Economic analysis of the threat posed by the Asian Tiger Mosquito in Australia

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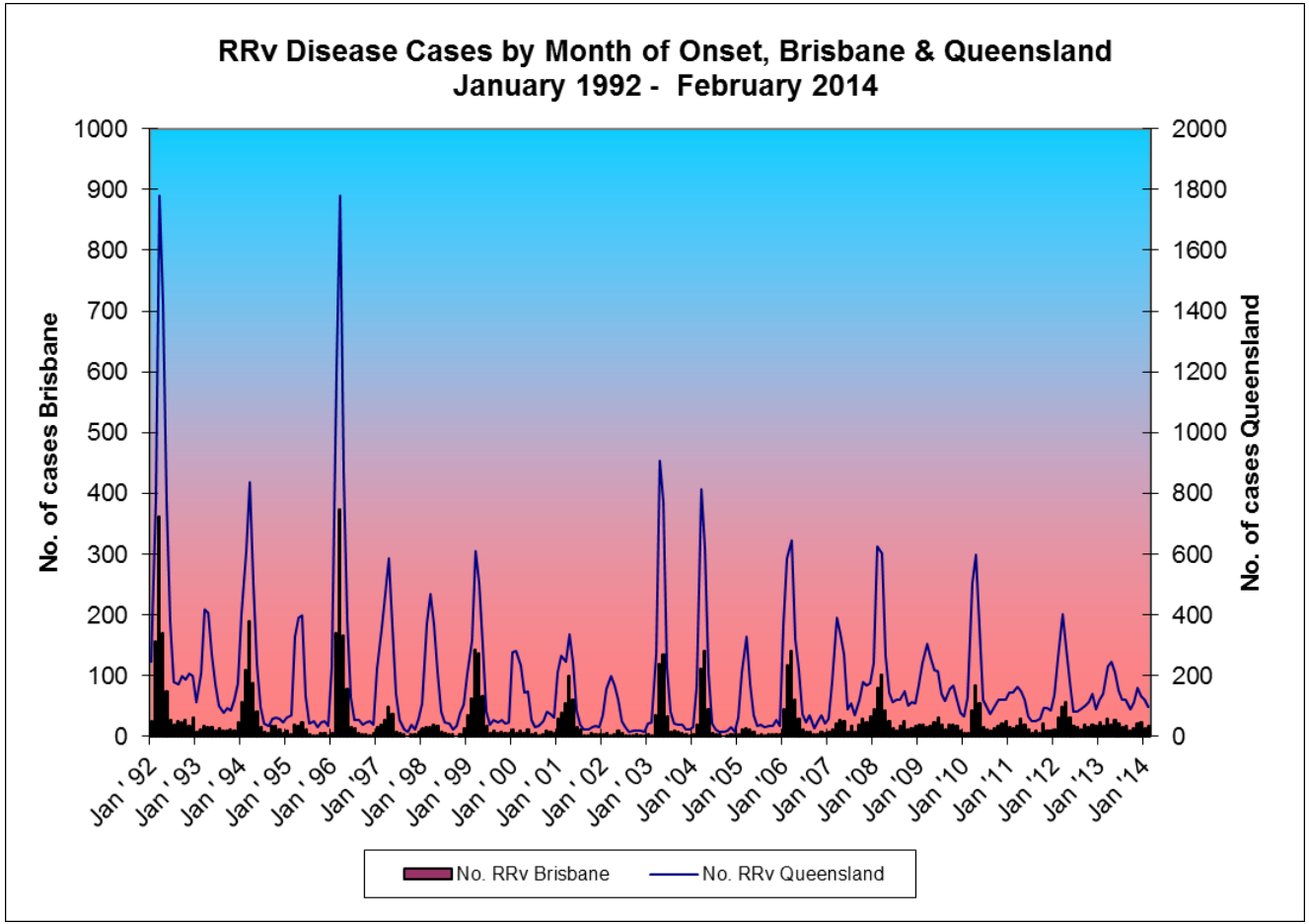
Problem: Asian Tiger Mosquito (*Ae. albopictus*)

- Currently the most invasive mosquito in the world

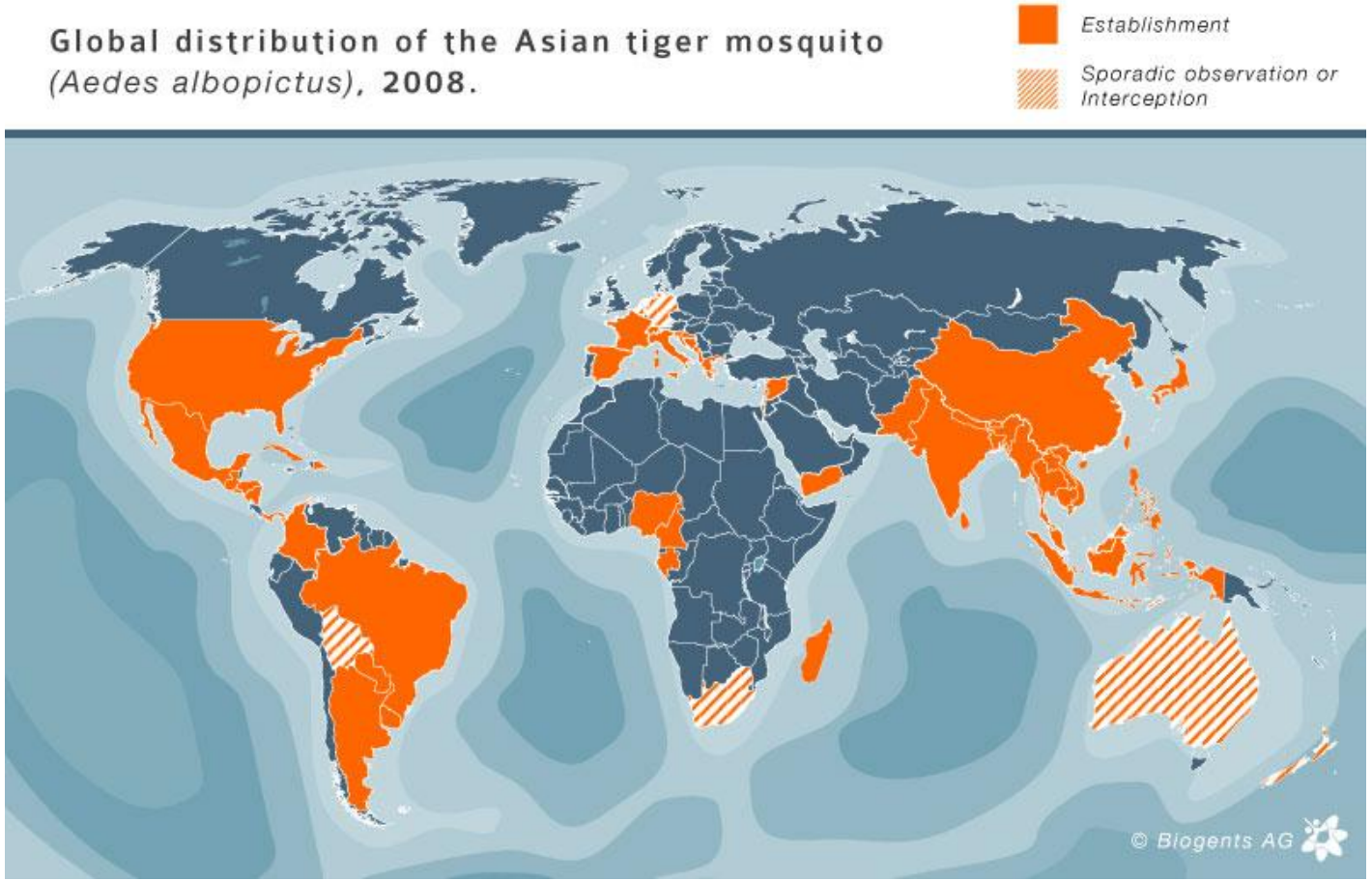
- No. 4 on the global invasive species database of the world's 100 worst invasive alien species
  - Aggressive day biting insect.
  - Potential to limit outdoor activity
  - Competent vector of several viruses such as Dengue, Chikungunya, Ross river virus

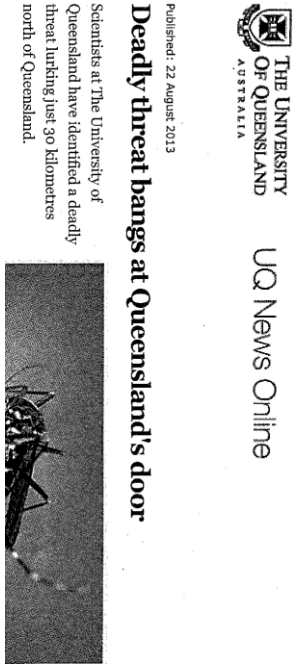
Photographer: Susan Ellis, Bugwood.org



Source: Queensland Health

Global distribution of the Asian tiger mosquito *(Aedes albopictus)*, 2008.

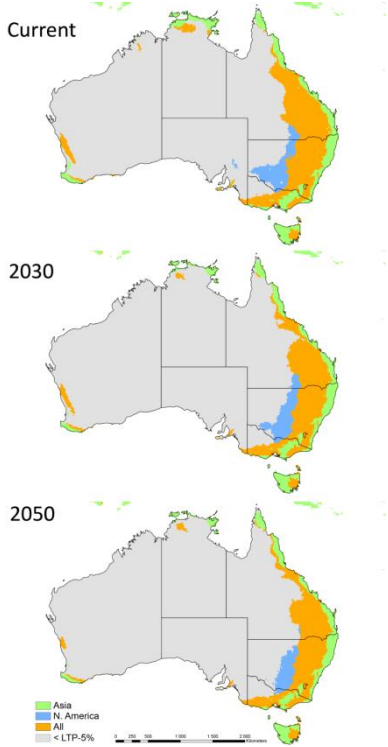




Source: Gloster.com

Ae. albopictus: Current and future situation

- Australia under threat of invasion
- Interceptions at Australian seaports (Darwin, Cairns, Townsville, Brisbane, Sydney, Melbourne etc)
- Established in the Torres Strait islands
- Climatic suitability models suggest it could spread along the entire north and east coast of Australia



Source: Hill et al. (2013)

Research Questions

- Investigate the willingness to pay of residents in high risk areas for extra mosquito programs to reduce the chance of the Asian tiger mosquito from becoming established in Australia.

- Estimate how much households currently spend on mosquito control products

- Estimate the costs of alternative control strategies and eradication to inform policy makers

Methodology outline

- Non-market valuation to estimate the monetary value of perceived benefits of increased probability of control
- Existing costs of mosquito infestations
  - Public health costs
  - Quality of life/nuisance impacts
- Choice modelling (CM) vs contingent valuation (CV)?? Both methods are appropriate

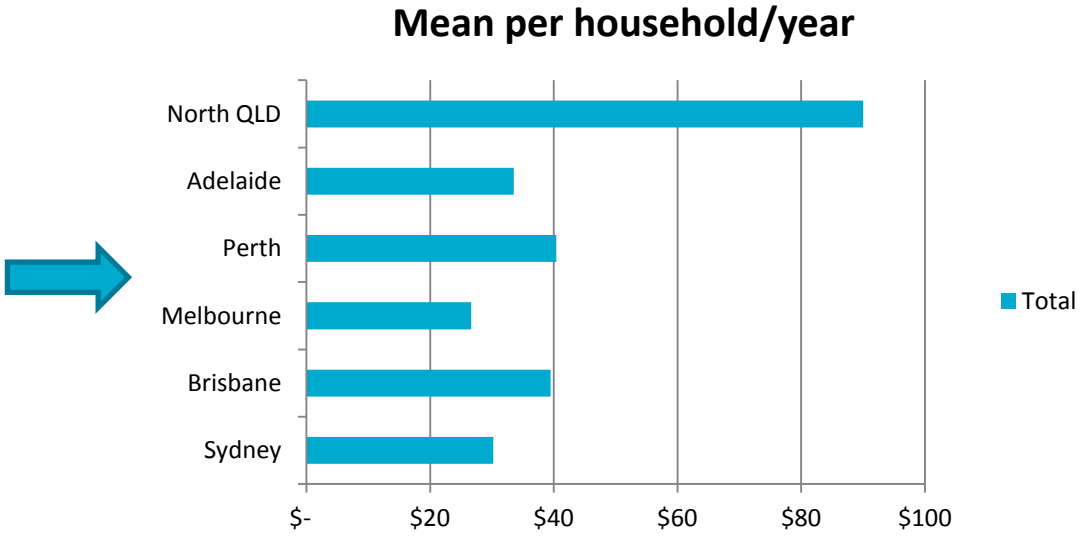
- Very few valuation studies available for Ae. Albopictus. This rules out use of Benefits-Transfer (BT) methodology
- We settled for a CV study: WTP for extra mosquito control programs to reduce the chance of the Asian tiger mosquito from becoming established in Australia from X% to Y% over the next 10 years

CV Study Design

- CV questionnaire: DC format with 7 rotating bid levels ($1-$400)
- Open-ended WTP follow up question
- Split sample to test for scope:
  - Group 1: presented with a set of programs that would reduce probability of incursion from 50% to 25%
  - Group 2: presented with extra programs that would reduce probability of incursion from 50% to 5%.
- Follow up questions
- 2 focus groups/2 pilot surveys

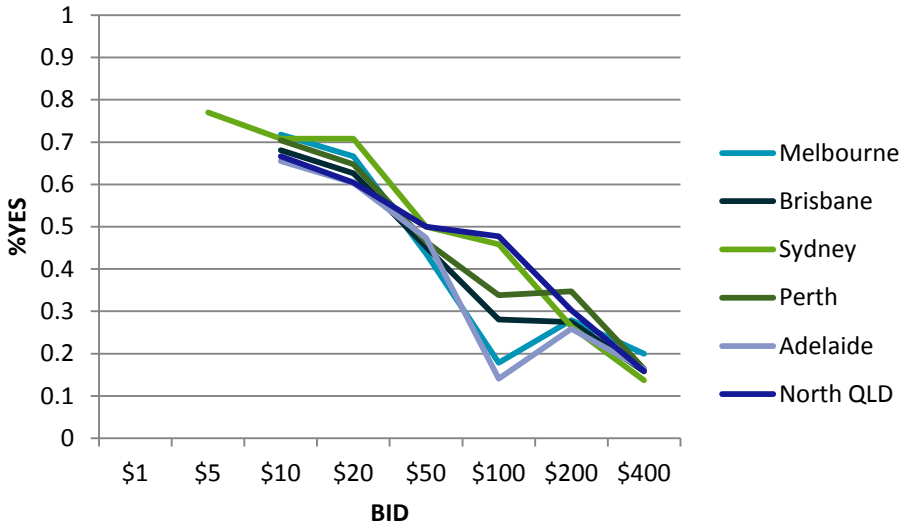
Results: Expenditures on mosquito control

- Why expenditures are relevant here?
- *Ae. albopictus* likely to establish on private property, where there are currently no routine control programs
- Gives an appreciation of the magnitude of additional expenditures with incursion.



Results: DC Bid Curves (Whole Sample)

- DC data are well behaved
- Proportion of respondents saying ‘yes’ declines with higher bid amounts
- Close to 100% rejection for upper bid level
- Lower bid level received close to 100% acceptance



Estimated WTP from Logit Models

- Scope test is passed in Sydney, Melbourne and Perth.
  - WTP values for sub-samples increase significantly with scale of risk reduction
- Scope test not passed in Brisbane, North QLD and Adelaide
  - Scope insensitivity could be due to differences in consumer preferences?

	Group 1 (probability: 50% to 25%)	Group 2 (probability: 50% to 5%)
Sydney	$28 ($24-$48)	$51 ($53-$55)
Brisbane	$56 ($51-$69)	$58 ($53-$72)
North QLD	$52 ($48-$86)	$68($64-$100)
Melbourne	$49 ($46-$64)	$84 ($71-128)
Perth	$40 ($39-$49)	$81($69-$126)
Adelaide	$52($44-$105)	$64($56-$106)

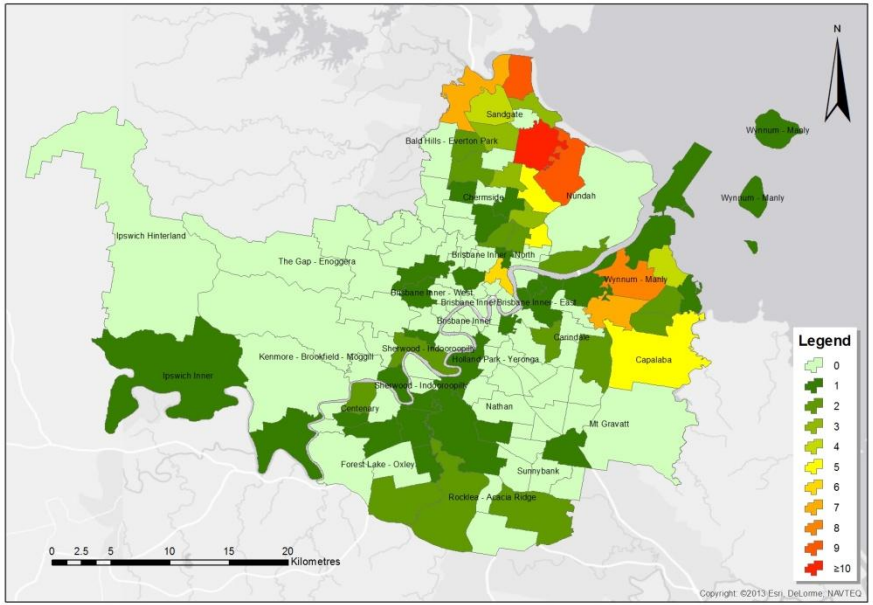
Open-ended WTP

- Open-ended WTP estimated with Tobit model
- Mixed results: Scope test passed in Sydney and Melbourne only. Inadequate scope sensitivity of WTP values in Brisbane, Perth and Adelaide? To be confirmed
- Anchoring of OE follow up
  - Regression of OE data shows bid level to be significant.
  - Mean of OE WTP increases with the bid amount offered.

	Group 1 (probability: 50% to 25%)	Group 2 (probability: 50% to 5%)
Sydney	$26 ($20-$32)	$46 ($34-$59)
Brisbane	$33 ($24-42)	$37 ($26-$49)
North QLD	$41 ($28-$54)	$43 ($29-$56)
Melbourne	$34 ($23-45)	$42 ($30-53)
Perth	$44 ($33-$54)	$44 ($33-$54)
Adelaide	$28 ($16-$40)	$31 ($21-$40)

Case Study: Brisbane City Council

Mosquito management program

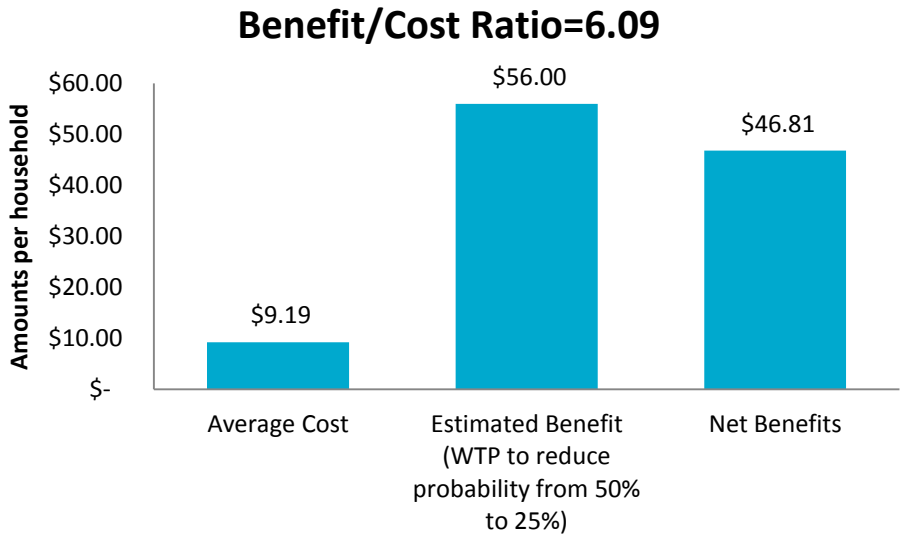


Service requests: 172 (2012-13)

Components	
Area covered	132,618 km2
Population (2012)	2.19 million
Total households	380,776
Staff	4 technical staff, 15 operators
Total Cost (2013-14)	$3.5 million (AUD)
Programs	• Ground larviciding • Aerial larviciding by contractors • Local surveillance

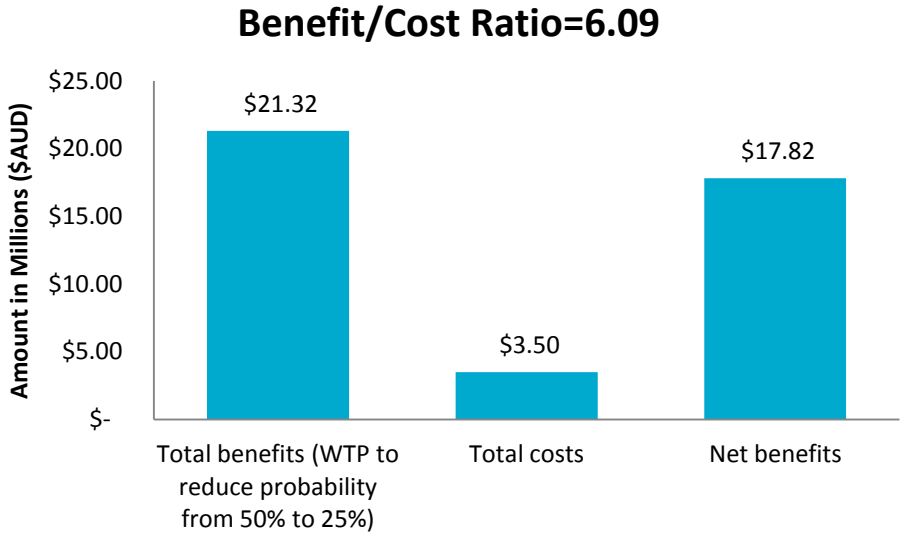
Benefit-Cost Analysis: Per Household Perspective

- The benefits are the outputs from the proposed program, expressed in dollar terms.
- The costs are inputs for implementing extra mosquito programs.
- A rough benefit-cost analysis indicates positive net benefits for the proposed programs



Aggregate Annual Benefits and Costs

- Based on population of 380,776 households.
- CV WTP estimate of $56 per household to reduce incursion probability from 50% to 25%.
- Costs of extra programs to be estimated. We use current costs as a proxy



Conclusions and next steps...

- Positive and significant WTP
- Mixed results: Scope insensitivity in sub-samples but this is to be confirmed with further analysis
- Results are consistent with health literature (e.g. Hammitt and Graham, 1999; Corso et al., 2001)
- Example from the literature: WTP to control the Asian Tiger Mosquito in New Jersey estimated at US$ 9.54 per capita per year (Halasa et al 2012)

- A rough benefit-cost analysis shows positive net benefits for the proposed program.

- Next step is to estimate cost of the extra mosquito programs. A more detailed BCA is being undertaken.

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