Risk and intentional introductions

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Better Border Biosecurity (B3)

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Risk and intentional introductions

B3 Theme One : Impact Prediction - develop new knowledge and methodologies to enable better prediction of the potential impacts of new organism introductions, both intentional and accidental

Stakeholders: EPA, MPI & DOC and industry applicants

Science aim/approach: Underpinning science to assist EPA applicants to better meet HSNO Act Section 36 Minimum Standards.

Outcome: Improved effective decision making around importation of natural enemies

Risk and intentional introductions cont.

New Zealand collaborators:

University of Auckland

International collaborators:

Dr Peter Mason of Agriculture and Agrifood Canada

René Sforza of the European Biological Control Laboratory in Montpellier, France

Other acknowledgments:

Colleen Carlson (RIP)

PhD co-supervised by Greg Holwell, School of Biological Sciences, University of Auckland and co-funded by Chilean Government

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CONICYT Ministerio de Educación Gobierno de Chile

Classical biocontrol in NZ

The issue

- New Zealand's productive sector systems is based on a few species
- New pests often establish in NZ **without their natural enemies**
- This leads to a **worse problem** here than in their native environment
- To correct this balance NZ has a long and successful history of **classical biological control** to control pests, (diseases) and weeds
- The challenge is to introduce new natural enemies that don't further harm our **indigenous fauna and flora**
- **The potential economic benefits** of successful biocontrol are massive
- Work within **New Zealand law** – HSNO Act and Biosecurity Act
- **Science** that enables this to proceed safely and smoothly

Risk of intentional introductions

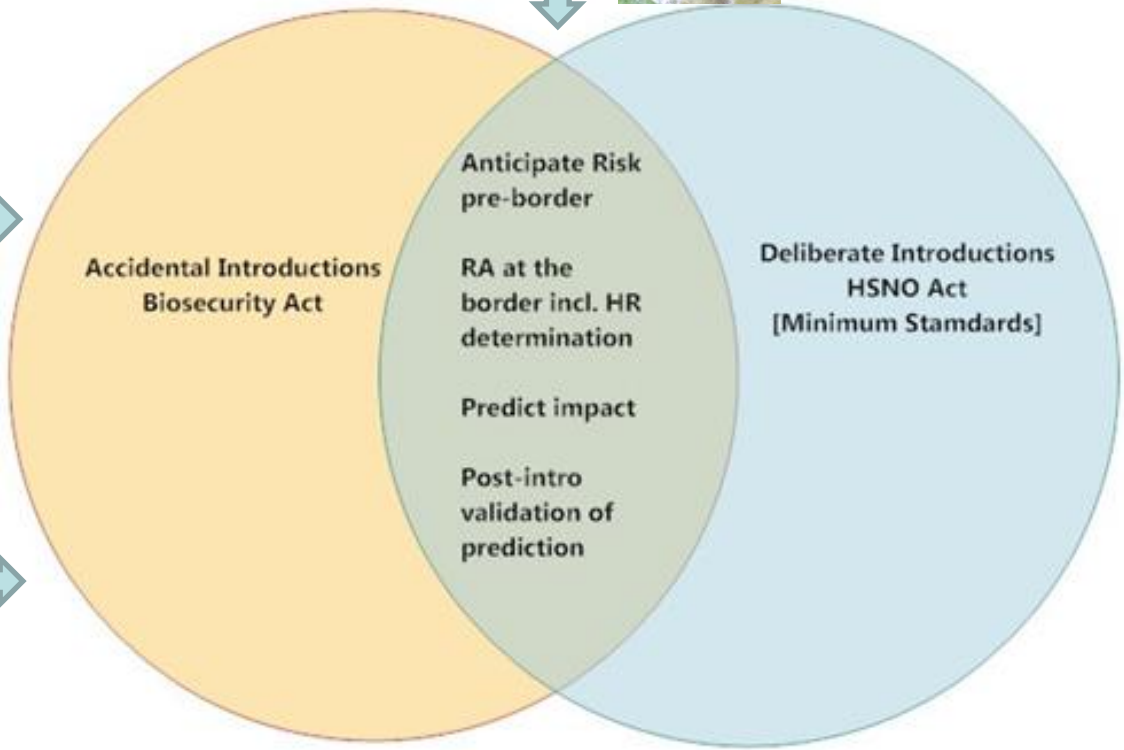
- Biocontrol agents are new organisms too
- They are selected to be successful invaders, to be climatically compatible, to be able to establish, to spread and to create impact
- They therefore make good surrogates to study accidental invasions
- Both present a risk, and research on them can inform and improve the predictive power of many aspects of a pest risk analysis

Accidental vs Deliberate Introductions

E.g. GLS on eucalypts

Host testing to estimate impact to natives (rata)

Survey to validate predictions



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Pre-emptive biocontrol risk assessment

Leader: **John Charles (PFR)**

Objective: **To determine risk pre-border using a potentially useful Biocontrol Agent as a model organism**

Value Creation and Impact:

Preparedness of NZ for Glassy-winged sharp-shooter

(vector of Pierce's disease of grapevines & potentially serious horticultural pest in NZ)

Egg parasitoid used successfully overseas, John put this parasitoid through a Risk Assessment for NZ:

- No NZ native insects identified as closely related to GWSS as well as having a suitable egg size for parasitoid development
- parasitoid very host specific – arguably could be rapid deployed without undergoing any host range testing
- Could significantly speed up a future biocontrol response

Charles JG 2012. Assessing the non-target impacts of classical biocontrol agents: is host-testing always necessary. BioControl 57: 619-626.
Charles JG, Logan DP 2013. Predicting the distribution of *Gonatocerus ashmeadi*, an egg parasitoid of glassy winged sharpshooter, in New Zealand. New Zealand Entomologist 36: 73-81.

Improving Quarantine testing

Leader: **Toni Withers (Scion)**

Objective: **improved host range determination methods for deliberate introductions**

Value creation and Impact:

Cleopus japonicus on its target weed buddleja

Tools to quantify uncertainty in risk assessment

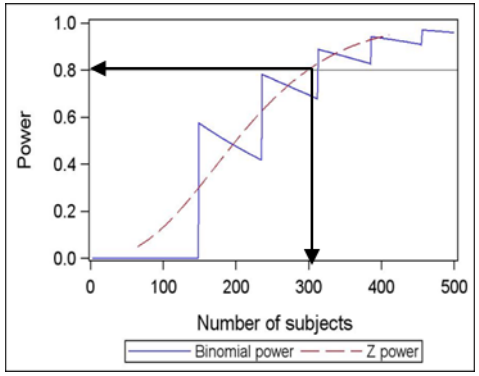
- Original host testing for *Cleopus japonicus* for buddleja showed that 1/30 larvae developed successfully on a non-target native host, a **precious taonga** species
- ERMA requested additional host trials be undertaken to help them deal with the uncertainty surrounding their decision to approve the release of the weevil
- Detailed 4 *statistical* approaches applicants can now use to interpret and report probability of 'rare' events to EPA

Hebe speciosa host range tests

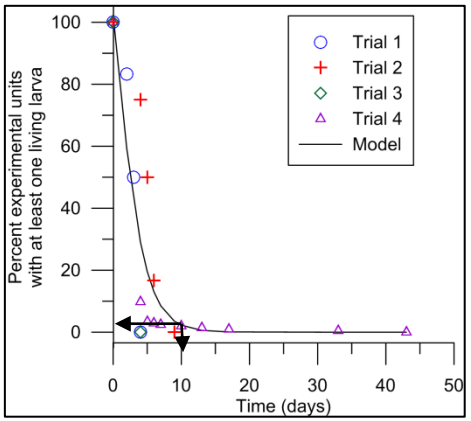
4 statistical approaches to report uncertainty now been described

Confidence Intervals – Risk of larvae surviving to pupate on native probability of 0 - 0.023 (lower-Upper 95%CI)

Equivalence Testing – Tolerable risk of larvae surviving is predefined. Observed Prob of 0.0037 within tolerable margins



Effect size – anything less probable than 0.02 will be undetectable at a sample size < 300



Survival analysis- here predicted < 2% of larvae will survive >10 days on the native NT plant

Withers, T. M., C. A. Carlson and B. A. Gresham. 2013. Statistical tools to interpret risks that arise from rare events in host specificity testing. Biol. Contr. 64: 177-185.

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Developing testing regimes for new microbial BCAs

Leader: Kirstin McLean (BioProtection RC)

Objective: ERMA asked B3 to fill a knowledge gap on the host range of deliberately introduced pathogens

Value creation and Impact:

- Recently completed research will now guide EPA applicants on how to assess risk of new microbial BCAs for native ecosystems
- Impacts of a commercial microbial BCA (*Trichoderma atroviride*) on native plant health and soil microbial diversity tested on native grassland and bush species - no major effects found
- Recommended native plants ideal for future HR assessments
- EPA "*these results will act as a good case study to help determine the most effective testing regime for any future applications.*"

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McLean, K. L., S. L. Dodd, R. F. Minchin, M. Ohkura, D. Bienkowski and A. Stewart. 2014. Non-target impacts of the biocontrol agent *Trichoderma atroviride* on plant health and soil microbial communities in two native ecosystems in New Zealand. Australasian Plant Pathology 43:33-45

Model systems studied to date

- Plant-feeders
  - Gum Leaf Skeletoniser
  - Buddleja leaf weevil
- Natural enemies
  - Native aphids and their parasitoids
  - Mealybugs and their parasitoids
  - GWSS parasitoid
  - *Cotesia urabae* against GLS and non-targets
- Pathogens
  - *Trichoderma atroviridae* LU132 = Tenet®

Risk Assessment models and methods

New species status described !

Habitat and ecosystem specificity
Host range assessment methods

B3 and deliberate introductions

INFORMING

DEVELOPING TOOLS

REDUCING RISKS

On-line resources for EPA applicants

Leader: Barbara Barratt (AgR)

Objective: to develop accessible and up to date resource information for EPA applicants, stakeholders, & researchers

Value creation and Impact:

- BIREA website – provides relevant information for EPA applicants; review of recent science outputs from B3 and other sources http://b3.net.nz/birea/
- BCANZ website – provides up-to-date, comprehensive database of all biocontrol agent introductions into NZ; information on establishment, impact etc. http://b3.net.nz/bcanz/

B3 science used in a recent application to EPA to release a generalist biocontrol agent

- Historical precedent. Generalist BCA – first application of its kind for NZ – challenge for everyone
- Application. The applicant cited some B3 science outputs
- EPA Insect Advisory Panel included 8 experts from B3
- EPA advice to decision making committee cited a range of B3 science outputs
- The Insect Advisory Panel reviewed both the application and the EPA advice for scientific accuracy.

Uptake Summary

Outcomes realised

- Extensive **body of knowledge** for scientists, applicants & regulators on risks of BCAs to NZ's unique productive and natural systems
  - What is required for pre-introduction risk assessment?
  - How to improve the predictability of quarantine host range testing?
  - How good were our previous assessments?
- On-line resources (**BIREA, BCANZ**) to enable easy access to this resource
  - Well prepared applications and well informed decisions
  - Enhancing Maori engagement
- Use of relevant **B3 science outputs** (e.g. publications, reports) by applicants & regulator in applications and advice to decision makers
  - Recent application and advice to decision making committee cited a number of B3 outputs
- **Expert advice** provided by B3 researchers to regulator to inform decision making (e.g. reviewing applications, commenting on advice)
  - EPA Insect Advisory Panel

Questions


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