Textile Testing Methods for Nets

VCWG Work Stream: Durability of LLIN in the Field

Summary of presentations, discussion and consensus

Lyon, February 2-3, 2012

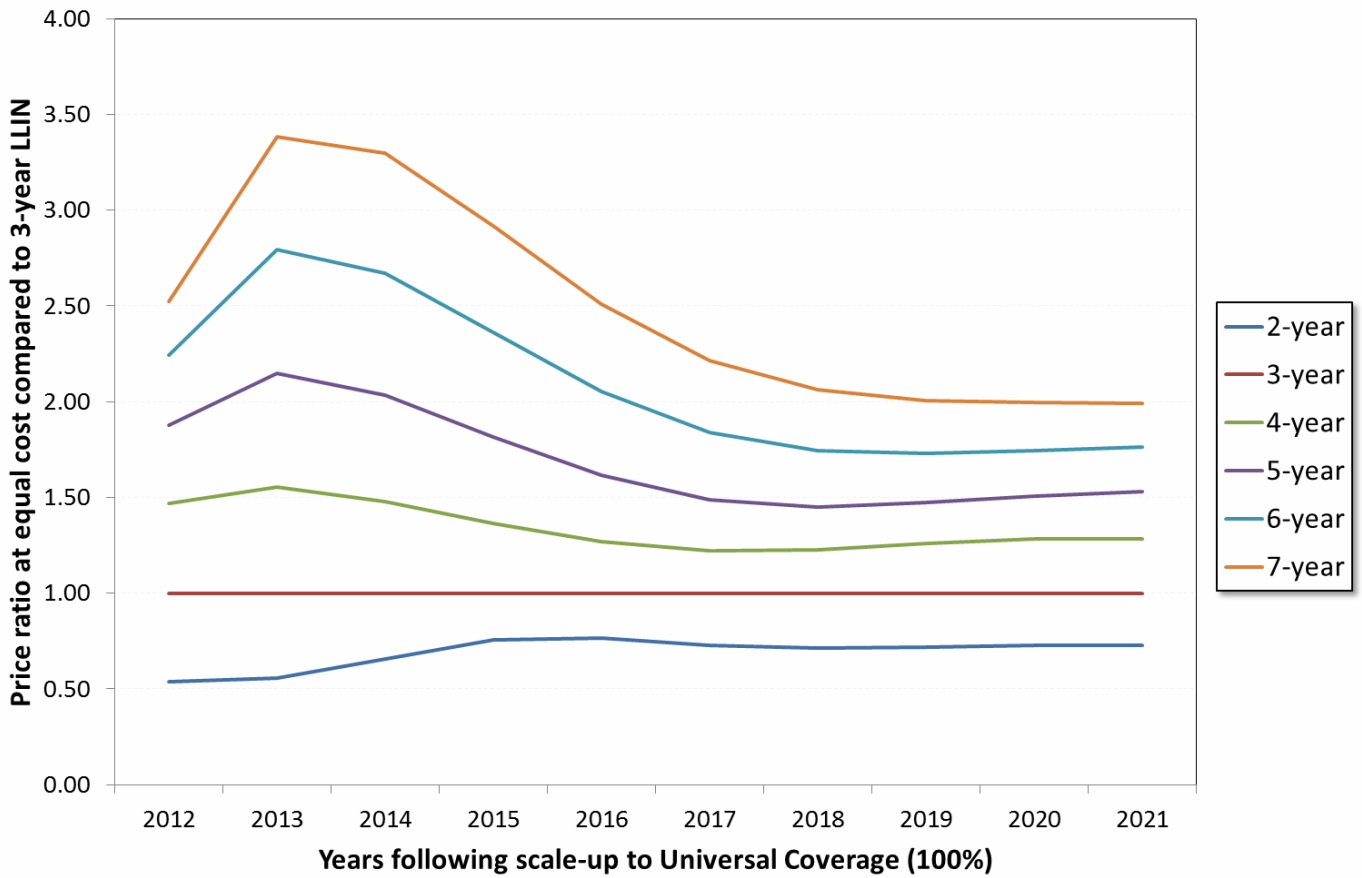
ROLL BACK MALARIA

Background

- Increasing interest in including quality (durability) as a criteria in LLIN procurement
- For this to be possible we need
  - Either
  - Precise and accurate data on cost/useful life
  - Or
  - Lab test(s) that reflect performance in the field and have grouped specifications

Impact of durability on Demand and Cost

Savings could be as high as $ 1billion in the next 5 years for an LLIN with a 5 year useful life and $ 1.5 billion for a 7-year LLIN



Objectives

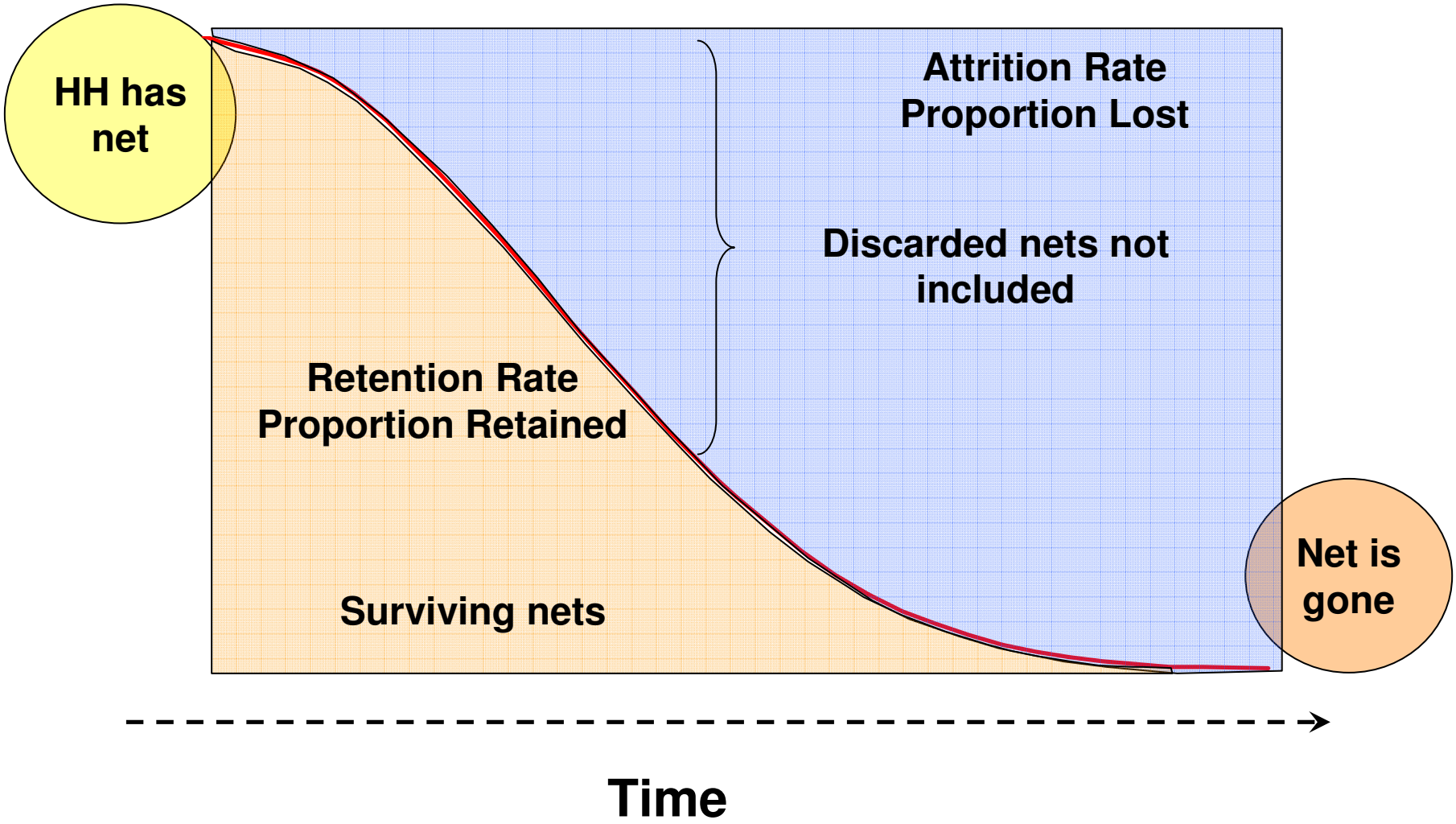
- To understand current conceptual and methodological issues around "durability"
- To review existing options of textile testing that would better reflect the real life situation
- To recommend next steps on how to arrive at improved standards and/or specifications
- To suggest an action plan to obtain sufficient data to define cut-off levels for potential test methods

Outline of Programme

- Define the problem
  - Methods to measure useful life and durability, available data and specifications
- Review options for textile testing and evidence
  - What tests are already being used for nets, what experience or field data exists
- Develop recommendations for action

Methodology: Two components

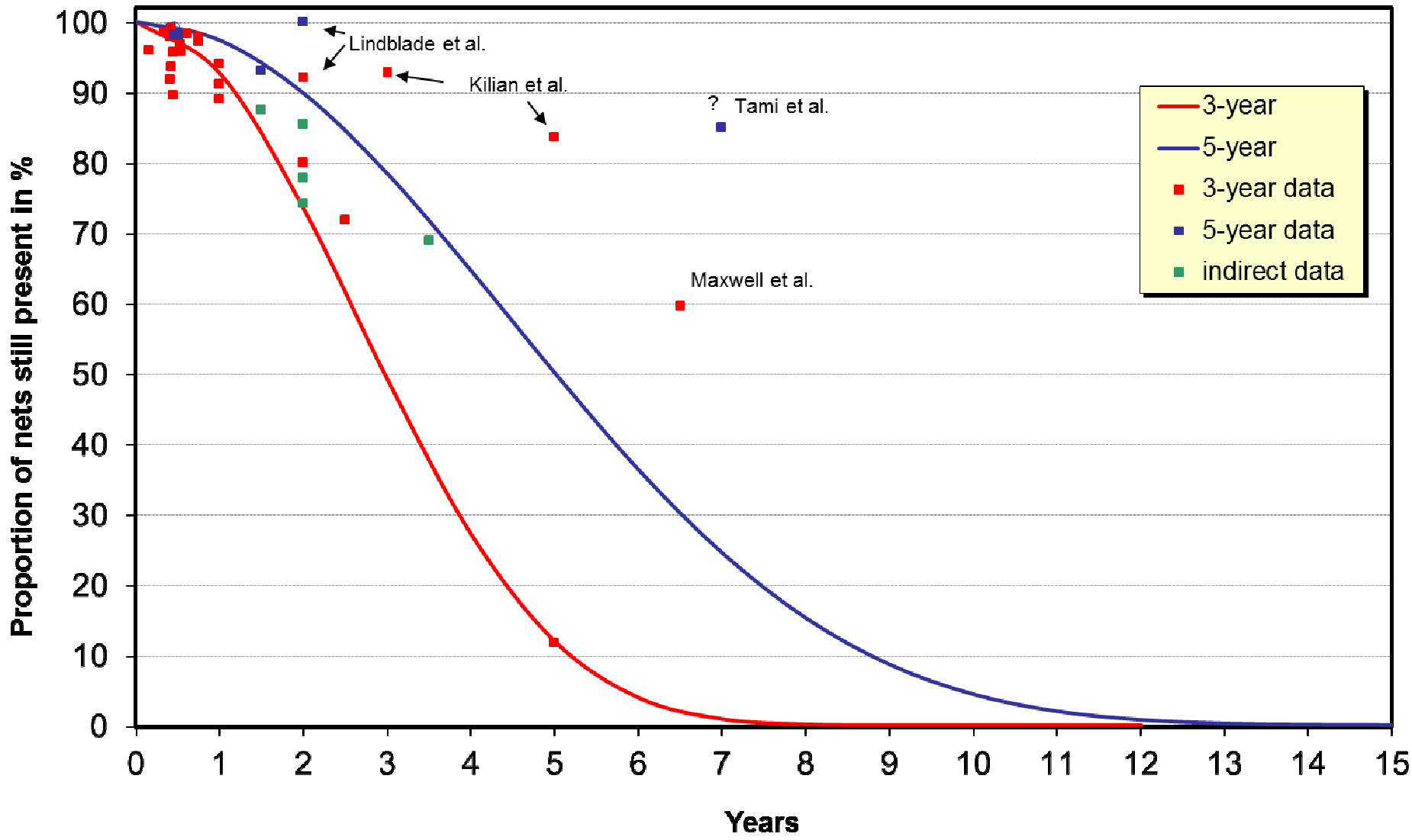
Attrition - Integrity



Field methods

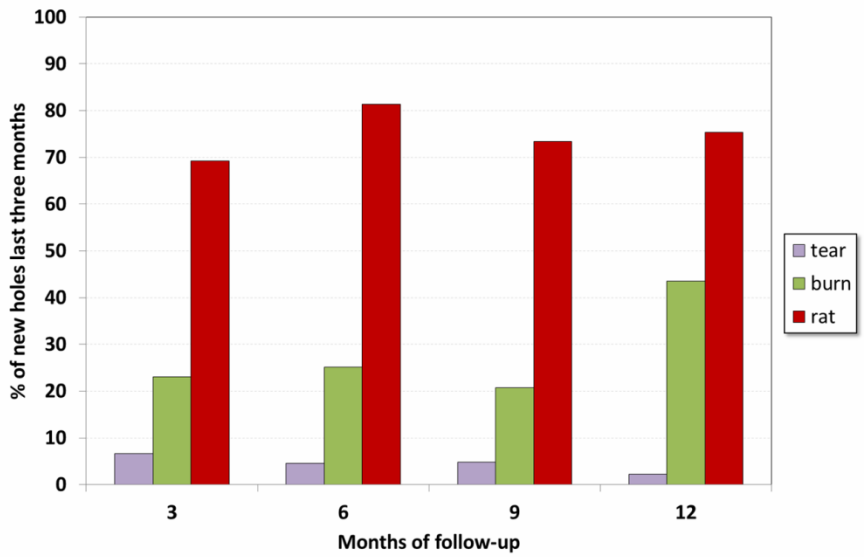
- Always need combination of attrition due to damage and proportion of surviving nets still "functional" or "not too torn"
- Cross-sectional surveys can measure attrition and integrity if done well but have problems with recall
- Prospective studies good to measure integrity but seriously underestimate attrition (nets kept)
- We have currently no good methods to distinguish cause of holes through surveys (need qualitative approaches)

Survival of nets as a function of time



Field data

- There is a high variation of net performance between
  - Geographic areas
  - Between villages (clustering)
  - Within households
- Behavioural and non-product related factors are significant (burn holes – rodents)



Context with textile testing

Lab test on netting

Material, Product

Field use

Behaviour, Environment

Potential Performance

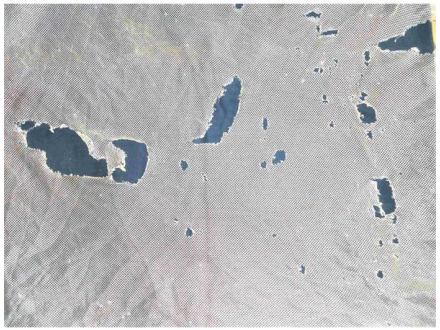
Photo: Sarah Hoibak

Actual Performance

Significant variation
Sampling crucial

Context with textile testing

- Four principal initial causes of holes
  - Tears, burn holes, animal damage, seams



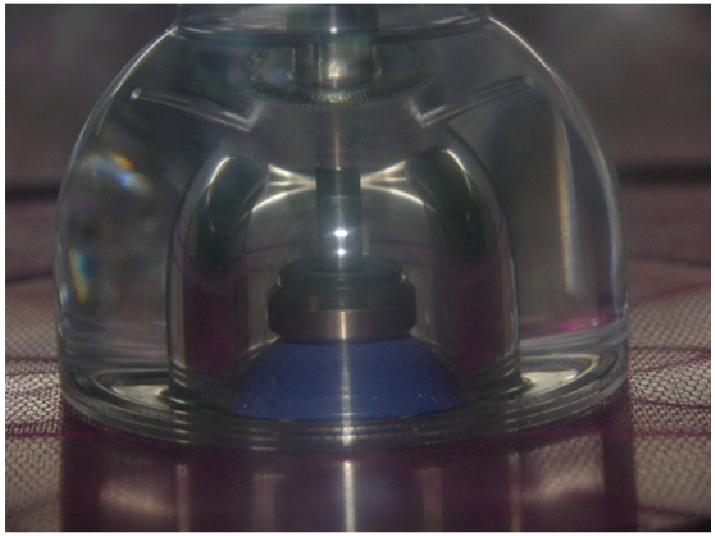
Context with textile testing

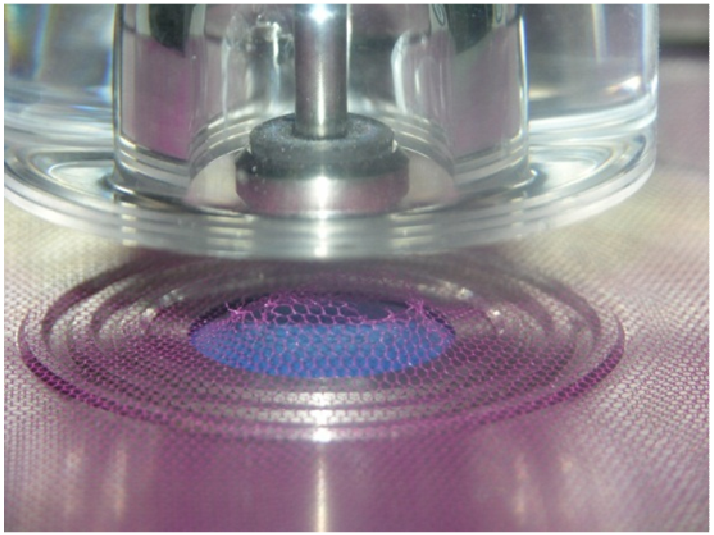
- Four principal initial causes of holes
  - Tears, burn holes, animal damage, seams
- Possible pre-damage through other factors (aging)
  - Heat, abrasion, chemical, UV
- Only if textile testing reflects the dominant stress on net (modes of failure) will there be a correlation between lab results and field data

Textile testing methods

- Many methods exist that can mimic certain stresses on the net … except for animal damage

Bursting test





Source: Ana Paula Fonte, CITEVE

Textile testing methods

- Many methods exist that can mimic certain stresses on the net … except for animal damage

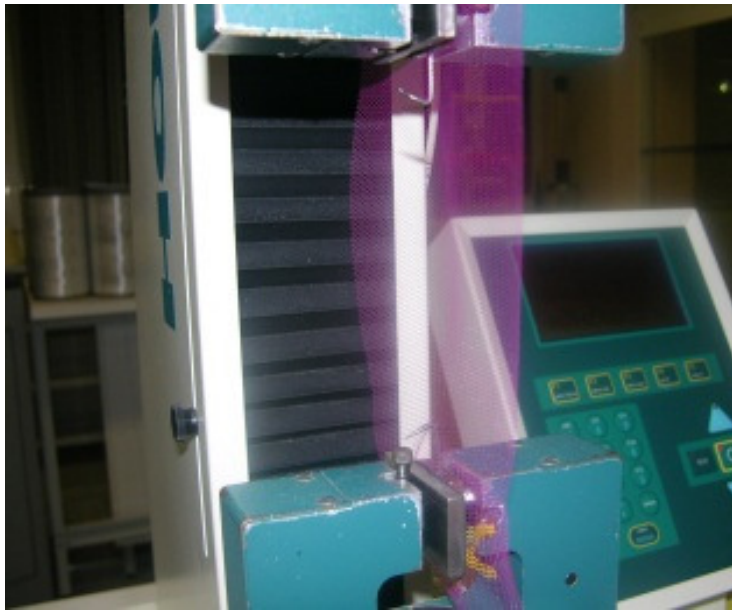
Shrinkage after washing

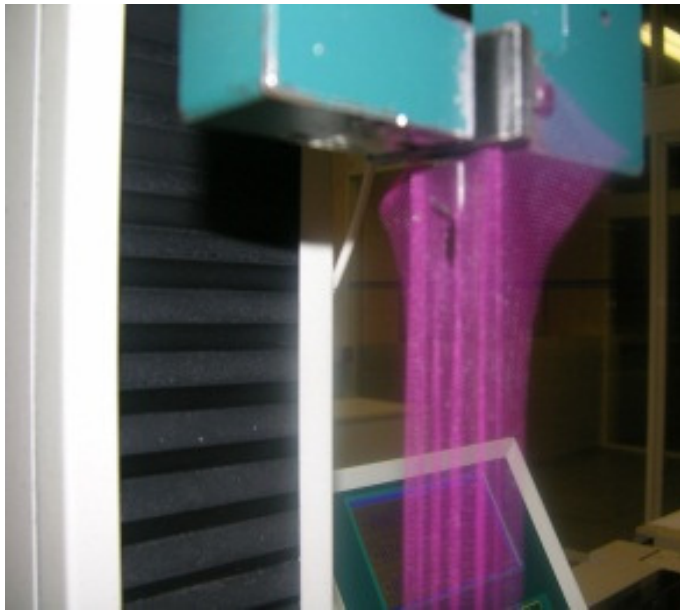
Source: Hartmut Haid, ITV

Textile testing methods

- Many methods exist that can mimic certain stresses on the net … except for animal damage

Tensile test with hook(s)





Source: Ana Paula Fonte, CITEVE

Textile testing methods

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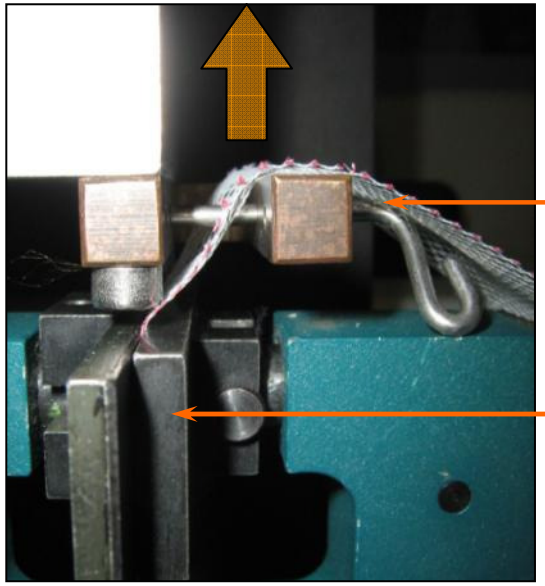
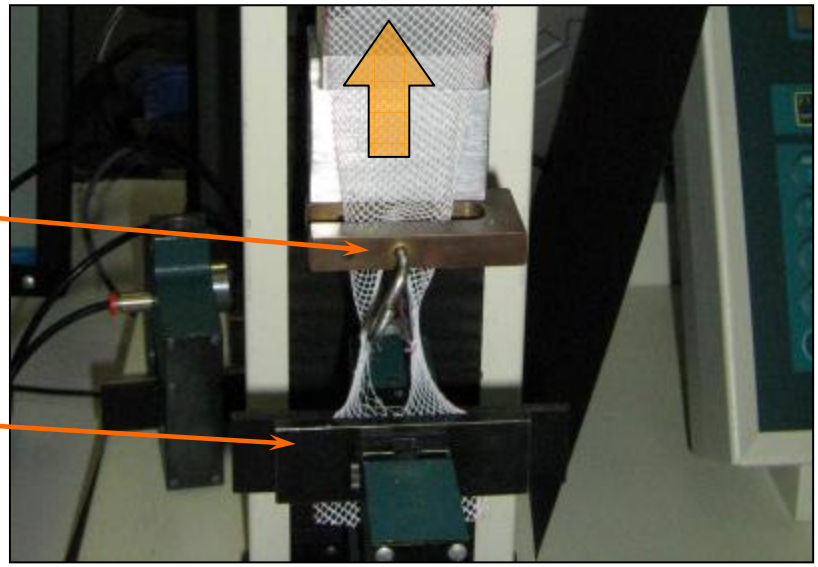
Dynamic or slow nail test



Side view

Nail

Fixed clamp



Front view

Source: Marc Dedieu, IFTH

Textile testing methods

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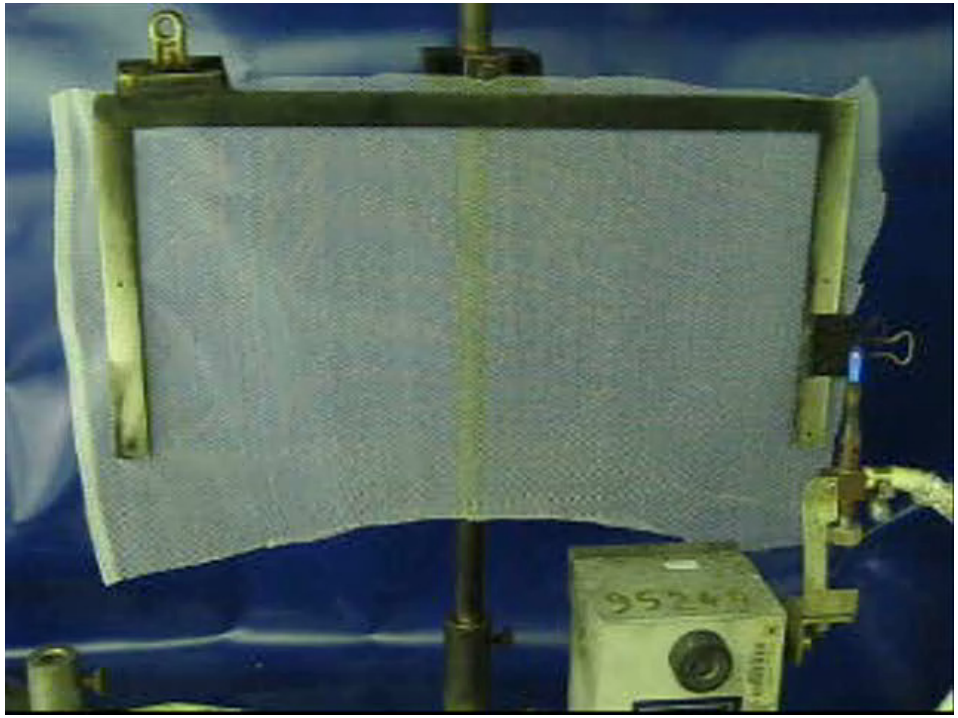
Fire test



Source: Marc Dedieu, IFTH

Abrasion

Source: Ana Paula Fonte, CITEVE

Textile testing methods

- Methods to simulate aging in the lab
  - Weather-o-mat (wet-dry-heat-UV)… but relevant?
  - Stone washing… but easy to standardize?
  - Abrasion + tensile test = Abrasion resistance promising to show vulnerability to damage in a "stressed net"
- Microscopic and spectral analysis of representative samples of nets not too old could give a picture of proportionate distribution of initial damage (complement field data)

Conclusions from field and lab data

- While good progress is made to define methodologies there is still a high level of variation and uncertainty
  - Behavior and rodents
  - Variations in testing conditions
- This explains the current absence of correlation between lab and field data (especially bursting strength)

Potential textile tests

- Textile Experts reviewed potential tests at end of meeting and propose the following as most promising
  - i. Bursting strength (strength and integrity of fabric)
  - ii. Modified hook test to simulate tearing vs. cutting effects.
  - iii. Modified ball-burster test. 3D pull for a net hanging at 90 degrees with stress on a branch and intersection of net.

Potential textile tests

- Textile Experts reviewed potential tests at end of meeting and propose the following as most promising
  - iv. Test for hole-spreading using ball-burster machine. Make a defined cut in net, push through with 1-inch metallic ball, and measure the force it takes to spread a hole.
  - v. If the modified hook test and the ball-bursting tests are used, the traditional tensile test will no longer be necessary.
  - vi. If microscopy shows a degradation of the fibers (size reduced), then conduct a light abrasion test before the above tests

Way forward-action points

- Collect well-defined field data from representative locations ASAP in accordance with WHO-GMP guidelines to be analyzed for attrition, physical condition and tested in lab
- Develop methods (validated field tools) to distinguish cause of holes in the field in early phase of destruction
- Evaluate the actual proportional contribution of each "mode of failure". Then determine suite of (weighted) tests reflecting cause pattern
- Target to have minimal standards (cut-off) for different aspects of net performance set by WHOPES
- Find better ways to define the magnitude of rodent problem and options for interventions