



**University of Padova - DAFNAE Entomology**

# **FROM ARRIVAL TO SPREAD: IMPROVING THE EARLY DETECTION OF ALIEN WOOD BORING BEETLES**

**PhD student: Davide Rassati**

**Supervisors: Massimo Faccoli  
Lorenzo Marini  
Andrea Battisti**



# The PhD experience: why to do it?



**THANKS FOR YOUR  
ATTENTION !!!**

# The PhD experience: why to do it?

1) Because you're doing something most people couldn't do \*



\* ....PAID!

# The PhD experience: why to do it?

- 2) You're doing something that's never been done before getting satisfactions from you work!



Journal of Applied Ecology 2014

doi: 10.1111/1365-2664.12347

## Improving the early detection of alien wood-boring beetles in ports and surrounding forests

Davide Rassati\*, Massimo Faccoli, Edoardo Petrucco Toffolo, Andrea Battisti and Lorenzo Marini

J Pest Sci (2014) 87:61–69  
DOI 10.1007/s10340-013-0499-5

ORIGINAL PAPER

## Trapping wood boring beetles in Italian ports: a pilot study

Davide Rassati · Edoardo Petrucco Toffolo ·  
Alain Roques · Andrea Battisti · Massimo Faccoli



NATURE | RESEARCH HIGHLIGHTS

ECOLOGY

## Boring invaders held at the border

Nature **513**, 462 (25 September 2014) | doi:10.1038/513462c  
online 24 September 2014

# The Phd experience: why to do it?

3) You get to work with very smart people....

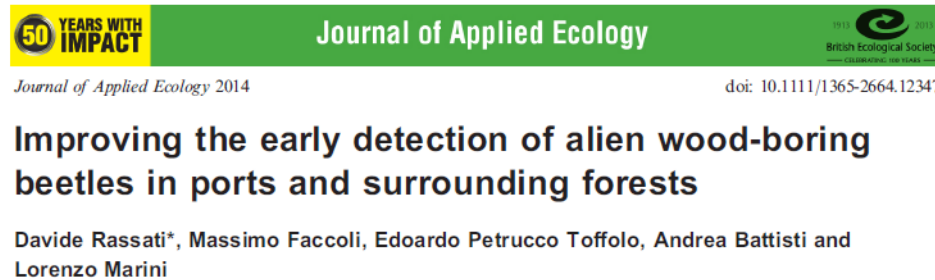


.... but not always!

# The Phd experience: why to do it?

- 4) Because you have an idea and you test if it was good or not!  
And if it was good....

...papers...



...conferences...



...and tons of satisfactions!!!

# The Phd experience: why to do it?

5) Because you learn a lot of cool stuff....



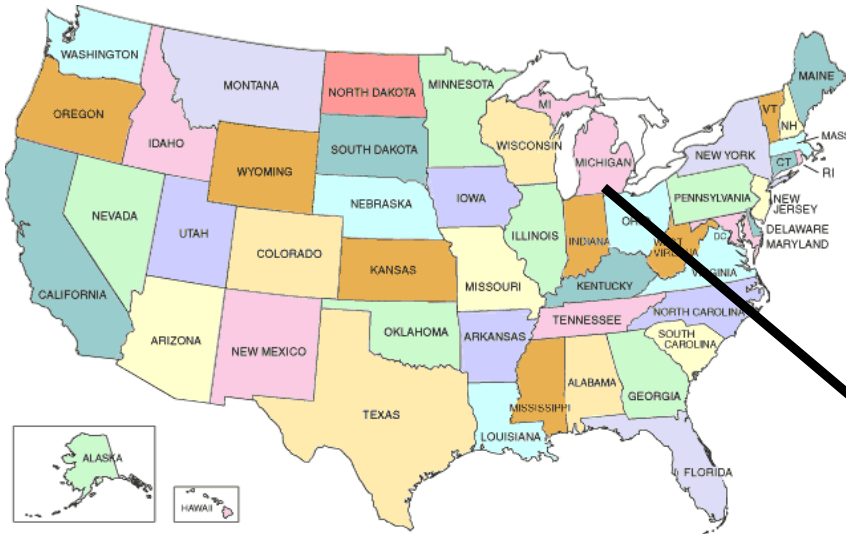
...sometimes in really cool places!!





# The PhD experience: why to do it?

5) Because you spend a period abroad....



**MICHIGAN STATE**  
**UNIVERSITY**

# The Phd experience: why Michigan?

a) Collaboration with:



BOB HAACK (USDA)

Invasive species, monitoring,  
early detection, wood boring beetles



DEBORAH MCCULLOUGH (MSU)

Invasive species, EAB

# The Phd experience: why to do it?

b) American dream:



# The PhD experience: why to do it?

In brief:

- because you spend three years doing what you like most..



- ...with people who become your second family!

**JUST DO IT!!!!**



# Why wood-boring beetles?

- Many species can be destructive



*Dendroctonus ponderosae*

# Why wood-boring beetles?

- Easily transported in timber...



- ...but also in wood packaging materials, crating and pallets!



# Detection of alien wood-boring beetles



**RAVENNA port (ITALY) - Summer 2012**

# Most commonly intercepted families

- Scolytidae

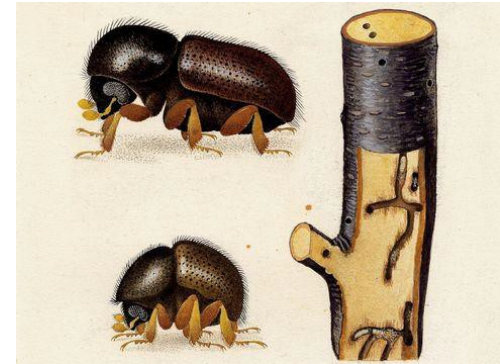
- *Bark beetles*

- bore under the bark
- phloem-feeders
- high host specificity



- *Ambrosia beetles*

- bore into the wood
- trophic specialization with fungi
- highly polyphagous species

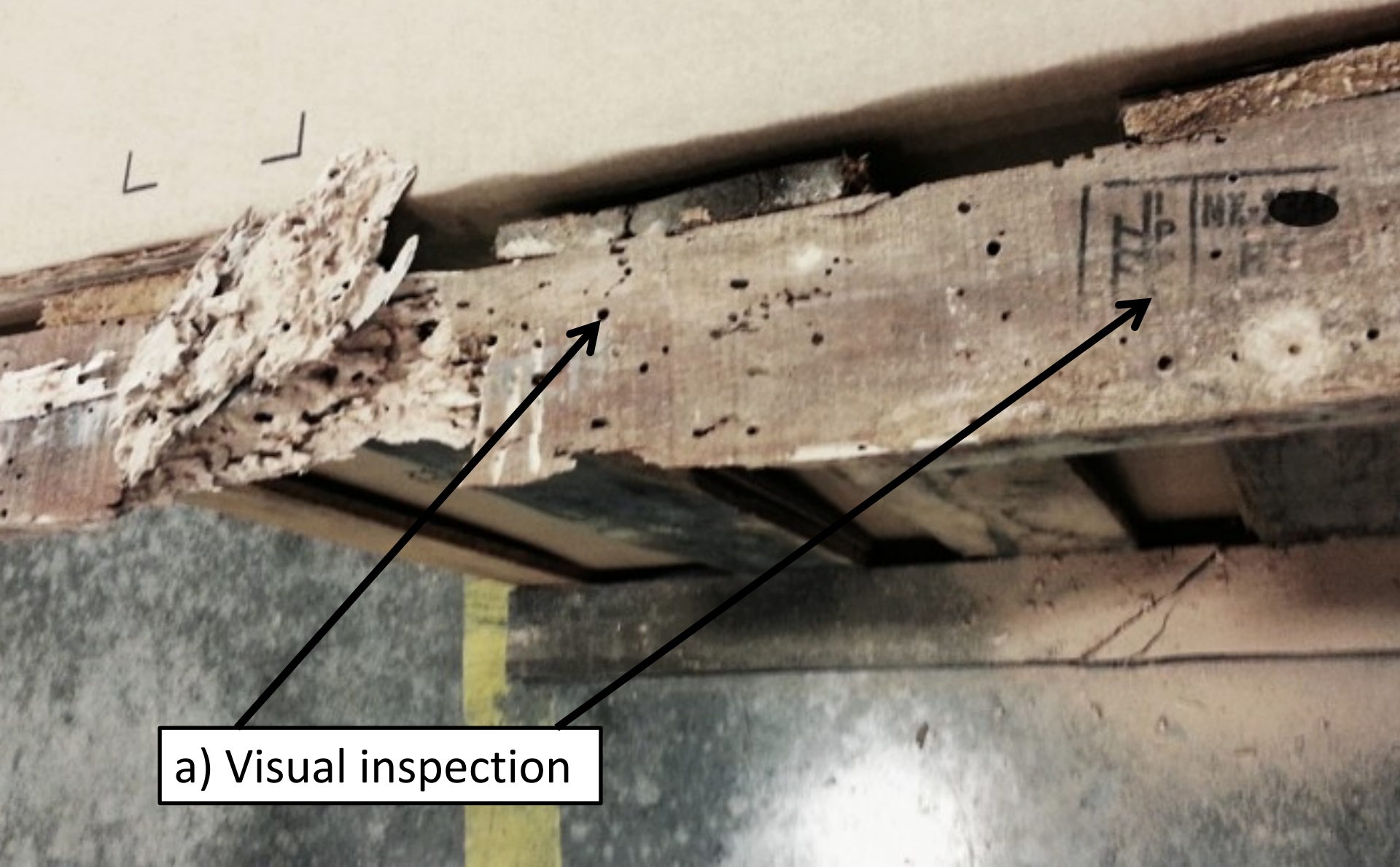


- Cerambycidae, Buprestidae






# Detection of alien wood-boring beetles



a) Visual inspection

# Detection of alien wood-boring beetles

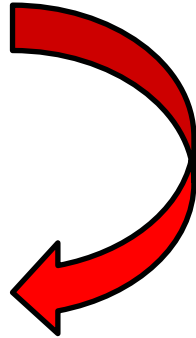


b) Traps baited with attractive lures (e.g. pheromones and kairomones)

(USA, New Zealand, Australia)

# But...

- Limited resources
- High number of sites which should be monitored

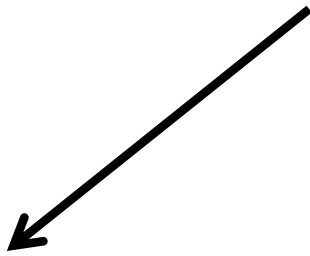


- To develop an efficient trapping protocol
- To concentrate efforts in highest risk sites
- To better understand the invasion process



# Early-detection protocols

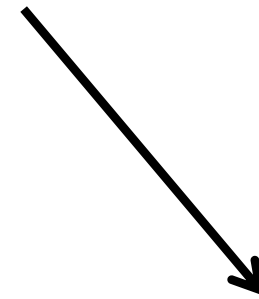
To validate an effective monitor protocol for the survey of alien bark and wood boring that can be used either in ports or forests



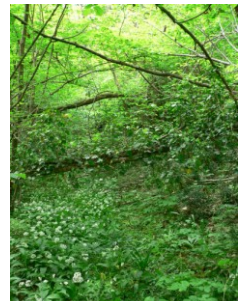
a) Traps



b) Lures



c) Trap position



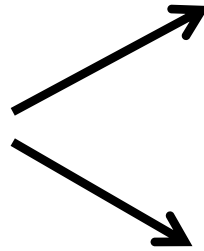
# DEFINING THE TYPE OF TRAPS



# Trap models

How to choose the trap model:

a) Which are the target insects



b) Where the trap are going to be used



Port



Forest

# Traps For Wood-boring Beetles

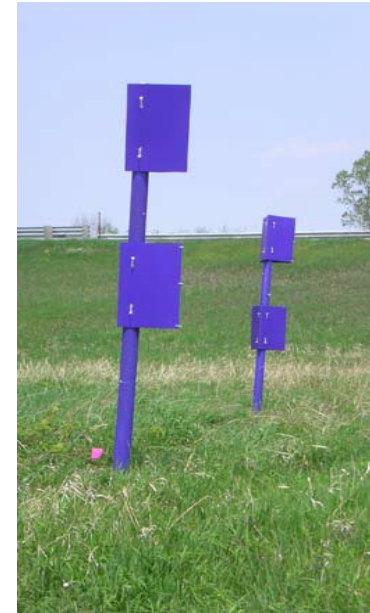
Many comparisons in forests....



**Multi-funnel**



**Cross-vane**



**Double decker**



...but almost nothing have been done at ports of entry!

# Trap comparison in ports

- Year: 2010



- 4 international ports of NE Italy (Marghera, Chioggia, Monfalcone, Trieste)



# Trap comparison in ports

**Cross-vane**

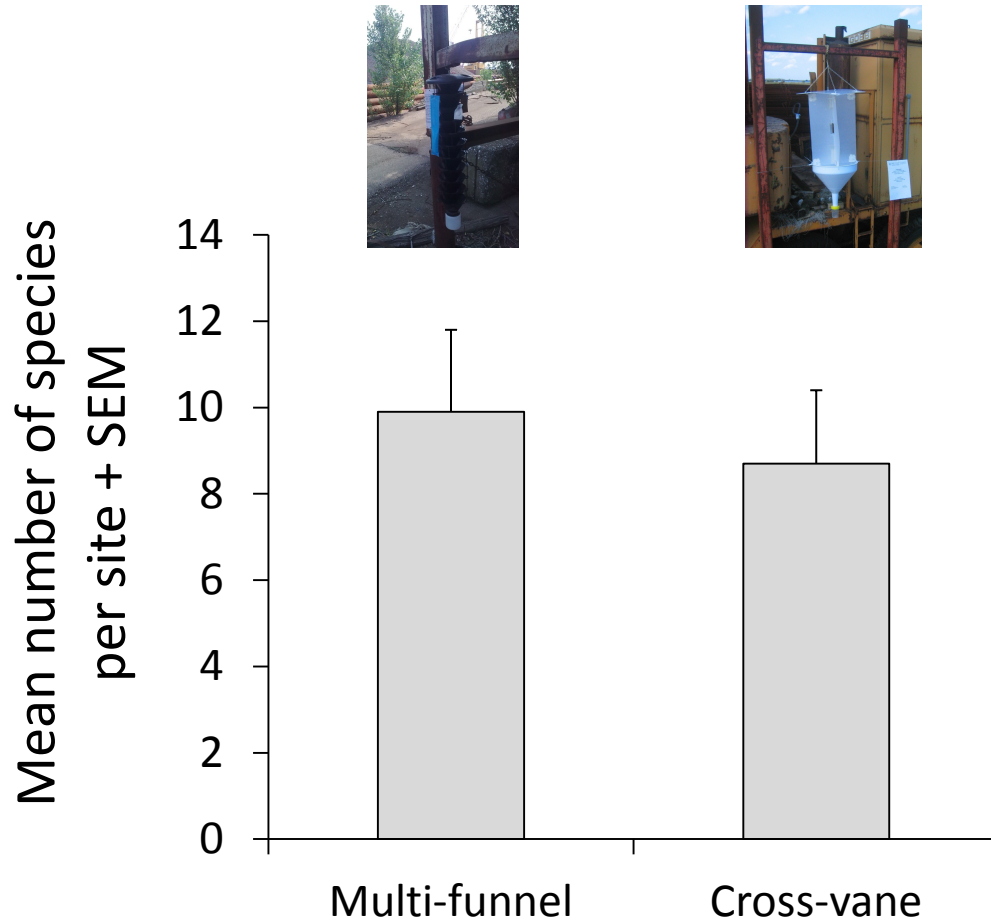


**VS**

**Multi-funnel**



# Trap comparison in ports



- No difference in n° of species
- Multi-funnel more resistant and easier to use

# DEFINING THE ATTRACTIVE LURES



# Type of attractive lures

➤ Generic lures



*Kairomones (e.g. ethanol, methylbutenol,  $\alpha$ -pinene)*



➤ Specific lures



*Pheromones (e.g. ipsdienol, ipsenol)*



# How to choose attractive lures

## How to choose the attractive lures:

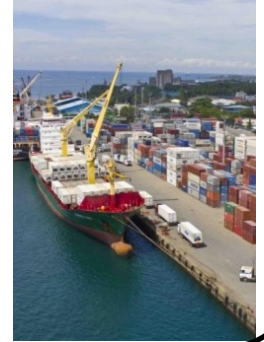
To catch as much species as possible (e.g. alien species early detection)



Generic (+ specific lures)



Kairomones (+ pheromones)



To monitor a target species (e.g. phenology or population density)



Specific lures



Pheromones (e.g. ipsdienol, ipsenol)



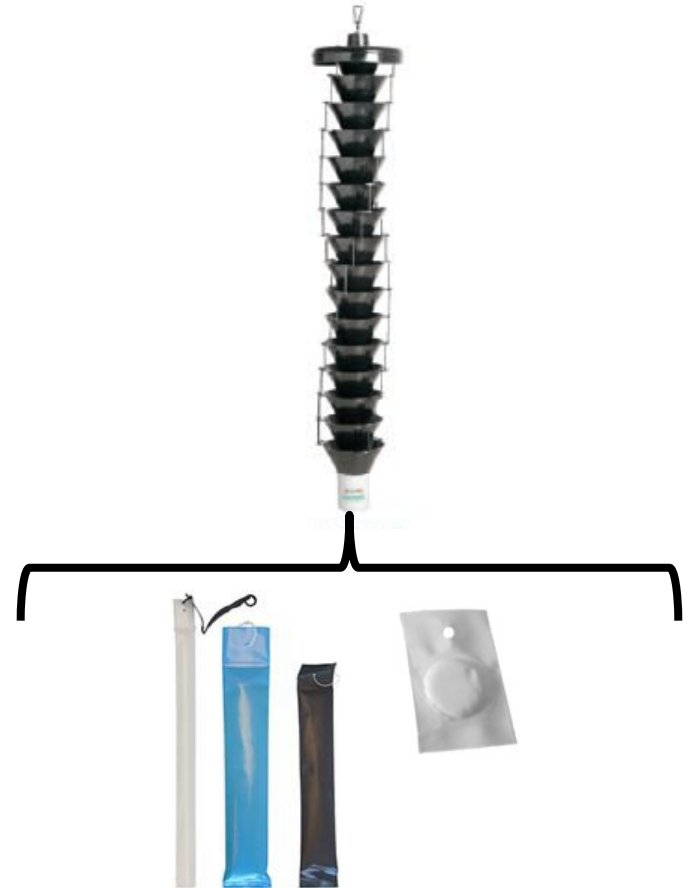
# How to use attractive lures

## Single-lure for WBB



VS

## Multi-lure



- Less traps / Less resources needed
- Are there negative interferences?

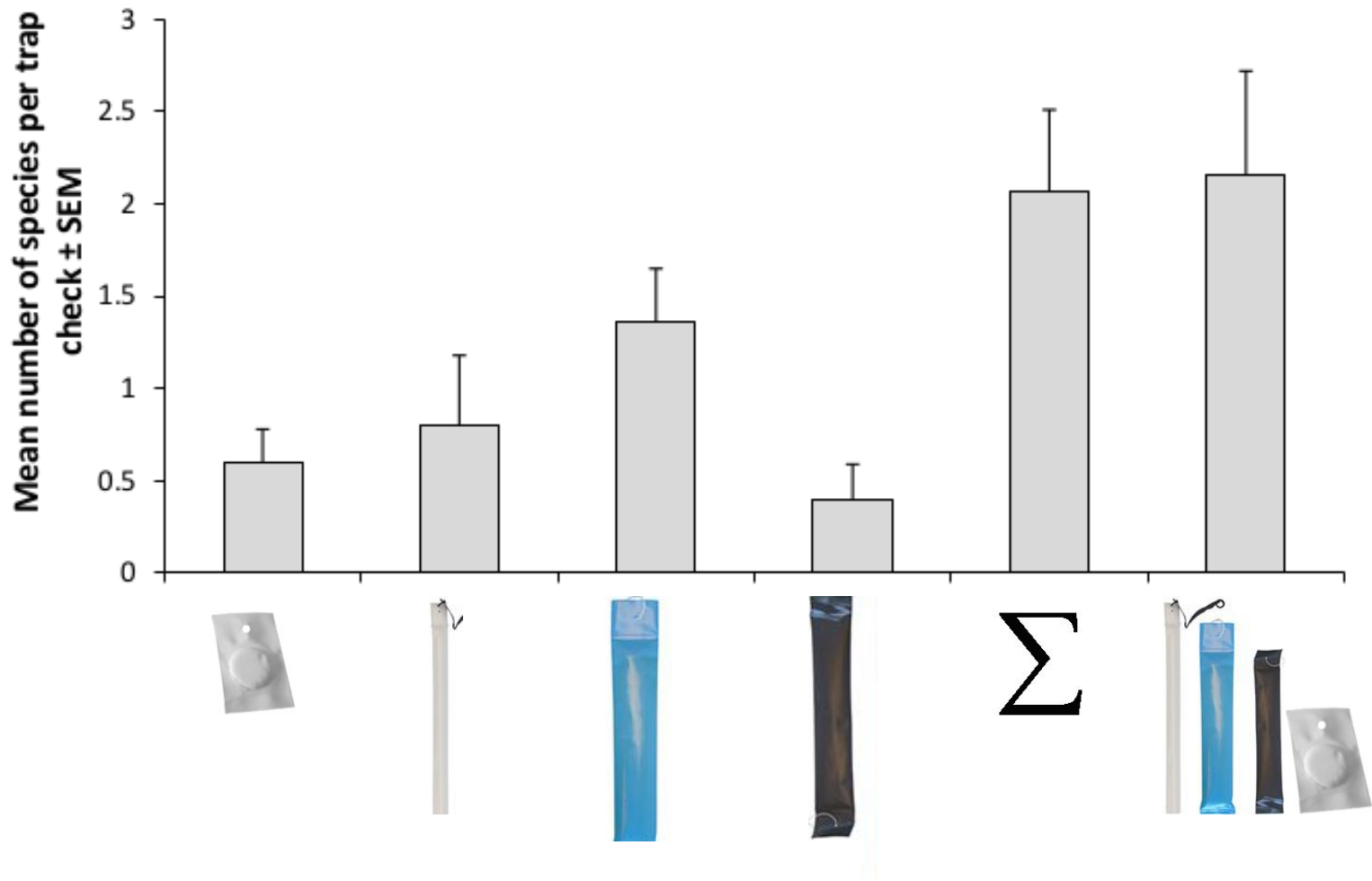
# Lure comparison in ports

- Year: 2009



- 4 international ports of NE Italy (Marghera, Chioggia, Monfalcone, Trieste)

# Lure comparison in ports



- Sum of single-lure catches similar to multi-lure catches



# How to use attractive lures

- Multi-lure better than single-lure for early-detection...
  - less number of traps
  - higher possibility to catch exotic species
  - no negative interferences between lures
- ...but, can the multi-lure replace always single-lure?

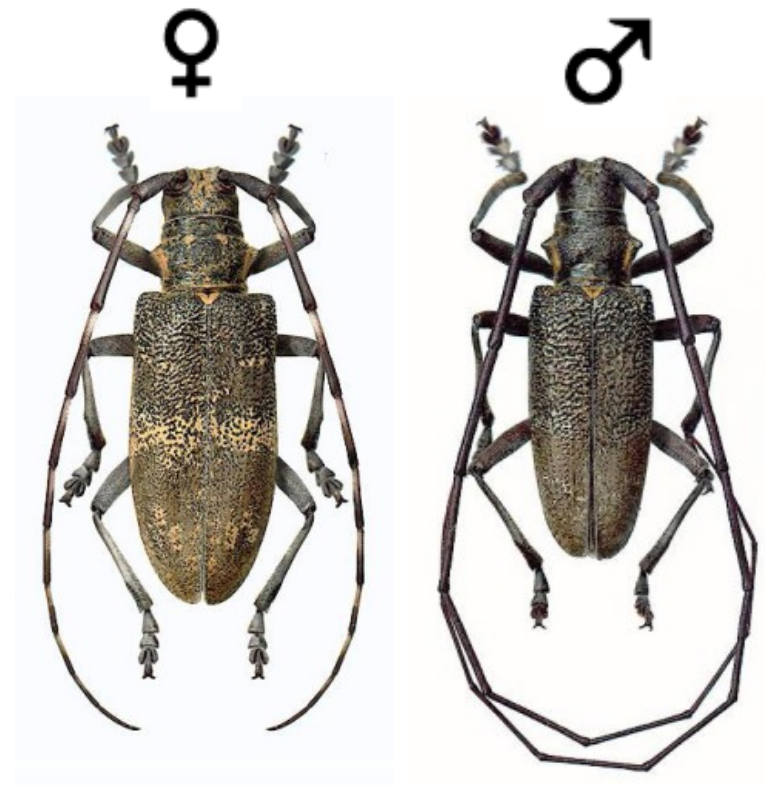
The case study of *Monochamus galloprovincialis*



# *Monochamus galloprovincialis*

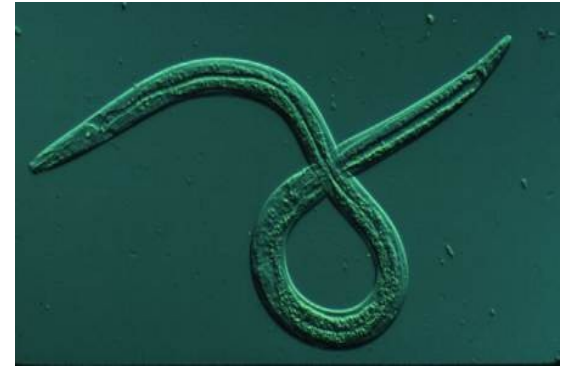
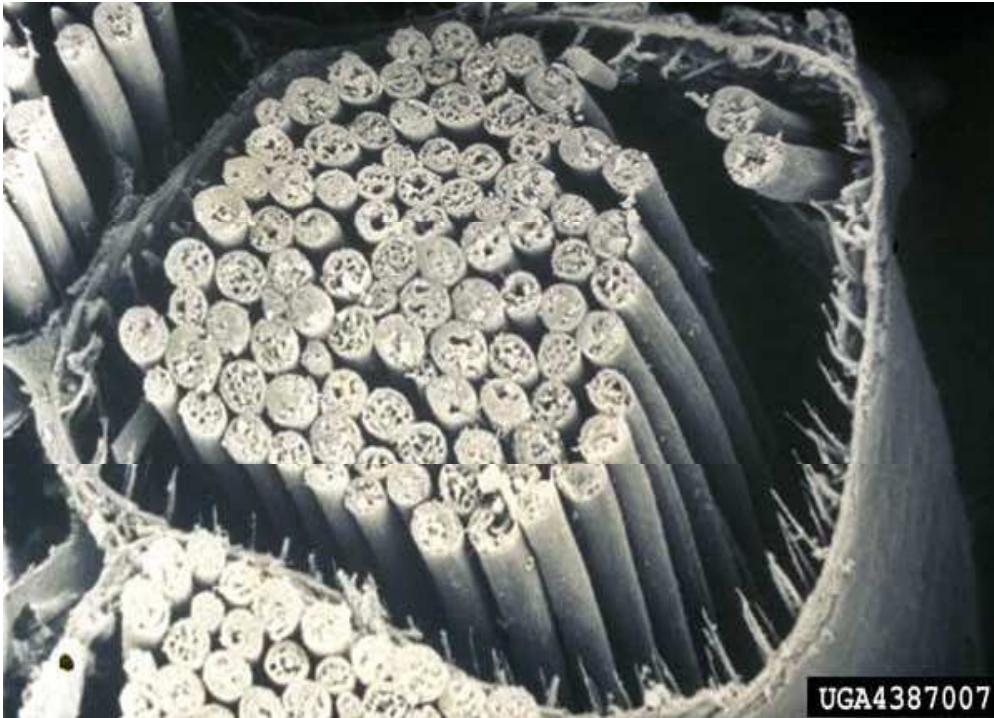
## *Monochamus galloprovincialis* (Cerambycidae : Coleoptera)

- Native to Europe
- 1 generation per year
- Adults active from May to October
- *Pinus* favourite host
- Not a pest
- Vector of the pine wood nematode  
*Bursaphelenchus xylophilus*



# Pine wood nematode

- Native to North America
- Introduced in Europe in 1999 (Portugal)
- Spread thanks to *M. galloprovincialis*



- Responsible of the Pine Wilt Disease

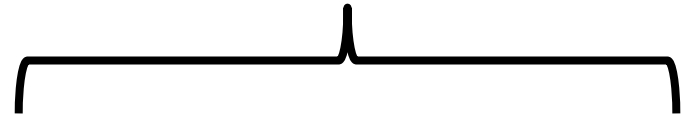
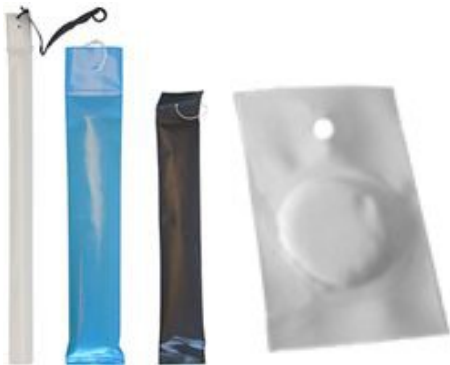
# Attractive lures for *M. galloprovincialis*

## • Generic multi-lure

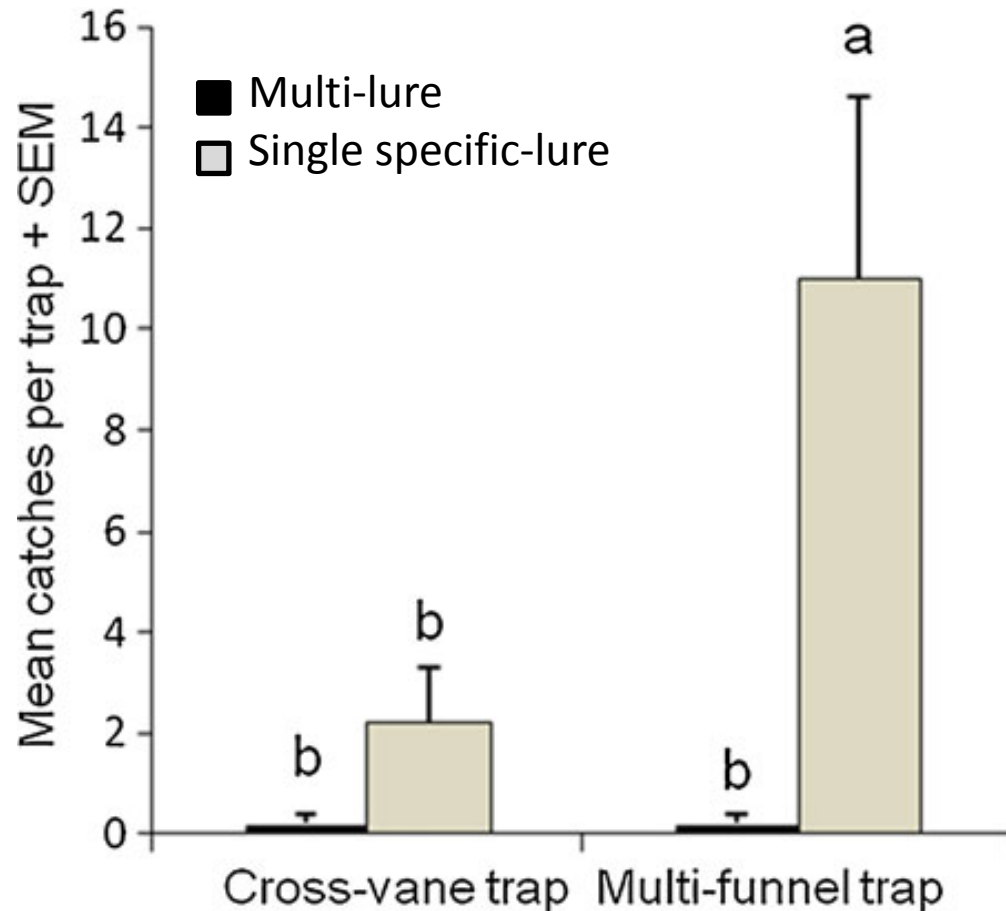


VS

## Specific single-lure



# Attractive lures for *M. galloprovincialis*



- Multi-funnel traps baited with specific single-lure best combination

# Attractive lures for early-detection

- Do I have to catch a target species (e.g quarantine pests)?



Specific single-lure traps  
(when available)

- *Galloprotect*



- Z-3 hexenol



- Do I have to catch as much species as possible?



Generic multi-lure traps

- *Ethanol*

- $\alpha$ -pinene

- methyl-butenol



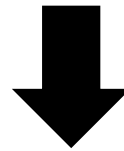
# UNDERSTANDING WHERE TO CONCENTRATE MONITORING EFFORTS IN COASTAL AREAS



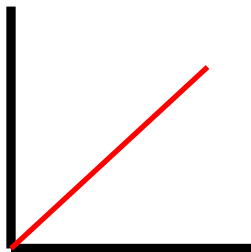
# Objectives

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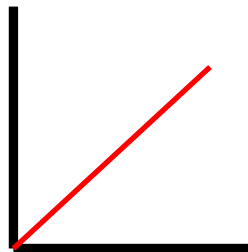
**Q:** Do the size of port or the surrounding environment influence the detection of alien xylophagous species?



## Hypotheses



IMPORT



FOREST  
COVER



BROADLEAF    CONIFER



# METHODS

- **Sampling design (three factors):**

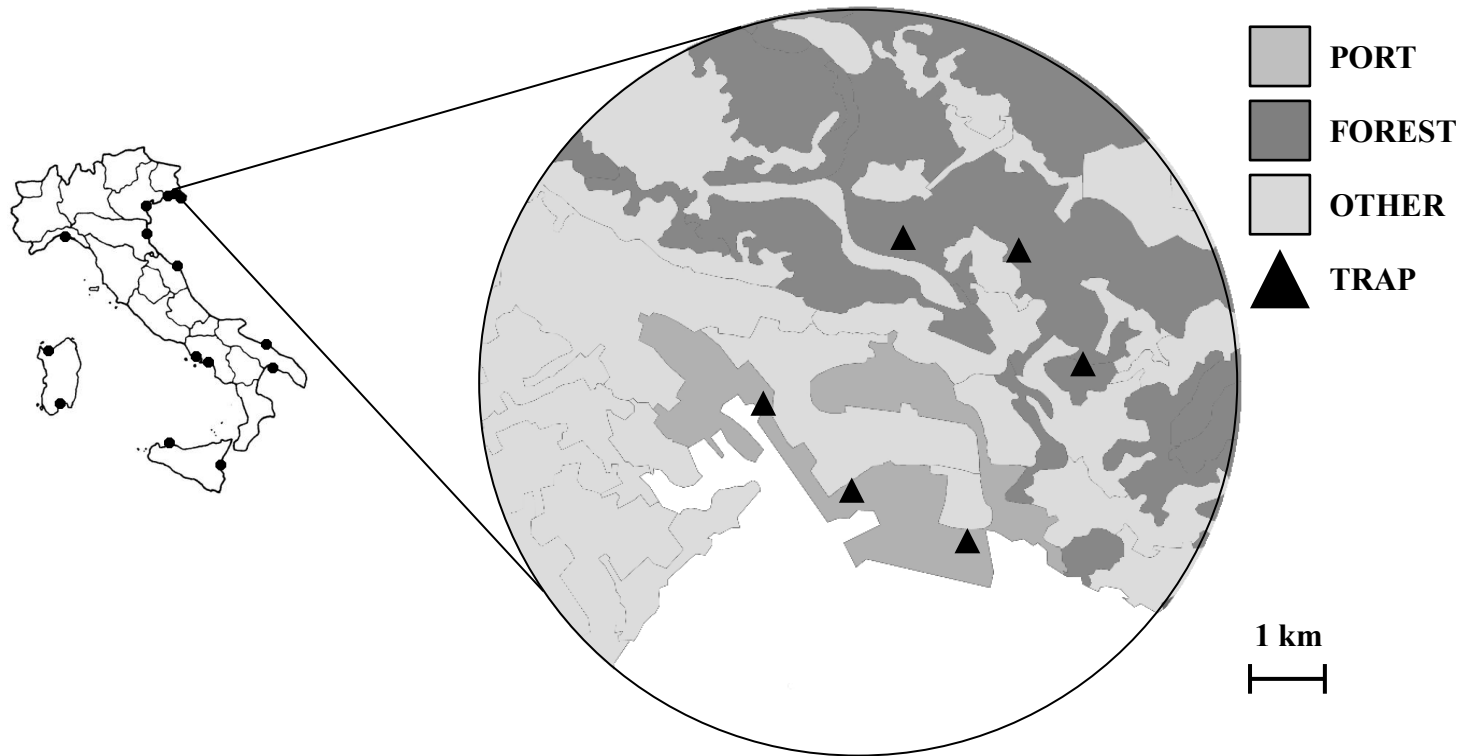
- Millions of tons of commodities imported per year
- Percentage of forested areas within 10 km of the port
- Forest composition (broadleaf vs conifer)

## 15 Italian ports



# Methods

- 6 traps per site (3 in port / 3 in surrounding forest)

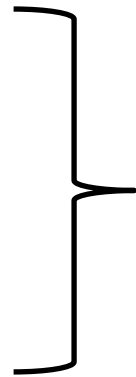


- Checked beweekly
- May – September 2012

# Results

- **67** native species

- **14** exotic species



40374 individuals

- **8** established

- **2** previously intercepted

- **4** new to italy



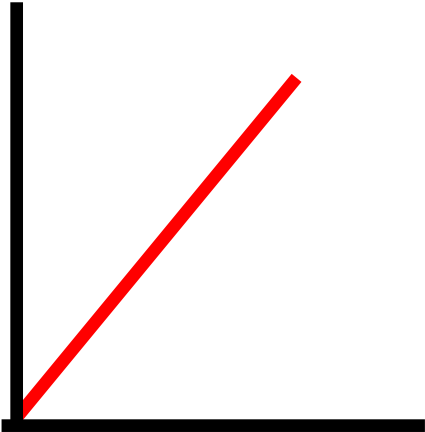
*Cordylomera  
spinicornis*

# Results

- **Import**



Number of  
alien species



Import



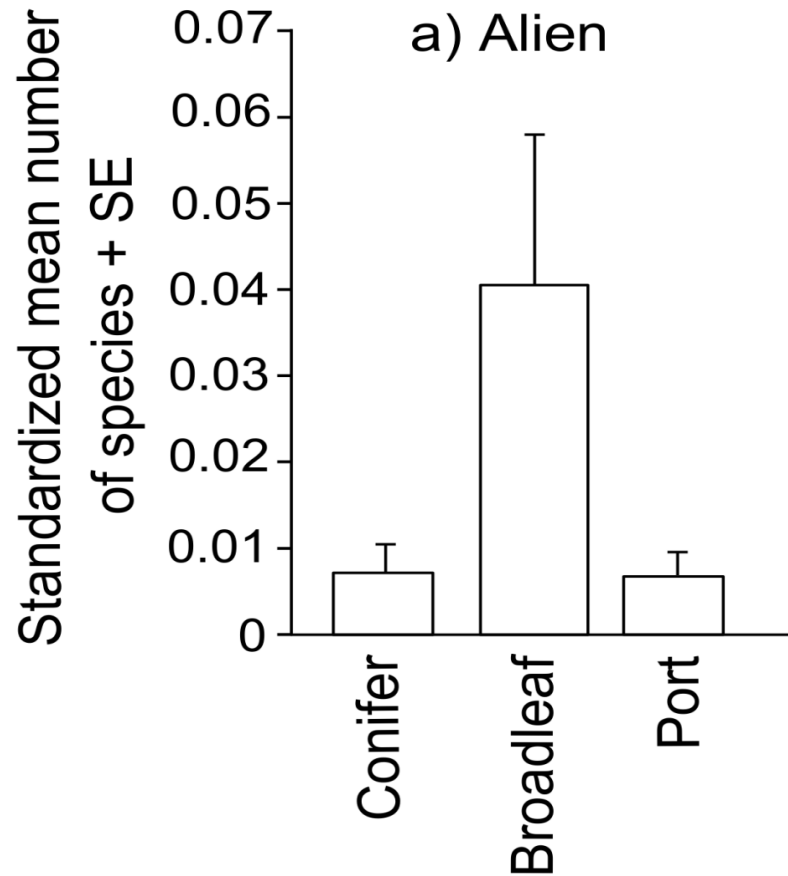
- **Forest Cover**



No effect



# Results



- More alien species in surrounding forests
- More alien species in broadleaf than conifer forests

# Conclusions

## Monitoring efforts in coastal areas should be focused:

- in ports with higher import volume



- in surrounding broadleaf forests



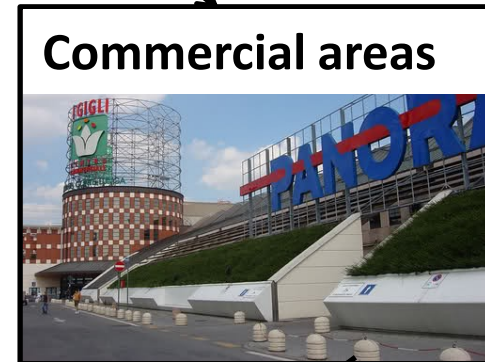
- using traps simultaneously in both environments



# **UNDERSTANDING WHERE TO CONCENTRATE MONITORING EFFORTS IN CONTINENTAL AREAS**



# Background





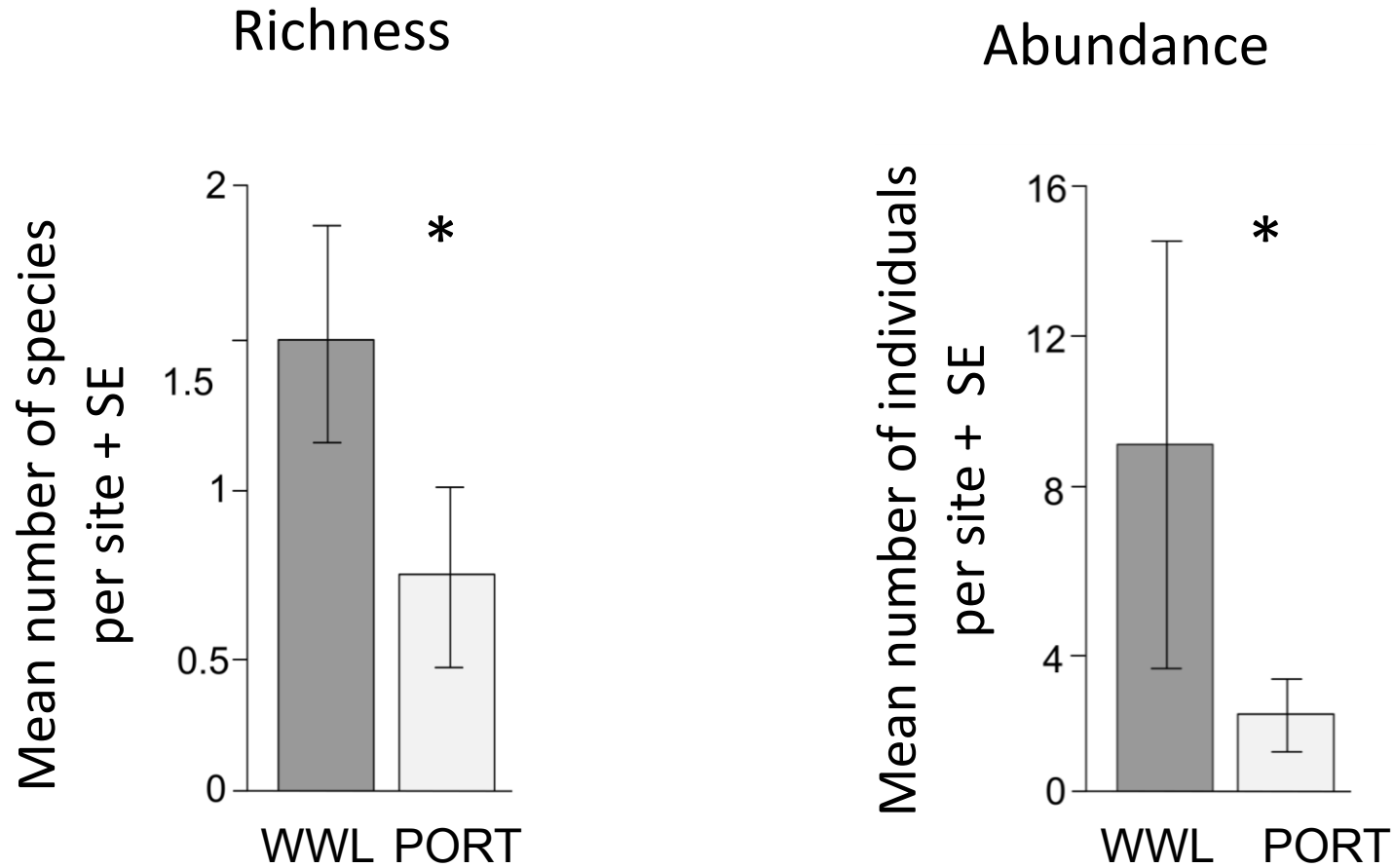
# Methods

- Multi-funnel traps baited with multi-lure blend
- 6 traps per site: 3 in port / 3 in wood waste landfill (WWL)
- Traps checked biweekly
- June/ October 2013

**11 Italian towns**



# Results

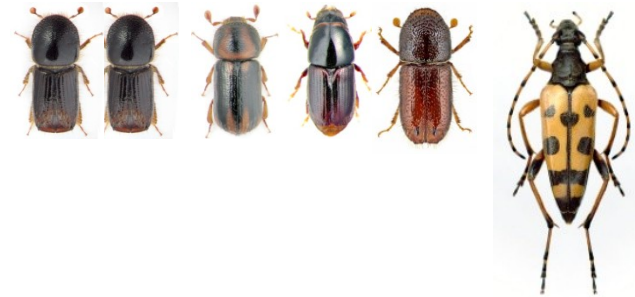


- More alien species and individuals in WWL than in ports

# Results



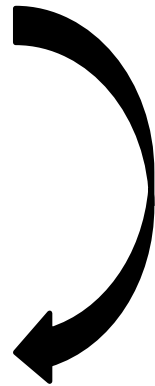
VS



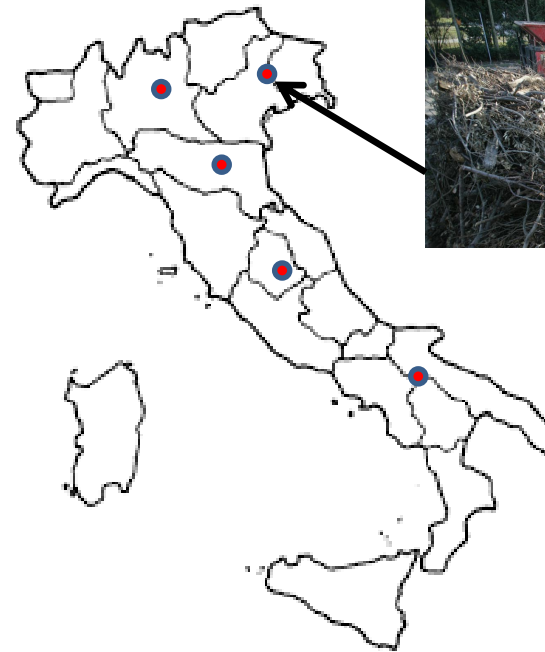
- Exotic species communities similar in WWL and port

# Conclusions

- Species richness and abundance higher in WWL than ports
- Wood-boring beetles communities similar in WWL and ports



Monitoring WWL to enhance the efficacy of early-detection in continental areas



**THANKS  
FOR  
YOUR  
ATTENTION**

