New Zealand Forest Research Institute

Sea container “contaminating pest” risk

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Objectives

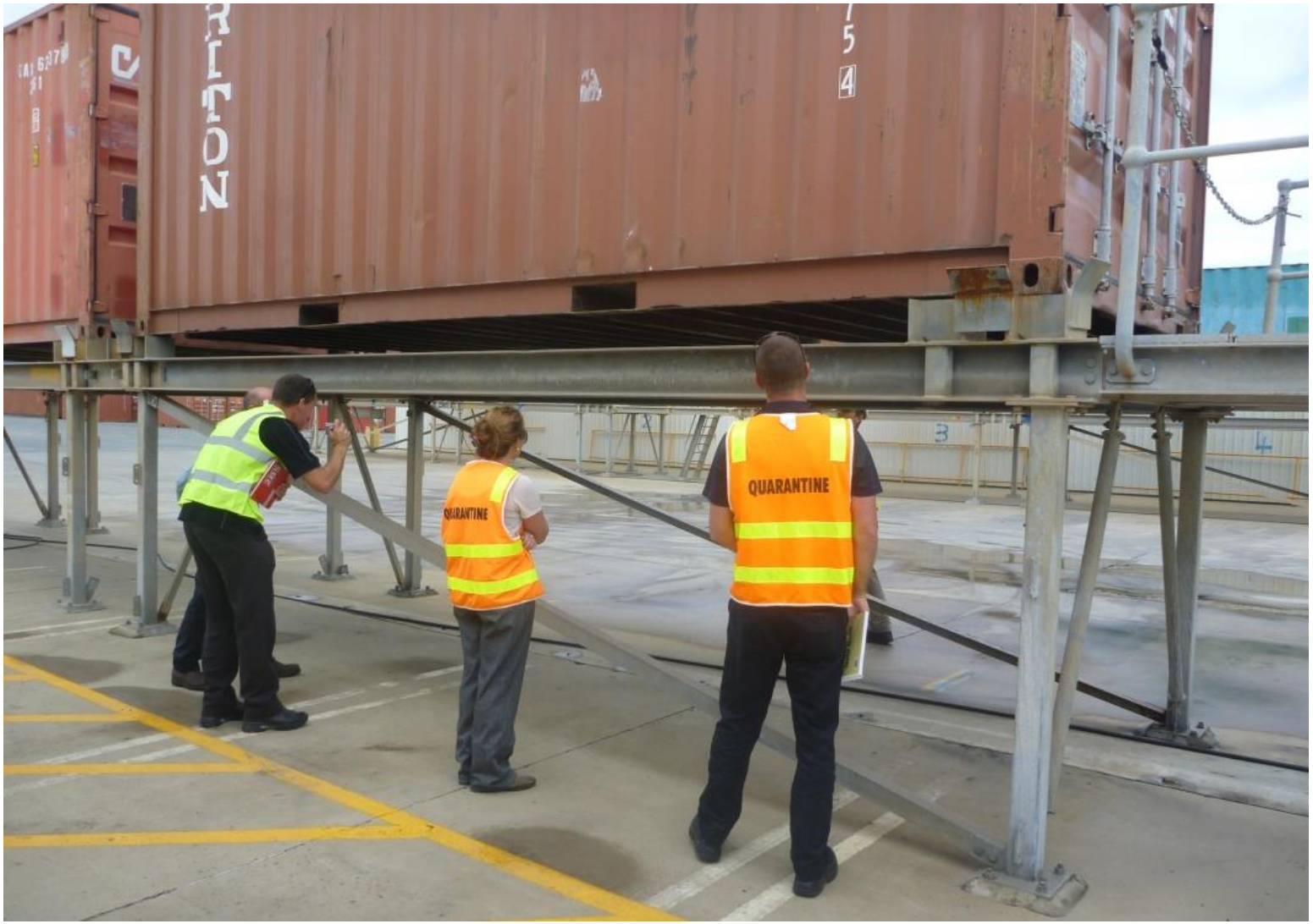
1. **Review risks associated with sea containers** moving '**contaminating pests' ("hitchhiker pests")** and **other contaminants**

2. **Assess benefits and costs of mitigation measures** addressing sea container contamination (conceptual analysis)

Note: For details see the posted report (Brockerhoff et al. 2016)

‘Contamination’ data from inspections and surveys

(New Zealand, USA, Australia, China)

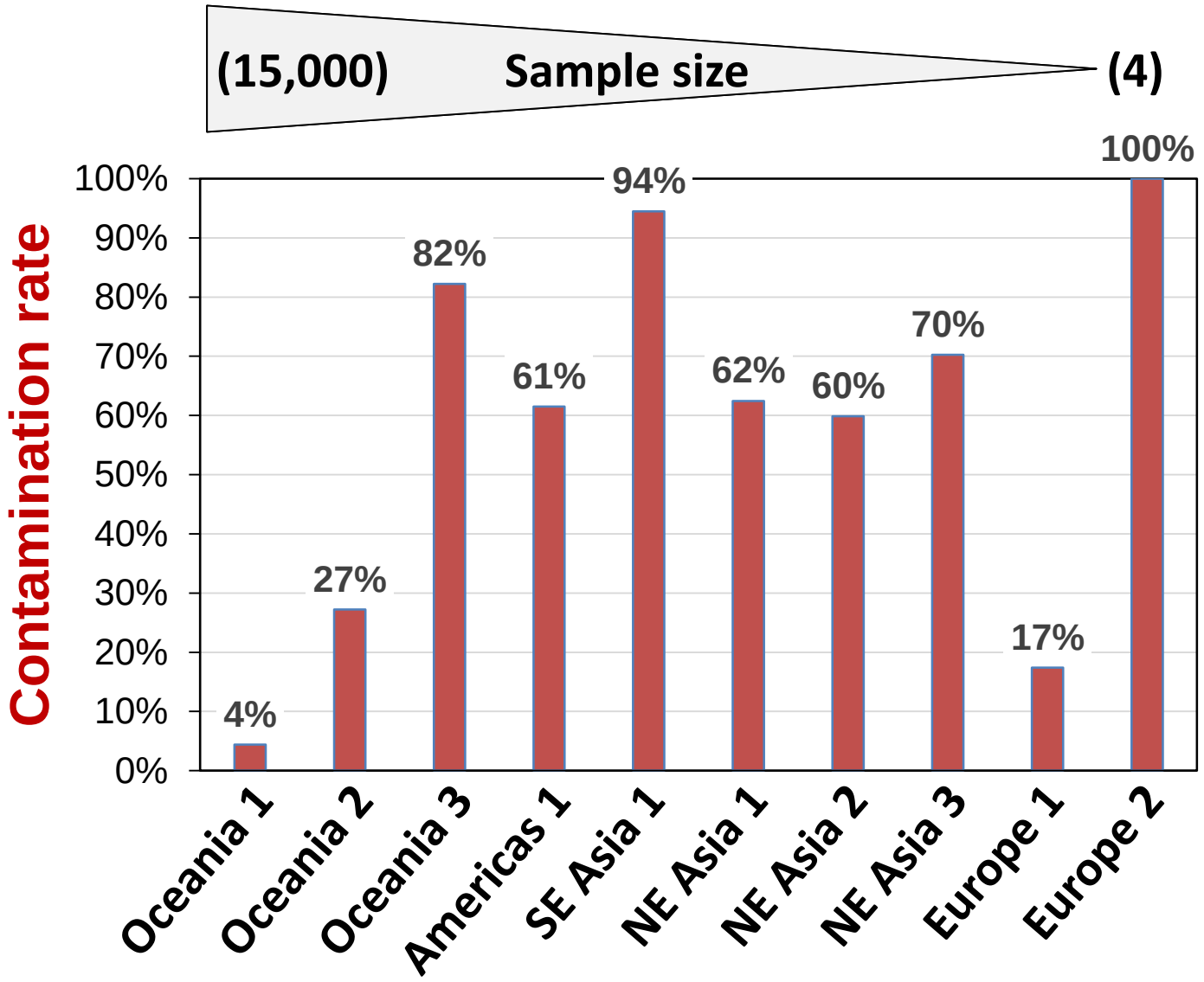


Contaminating pests & contaminants on/in **empty containers arriving in New Zealand** (2010-15)

Contaminant	External contamination		Internal contamination		External and/or internal contamination	
No contamination					**99,606**	**85.4%**
Soil	6,446	(5.5%)	643	(0.6%)	**6,982**	**6.0%**
Plant products, seeds	3,271	(2.9%)	2,292	(1.9%)	**5,544**	**4.8%**
Insects, spiders, and snails	1065	(0.9%)	1741	(1.5%)	**2844**	**2.5%**
Reptiles	115	(0.1%)	60	(0.1%)	**177**	**0.2%**
Grand Total	**11,311**	**9.7%**	**5,854**	**5.0%**	**116,701**	**100.0%**

For details see Brockerhoff et al. (2016)

Contamination rates (examples), on/in sea containers (**empty**) **arriving in New Zealand** (2010-2015)



Frequency of contaminating pests **‘at large’** with sea containers **arriving in the USA** (2010-2015)

Taxon	Exterior	Interior (empty or full)	Refrige-ration unit	Unknown location (in or on container)	Total	
Plants	113	102	515	466	**1304**	71%
Insects and arachnids	41	106	1	122	**366**	20%
Molluscs	70	4		20	**100**	6%
Other	12	8	2	19	**58**	3%
Grand Total	**236**	**220**	**518**	**627**	**1828**	

USDA AQAS PestID database

Contaminants and contaminating ‘pests’ on/in **sea containers** arriving in **Australia**

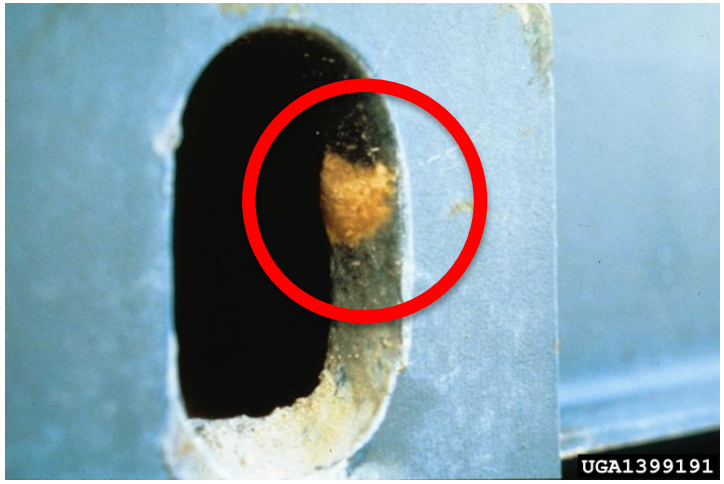
- **11,699,488** full containers (2010-2015, 5 ½ years)
- **816,854** empty containers

- **270,919** (of these) from ‘targeted’ (CAL) countries
  - **six-sided external inspections**
- **44,701 (or 16.5%) with high-level contamination**
  - i.e., high levels of contamination of soil, plant or animal material that cannot be removed easily on site,
  - or the presence of live pests,
  - or contamination that cannot be accessed for cleaning,
  - or where mechanical means are required for removal.

Soil is the most common contaminant of containers

Soil may contain plant pathogens, seeds, nematodes, ants, etc.

Common contaminating pests on sea containers



Asian gypsy moth egg mass

Giant African snail

Several incursions in NZ of invasive moths arrived as contaminants with sea containers, including painted apple moth and gypsy moth

Brown marmorated stink bug – impacts and spread

- Native to Northeast Asia
- 2001: Detected in the United States
- 2007: Detected in Switzerland
- By 2014: France, Germany, Italy, Greece & Hungary
- **A contaminating pest (see evidence in next slide)**

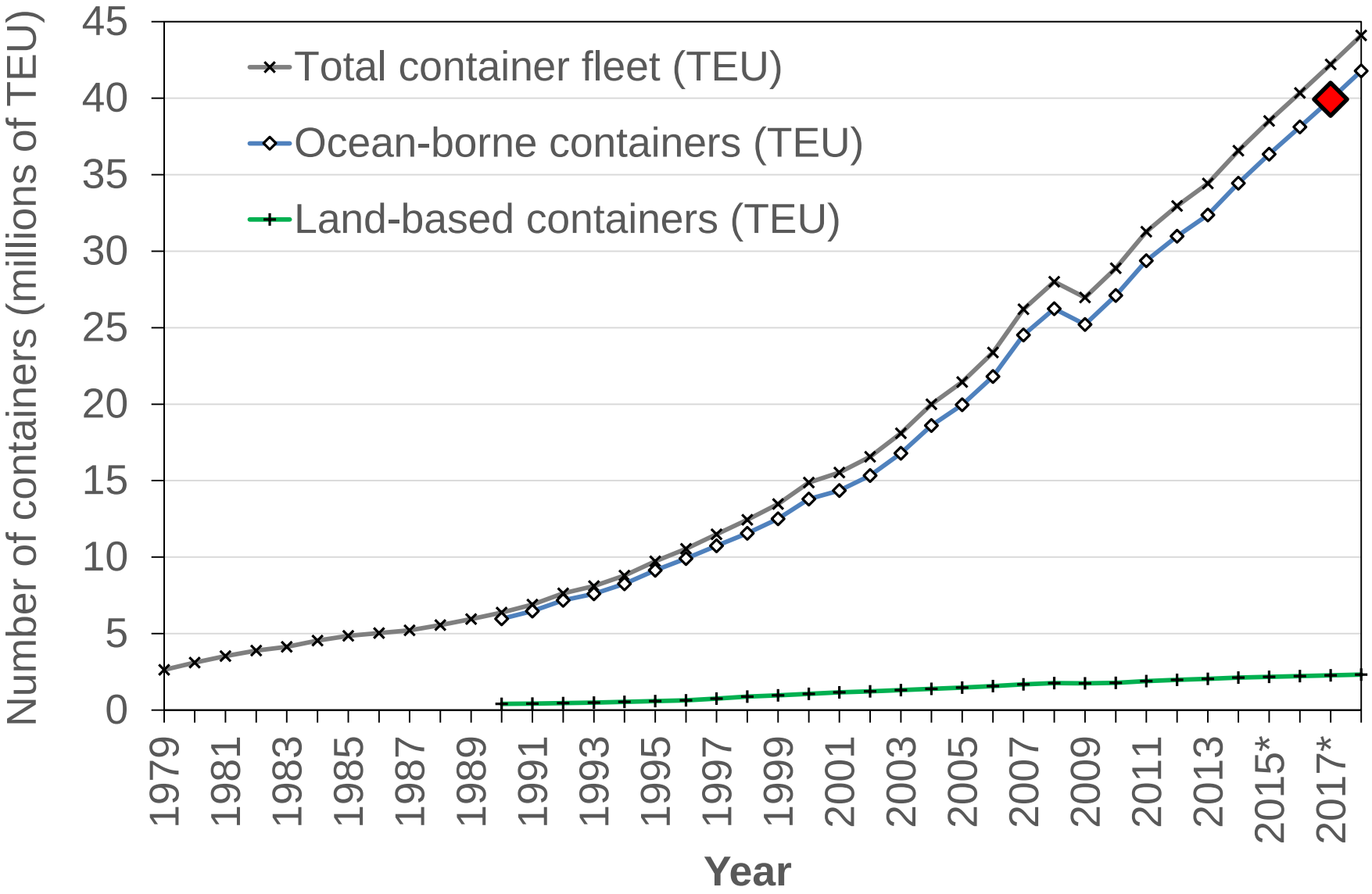
Brown marmorated stink bug - interceptions with imports to New Zealand, 2005-2016

"Pathway"	North America 1	Europe 1	Northeast Asia 1	Northeast Asia 2	Northeast Asia 3	Other or not known	Grand total	
Vehicles	174		8		1	7	**190**	(39%)
Sawn timber	98						**98**	(20%)
Sea container	**51**	**25**	**2**	**1**		**1**	**80**	(16%)
Vessel (ship)	13			1		27	**41**	(8%)
Luggage, etc.	31		1	2	1		**35**	(7%)
Grand total	**387**	**37**	**23**	**4**	**2**	**39**	**493**	(100%)

Sea container ‘pathway’ trends

> 60% (by $$) of goods shipped via sea are transported in containers

Number of containers (TEU) in use (1979 – 2017)



Drewry Maritime Research (2015)

Benefits and costs of mitigation measures addressing sea container contamination

Examples of costs of invasive contaminating pests:

- Gypsy moth (*Lymantria dispar*) in the US, expenditure/loss (annual): (**USD) $85 M** government;
  $120 M residential property value loss;
  $46 M household;
  $5 M forest owner timber loss.

- Plus: loss of market access; loss of economic activity; non-market ecosystem services; etc.

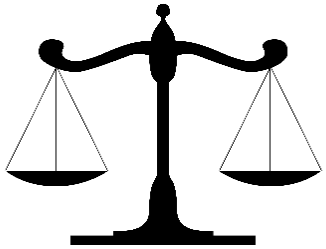
- Moth eradication & incursion response costs in New Zealand (e.g., painted apple moth, *Teia anartoides*): **NZ$61 M** (1999–2006).

Potential measures, "**Draft ISPM**: Minimizing Pest Movement by Sea Containers (2008-001)"

www.ippc.int/en/publications/draft-ispm-minimizing-pest-movement-sea-containers

- **Visual examination** of sea containers
- Methods to **remove contamination** (e.g., sweeping, washing)
- **Certification of shipping companies** …
- **Verification of cleanliness** (after examination, etc.)
- **Preventing contamination** at **storage sites**
- **Inspection** for compliance (by importing countries NPPOs)
- **Research** on methods to prevent contamination
- **Information exchange** including inspection results
- **Important**: 'Treatments' may be **combined with safety checks**, etc., when containers are already being examined… (reducing costs).

Conceptual **benefit-cost analysis** of a potential ISPM for containers



Costs:

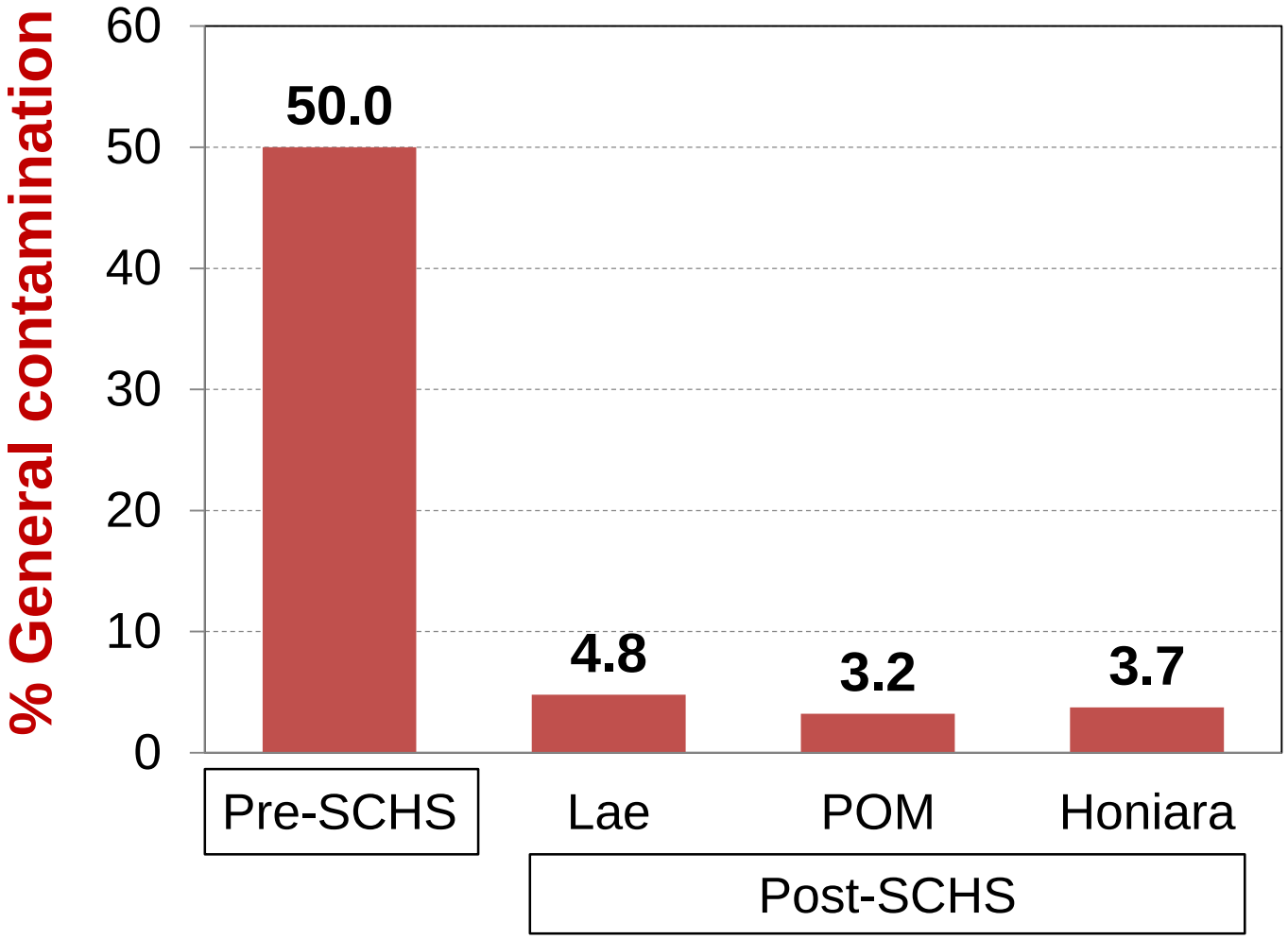
Benefits:

See the report for more information (Brockerhoff et al. 2016)

Sea container hygiene system (SCHS)
(from Pacific Islands to New Zealand & Australia)

- Safer storage of SCs to reduce infestation / re-infestation
- Pre-export inspection
- Cleaning
- Training
- Reporting, etc.

Pre- and post SCHS contamination rates (2006-2007)



Sea container hygiene system (SCHS)
(from Pacific Islands to New Zealand & Australia)

Benefits:

- Greatly reduced contamination rate
- Reduced inspection requirements in NZ (100% to 10%)
- Substantial net financial benefits (NZD)
  - Pre-SCHS: $306,000 inspection ... (~3,000 SCs p.a.)
  - Post-SCHS: inspection rate reduced to 10%
  - Additional treatment requirements less common
  - Ongoing **annual savings ca. $247,300**
  - Reduced contamination -> reduced future pest damage

(MAF 2009, Richards)

Conclusions

- Sea containers are a pathway for movement of contaminating pests and other contaminants
- Even low % contamination translates to many pests
  (2% insect contamination x 600,000 SCs = 12,000 arrivals p.a.)
- Sea Container ISPM is likely to provide net benefits
- As with ISPM 15, a thorough evaluation several years after implementation will allow the assessment of benefits and costs.

Thank you!