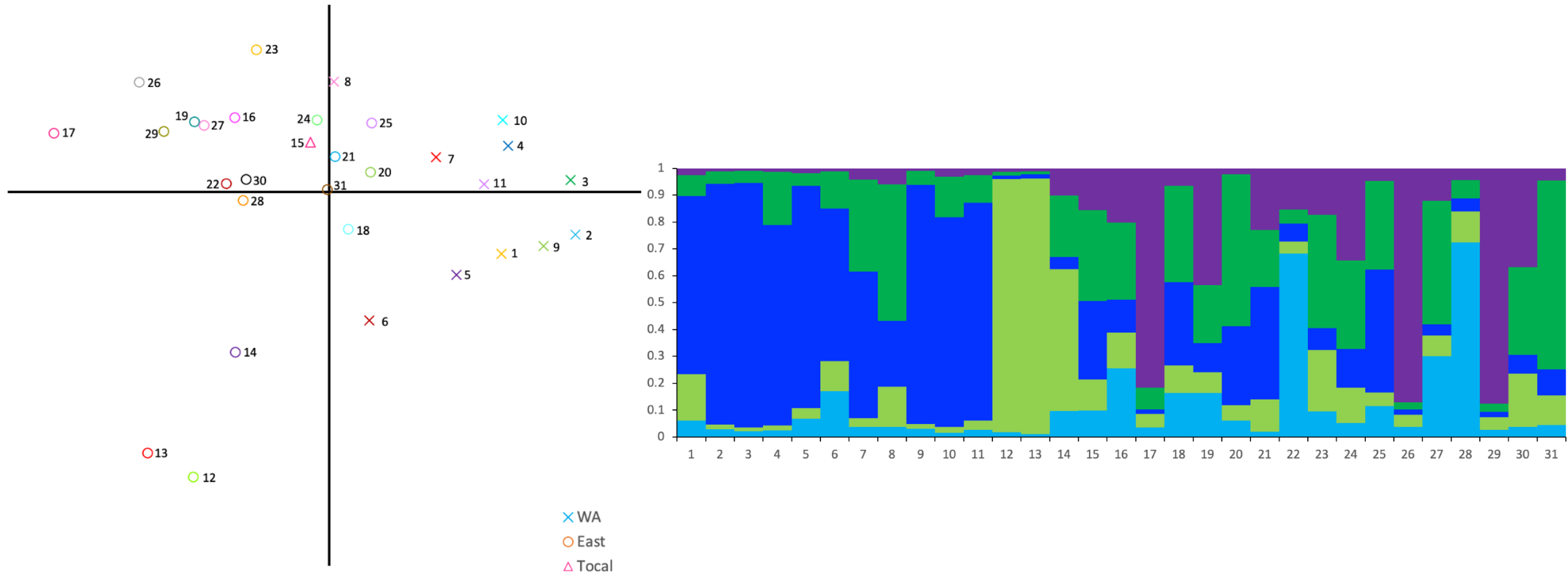
Plan Bee project



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Plan Bee

- National honey bee genetic evaluation program
 - Introduced species: European honey bee
 - Native bees: not considered
- Project started in 2020
- Centralised research population
 - Drought, COVID, Varroa, flood
- Small network of bee breeders providing data
 - Inexperienced industry, no trait definitions

Previous studies of diversity



Utaipanon et al., In Prep

Australian honey bee diversity

- Bee breeders and 1 research population
- 82 unique *csd* alleles across 4 populations
- 16 novel alleles



Mo et al., 2024

Samples & Genotyping

- Queens vs drones
 - Adult bee vs pooled body parts
 - Enough drones in sample????
 - Extraction procedures – high quality DNA
 - Many service providers not geared for insects

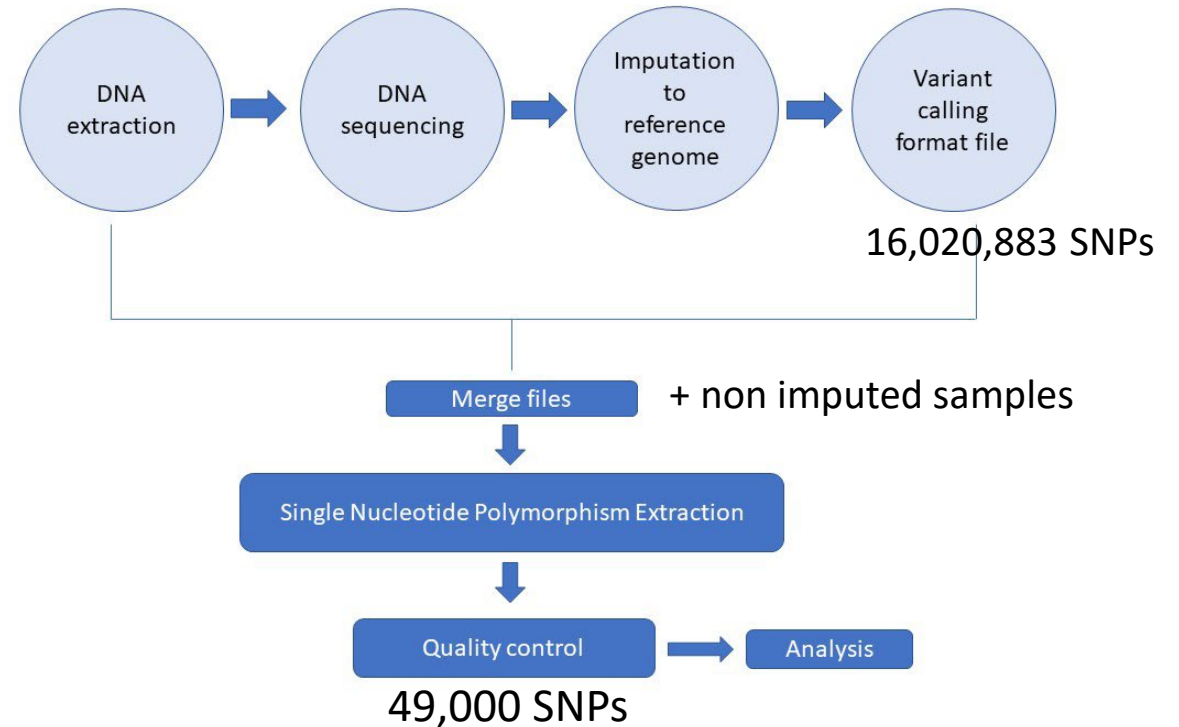


Image credit: Agriculture Victoria



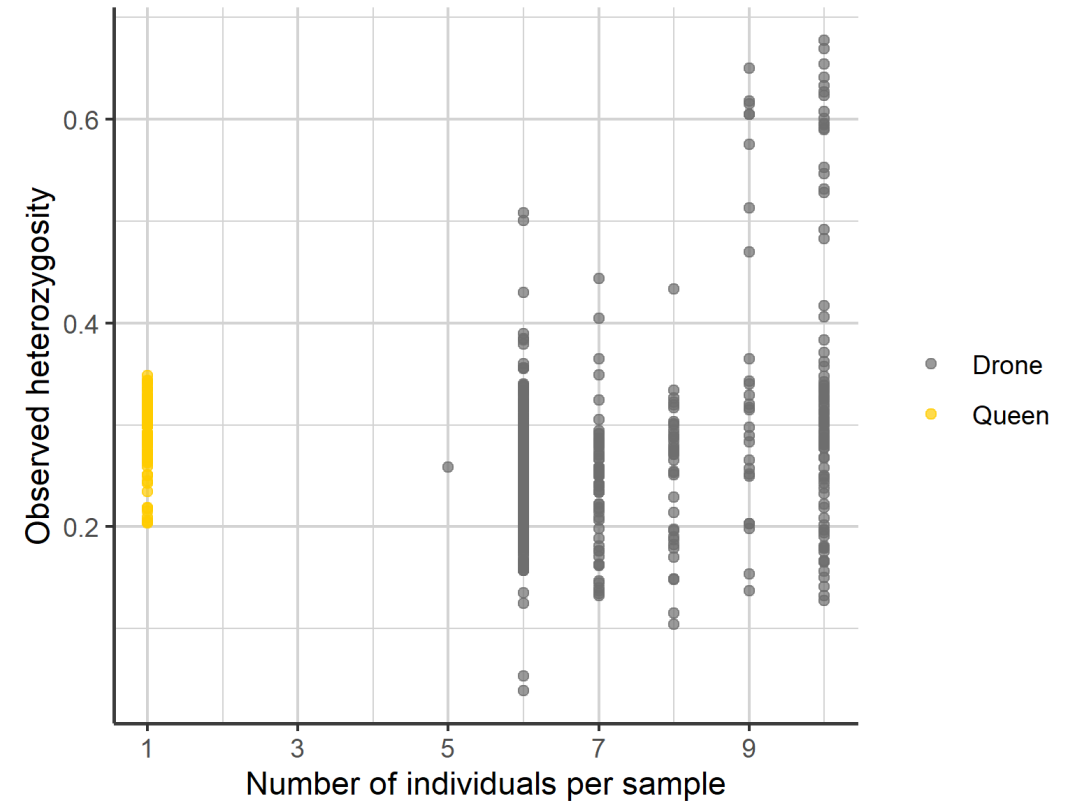
Image credit: B. Gross

Genotyping by sequencing

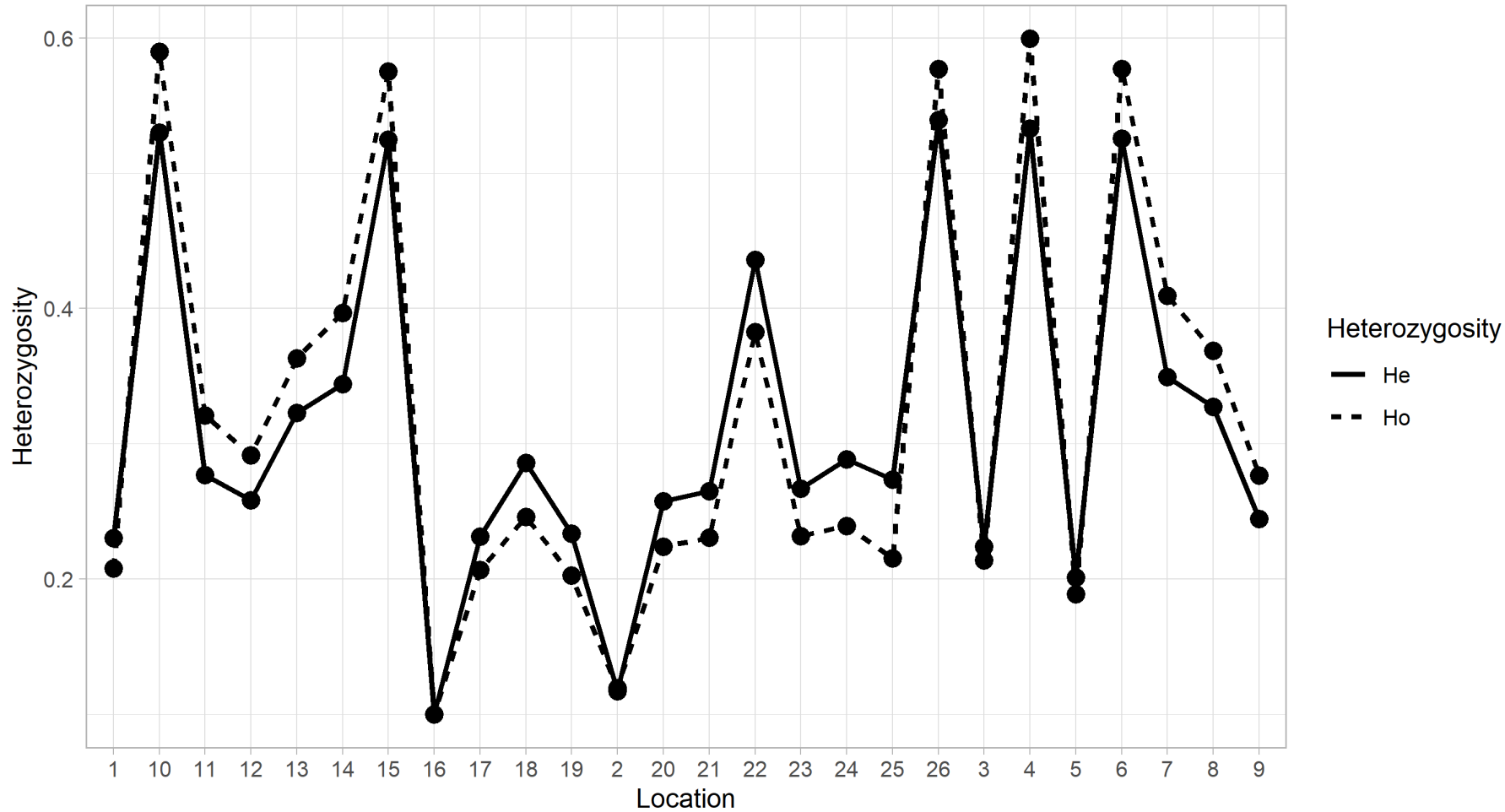


Samples and Genotyping

- 722 samples from 26 different locations
- Merging genotypes → quality control
- 49,000 SNPs

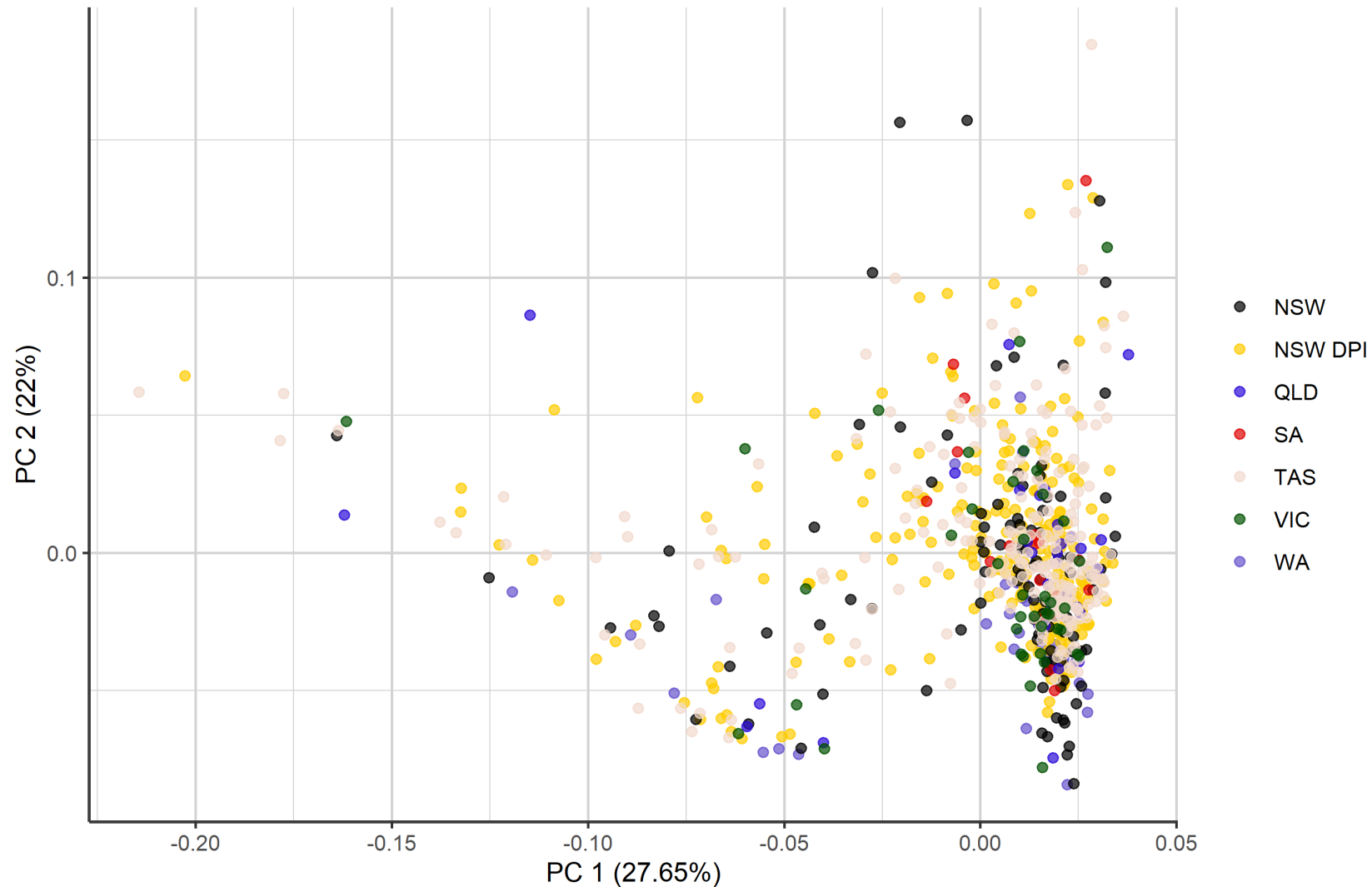


Genetic diversity by source

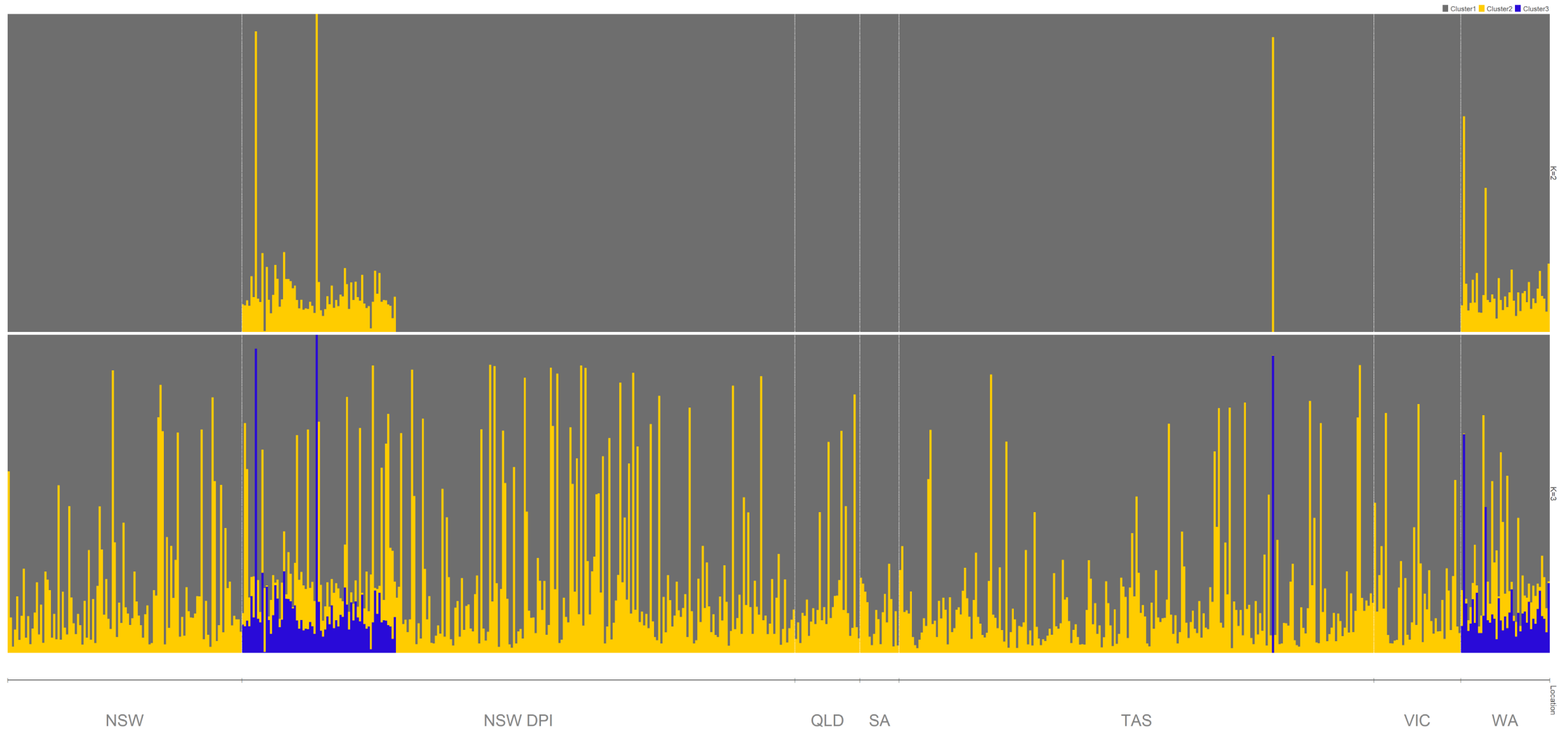


Observed heterozygosity values close to expected
Low diversity for 2 locations

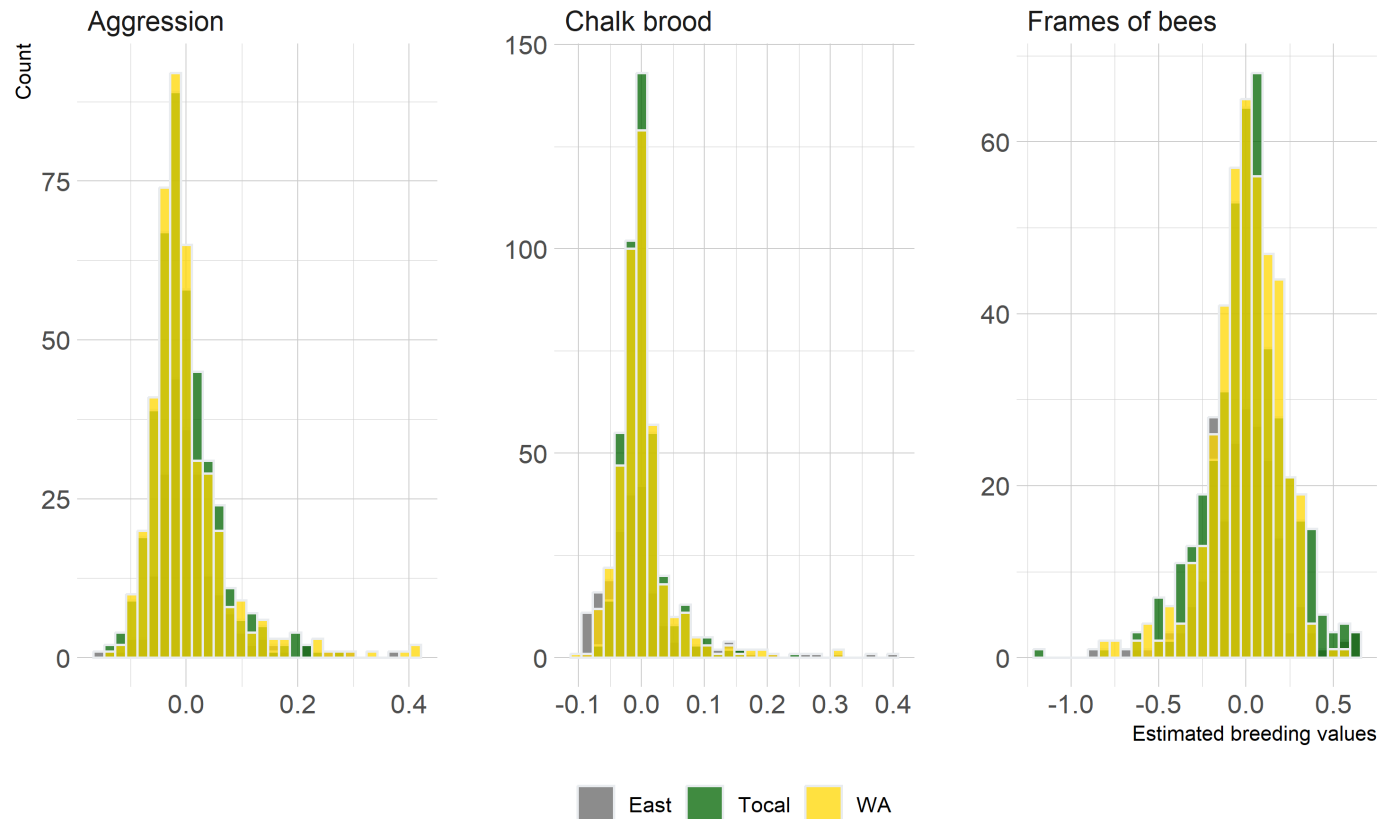
Population structure by group



Population structure by group



Preliminary breeding values



Using genomic relationship matrix

Conclusions

- Genotyping success?
 - DNA extraction success low on larvae but high quality
 - 49,000 usable SNPs
- Genetic diversity of Australian bees in general at expected levels
- Some locations exhibit low heterozygosity
- Low genetic differentiation between locations
- No obvious population structure
- Preliminary Genomic breeding values for Traits

Honey Bee Genetic Improvement Program (Plan Bee)

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Our team



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Commercial beekeepers via the When Bee Foundation



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