Research Project 1B- Estimating the Impact of Vector Control on Mosquito Effective Population Size using Approximate Bayesian Computation (ABC)

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Estimating the Impact of Vector Control on Mosquito Effective Population Size using Approximate Bayesian Computation (ABC)

How does ABC work?

1] Obtain population genetic data from a population from several time points. (e.g. microsatellite data)

2] Define demographic scenarios to be tested against each other (e.g. constant population size, bottleneck, expansion)

3] Simulate 1 million [microsatellite] data sets for each possible demographic scenario

-> compare the simulated data sets to our real data set to derive posterior probabilities for each possible scenario

-> Top 1% of simulated data of most likely scenario is used to provide estimates of various parameters of interest (e.g. Effective population size, timing of changes in size)
Goal of our research project

Determine the impact of vector control on the population dynamics of C. quinquefasciatus in Houston:

- What do the population size fluctuations of mosquito vectors look like across seasons?
- What impact do vector control efforts have on these dynamics?
- How does the presence of kdr affect impact of control efforts?
- How did mosquito populations respond to hurricane Harvey?
Area 802: 35 spray truck deployments between June 14th and Sept 18th 2016/ no control in 2017

Area 415: no organized control efforts in 2016/2017

Current focus of research activities

Sampling points (n=95)

Area 415  2016  2017

Area 802  2016  2017

Extensive control efforts in area 802

Hurricane Harvey (late August)
Progress to date

- We have completed genotyping the 2016 data set for area 415 and 802.

- We have completed DNA extractions, PCRs for 2017. These have been sent off for analyses on an automated sequencer.

- We are starting the preliminary ABC analyses on the 2016 samples.
Metabolic resistance

*Metabolic resistance is resistance due to increased expression of detoxification enzymes/This allows mosquitoes to sequester and break down insecticides more rapidly, preventing or mitigating toxic effects.*

Three major metabolic detoxification gene families have been implicated in metabolic resistance:

- P450s
- esterases
- glutathione S-transferases (GSTs)
Metabolic resistance

- This is a collaboration with the Mosquito and Vector Control Division of Harris County Public Health.

Experiment 1

C. quinquefasciatus (from field collected eggs)

Malathion bottle assay

susceptible

resistant

Quantseq
(6 pools of 10 mosq.)

Compare expression of detoxification enzymes

Validate function with RNAi:

Does knock down result in increased susceptibility to insecticides?

Experiment 2

C. quinquefasciatus (from field collected eggs)

Susceptible C. quinquefasciatus strain

Quantseq
(6 pools of 10 mosq.)

Compare expression of detoxification enzymes
Metabolic resistance

- HCPH has started the collection and testing of the first batch of mosquitoes.

- We have successfully tested in house Quantseq library prep.

- Plan is to focus on *C. quinquefasciatus* this summer and expand to *Aedes albopictus* next year.
Acknowledgements

- Many thanks to collaborators at Texas A&M University and Harris County Public Health
  - Patricia Pietrantonio
  - Mustapha Debboun
  - Chris Fredregill
  - Christine Roberts
  - Kendra Dagg

- Funding is provided by CDC through the Western Gulf Center of Excellence for Vector-Borne diseases.