

# Monitoring Sites and Collections for Pest Activity

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Michael C. Carlos Museum, Atlanta, Georgia

# Why monitor?

- Helps keep your collections safe!
- Prevention is key
  - Saves money
  - Some insect damage severely impacts the integrity of heritage objects
  - Keeps an infestation from spreading
  - Builds awareness in staff of overall collections care

# Where to start?

- Writing an IPM policy with guidelines for monitoring
- It will take a while to figure out what is normal for your site
- Consider the first year as your baseline
- Start with a weekly monitoring program (esp. during summer months), can be backed off to bi-monthly if low insect activity is consistently noted

# Insects Gain Access...

- Through:
  - Doors
  - Windows
  - Gaps in walls
  - Holes
- Come in with:
  - People
  - Artefacts
  - Plants / Flowers
  - Packing materials
  - Storage materials

**Where to look**

**How to look**

**What to look for**

- If you're just starting your IPM program start with a survey of your building from the top down

Check for any small entry points or holes in:

- The roof
- Window sills
- Door frames
- Degraded weather-stripping
- The base of exterior walls



## Concentrate on dark, undisturbed places

- Back / underside of exhibit cases
- Undisturbed storage boxes for high risk artifacts (natural fibers, textiles, furs, wool, and leather)
- Inside artifacts i.e., wooden furniture

- Check the base of the hairs on taxidermy and fur



*Insect damaged taxidermy from the Brighton Museum, U.K.*



## Case Study: Pest activity at Cambridge Galleries



Angelika Werth. *Ode to Isobel Stanley and Hayley Wickenheiser*. 2003.  
Collection of Cambridge Galleries, Canada

## Case Study: Pest Activity at Cambridge Galleries



Cambridge Galleries Fine Art Vault

# Check Catchment Areas

- Windowsills
- Ductwork
- Air conditioning filters

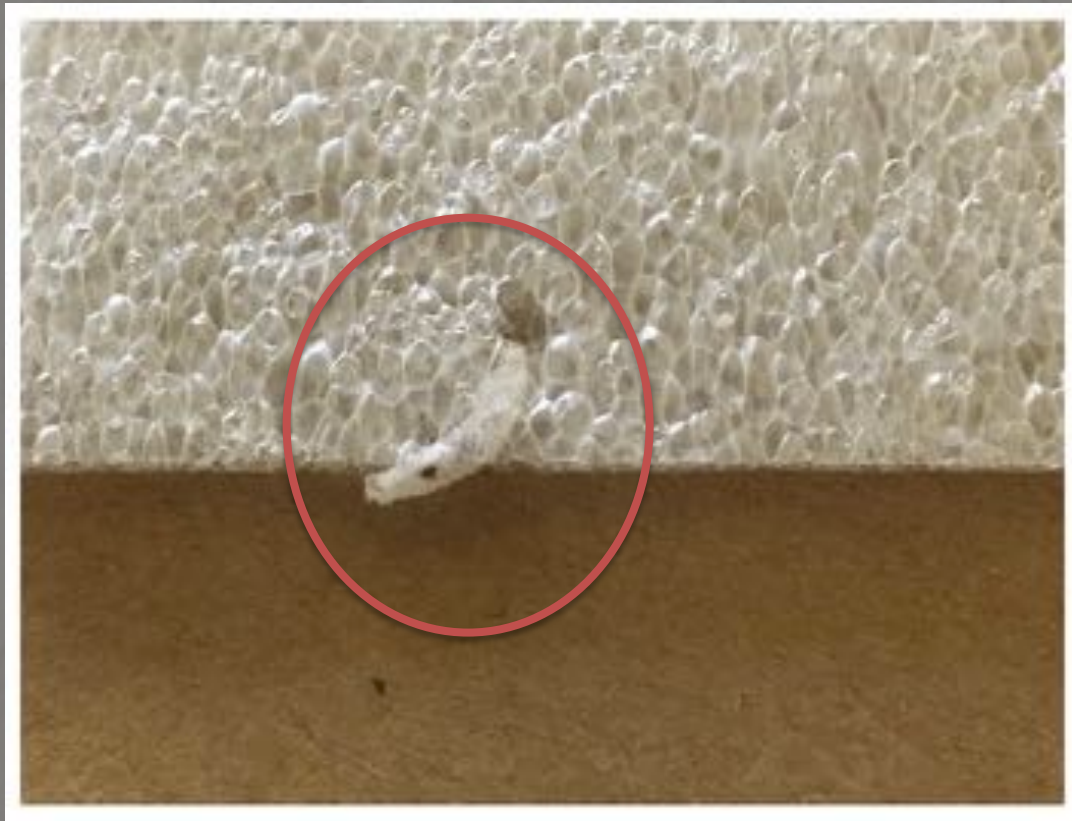


# Evidence of Pest Activity

- Live / dead insects
- Casings, insect parts
- Frass (it can look like the material they were eating i.e., wood boring insect frass can look like sawdust)
- Webbing
- New bore holes / exit holes
- Greasy marks (can be evidence of rodents)
- Shredded materials used in rodent nests



Webbing clothes moth casing in ethafoam tray liner from the American Museum of Natural History



Webbing clothes moth casing in ethafoam tray liner from the American Museum of Natural History



Furniture beetle frass and exit holes



Insect damaged study specimen from the Canadian Museum of Nature





Insect damaged study specimens and labels from the Canadian Museum of Nature

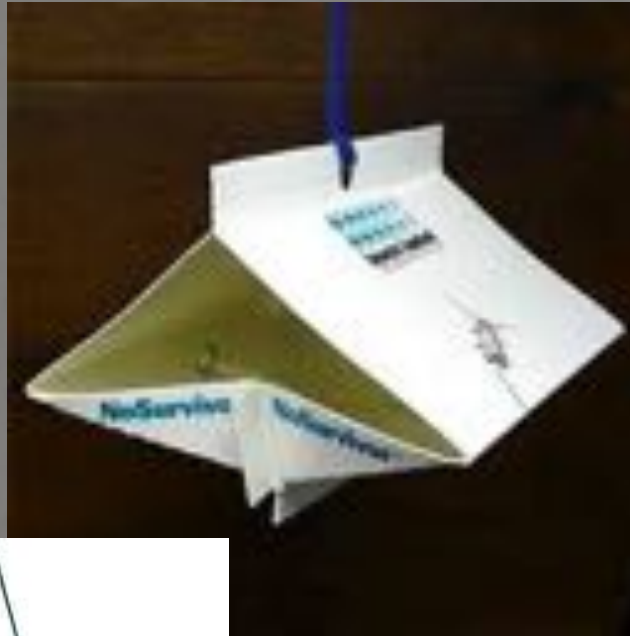
# Good Housekeeping...

- Will make it much easier to detect a new problem vs. old frass / casings
- Will help deter pests as bugs LOVE dust
- Dead bugs can be food for live bugs

# Monitoring Equipment/ Kit

- Pencil
- Clip board
- A method for capturing the information (notebook, laptop, tablet, etc.)
- Polyethylene bags
- PPE (nitrile gloves, dust mask, ventilator)
- Flash light
- Environmental monitors
- Traps...

# Selecting the right trap...



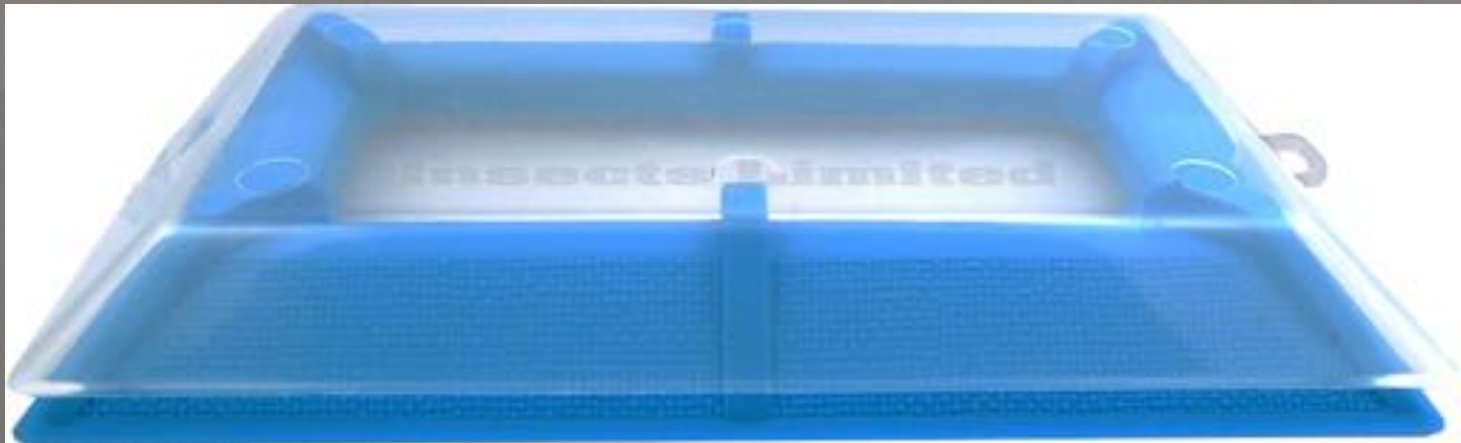
# Blunder / Sticky Traps

- Great for institutions just starting their IPM program
- Will catch any insect that “blunders” in to it
- Should be replaced every two months (or before that if it’s full) to ensure the glue hasn’t dried out



# Pitfall and Funnel Traps

- Use gravity and a non-friction surface to trap crawling insects
- Used with a pheromone lure
- Great for dusty areas where blunder traps are ineffective



# Hanging Traps

- Used with pheromone lure for moths and flying beetles



# Bucket Traps

- Also hangs, uses lure to attract pests and slippery surface to prevent escape





# Light Traps

- Stun / explode pests when they enter
- Destroys insect so you can't identify / track pests that are attracted to trap



# Case Study: UV Light Traps at the Canadian Museum of Nature



*Photo courtesy of the Canadian Museum of Nature*

# Rodent Traps



# Pheromone Lures

**Pheromones**- chemicals released by insects to communicate behaviors i.e. mate attraction, foraging for food, and defense

- Pheromones are species specific



# Pheromone Lures

- Come in a wide variety of forms i.e., on tapes, in vials, in flakes, in gels
- You get what you pay for!
- Delivery method must be similar to natural concentration and release rate of species
- Some insects will be repelled by too much pheromone

# Pheromone Lures

## To Use:

- Identify the bug you want to trap
- Find out if there is an available pheromone
- Try to keep entry points closed in the room you are monitoring
- Keep the lure at least 15 feet away from any regularly used doors

# Pheromone Lures

## To Use:

- Set up traps in grid pattern and adjust as you monitor to help pinpoint source
- Remove pheromone from packaging using tweezers and/or gloves (nitrile) and immediately place in trap, never in contact with a collection item, storage container, or display mount

# Commercially Available Pheromone Lures

- **Moths**

- Almond Moth, *Ephestia cautella*
- Angoumois Grain Moth, *Sitotroga cerealella*
- Brown House Moth, *Hofmannophila pseudospetella*
- **Casemaking Clothes Moth**, *Tinea pellionella*
- Indian Meal Moth, *Plodia interpunctella*
- Mediterranean Flour Moth, *Ephestia kuehniella*
- Tobacco Moth, *Ephestia elutella*
- **Webbing Clothes Moth**, *Tineola bisselliella*

- **Beetles**

- **Black Carpet Beetle**, *Attagenus unicolor*
- **Brown Carpet Beetle**, *Attagenus elongatus*
- **Cigarette Beetle**, *Lasioderma serricorne*
- **Hide Beetle**, *Dermestes maculatus*
- **Furniture Carpet Beetle**, *Anthrenus flavipes*
- Guernsey Carpet Beetle, *Anthrenus sarnicus*
- Larger Grain Borers, *Rhyzopertha dominica*
- Lesser Grain Borer, *Prostephanus truncatus*
- Red and Confused Flour Beetles, *Tribolium spp.*
- **Varied Carpet Beetle**, *Anthrenus verbasci*
- Warehouse Beetle, *Trogoderma spp.*



# Where to Buy Traps

- Hardware store (rodent traps, basic blunder traps)
- Museum / archival suppliers
- Specialty pest monitoring companies

# Record Keeping

- Many different ways to keep track of your findings and trap locations
- Will allow you to compare month to month, year to year and identify spikes in activity
- Obtain a floor plan to map out trap locations

Integrated Pest Management 2018

File Edit View Insert Format Data Tools Add-ons Help Last edit was made 7 days ago by Martha Horton

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Location	A	B	C	D	E	F
1	Location	# Alive	# Dead	Type of pest/insect		
2	SC & UA 8th floor - Emergency Exit		1	Silverfish, larva		
3	SC & UA 8th floor - Stacks, front door		0	0	0	
4	SC 8th floor - A & B Room, Garbage Area	N/A trap missing	N/A trap missing	N/A trap missing		
5	SC 8th floor - Stacks, vault under desk		0	0	0	
6	SC Kislak Center - Kitchen		0	0	0	
7	SC Kislak Center - Case 5		0	4 Flying Ant (1), Gnats (2), Earwig (1)		
8	SC Kislak Center - Back Door		0	2 Spider (1), Gnat (1)		
9	SC Kislak Center - Case 9		0	3 Ant (1), Moth(1), Gnat(1)		
10						
11	OHC - Digital Room, door		0	1 Silverfish (1)		
12	OHC - Digital Room, stacks door		0	0 N/A		
13	OHC - Stacks, 55 B9 (near PEM)		0	0 N/A		
14	OHC - Cuban Exile Newspaper, backrow near 43A10		0	0 N/A		
15	OHC Stacks, Near row 1, oversize		0	1 Silverfish (1)		
16	OHC - Processing Room, near back door		0	2 Spider (1), Silverfish (1)		
17	OHC - Amanda's Office		0	12 Ants (12)		
18						
19						
20						
21						

Google Sheets Spreadsheet from the University of Miami Libraries

Multiple Disposition, Prob, 2 (Read-Only) - Excel

SECURITY WARNING: Macros have been disabled. Enable Content

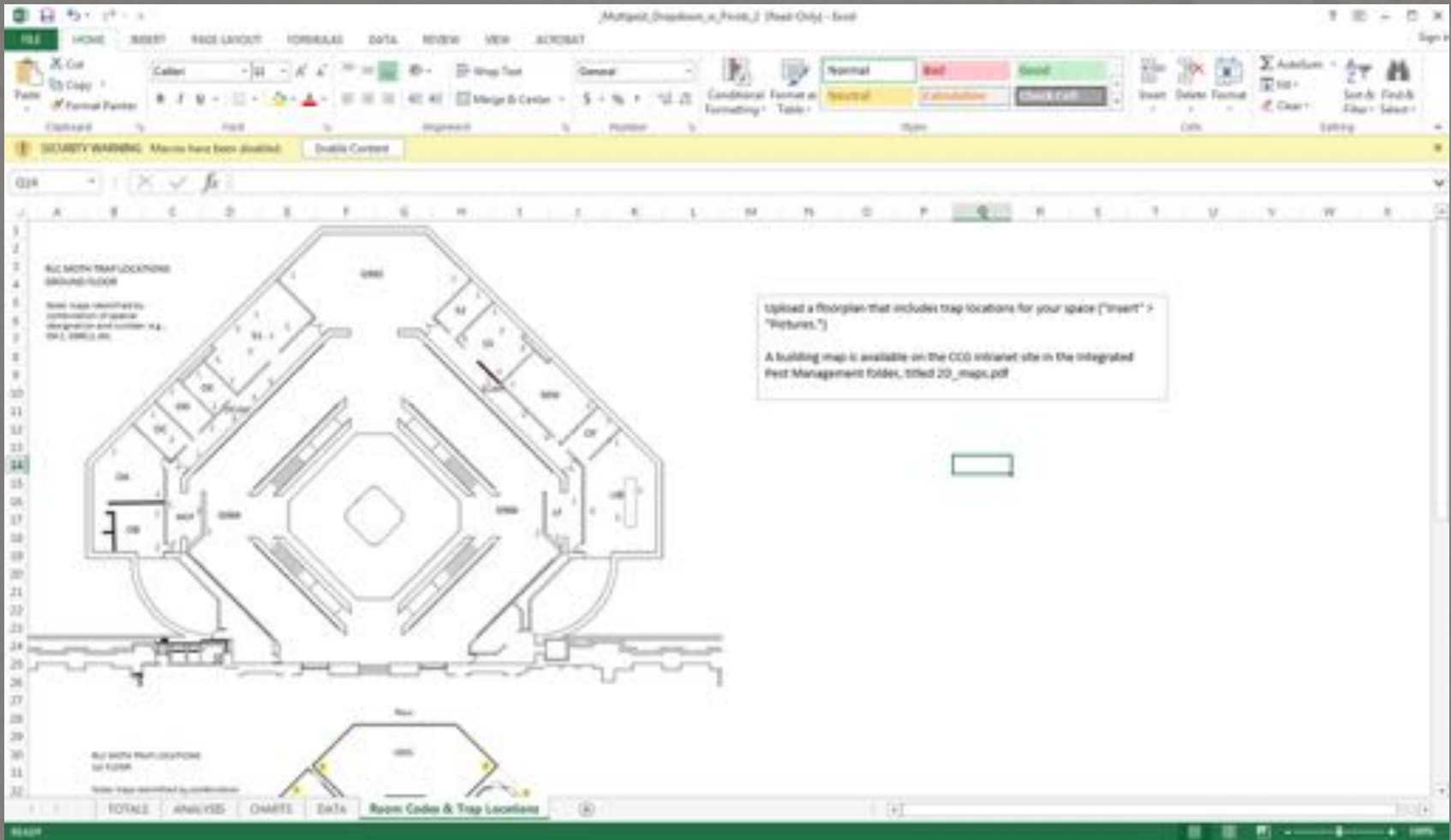
DATE CHECKED / SIGHTED	WEEK OR	FINDEN	TRAP #	TRAP TYPE	PEST	EDUC	ROOM #	ROOM (DESCR/STOR)	LOCATION	NOTES
12/6/2003	12/7/2003	Ground			Clothes Moth	2	LCorr	L Corridor	east end of hall, waist-high	
12/6/2003	12/7/2003	Ground			Clothes Moth	1	OCorr	O Corridor	in flight near door to OA	
12/6/2003	12/7/2003	Ground			Silverfish	1	S83	Stoneroom 1	right of doorway to Corr	
12/9/2003	12/9/2003	Ground			Clothes Moth	2	S83	Stoneroom 1		
	12/9/2003	Ground			Clothes Moth		S82			empty row - formatting
	12/9/2003	Ground			Clothes Moth		148			empty row - formatting
12/16/2003	12/16/2003	Ground			Clothes Moth	1	LF	L Foyer	on target left of door	dead
12/16/2003	12/16/2003	Ground			Clothes Moth	1	MOA	Office A Foyer	behind file cabinet	dead
12/16/2003	12/16/2003	Ground			Clothes Moth	1	OCorr	O Corridor	west end of hall	
12/21/2003	12/21/2003	1st			Silverfish	1	0007	Gallery 007	below secretary	
12/23/2003	12/23/2003	Ground			Clothes Moth	1	0014	Gallery 014	middle of north wall	
12/29/2003	12/29/2003	Ground			Clothes Moth	1	0018	Gallery 018	6' up, NE corner	
12/29/2003	12/29/2003	Ground			Clothes Moth	1	0014	Gallery 014	right of table	
12/30/2003	12/29/2003	Ground			Clothes Moth	1	OCorr	O Corridor	south end, right of door to DF	
1/5/2004	1/4/2004	1st			Clothes Moth	1	0005	Gallery 005	SW corner	
1/4/2004	1/4/2004	1st			Spider Beetle	1	0007	Gallery 007	behind side chair	
1/5/2004	1/4/2004	1st			Clothes Moth	1	0007	Gallery 007	etc.	
1/5/2004	1/4/2004	Ground			Clothes Moth	1	0014	Gallery 014		
1/6/2004	1/4/2004	Ground			Clothes Moth	1	0018	Gallery 018		
1/5/2004	1/4/2004	Ground			Clothes Moth	3	LF	L Foyer		
1/6/2004	1/4/2004	Ground			Silverfish	1	OCorr	O Corridor		
1/13/2004	1/13/2004	1st			Clothes Moth	1	0007	Gallery 007		
1/13/2004	1/13/2004	1st			Silverfish	1	0007	Gallery 007		
1/15/2004	1/15/2004	1st			Clothes Moth	1	0010	Gallery 010		
1/15/2004	1/15/2004	Ground			Clothes Moth	1	0014	Gallery 014		
1/15/2004	1/15/2004	Ground			Clothes Moth	1	0014	Gallery 014		
1/15/2004	1/15/2004	Ground			Clothes Moth	1	OCorr	L Corr		

PEST TYPE

- Clothes Moth
- Phorid
- Spider
- Ant
- Prilling
- Silverfish
- Other moth
- Gnat
- Fly
- Cockroach
- Woodborer
- Spider beetle
- Ground beetle
- Beetle, undent
- flying insect, or

TOTALS ANALYSIS CHARTS DATA Room Codes & Trap Locations

Excel Spreadsheet from the MET, courtesy of Garth Swanson, Metropolitan Museum of Art



Excel Spreadsheet from the MET, courtesy of Garth Swanson, Metropolitan Museum of Art

Microsoft Access Database interface showing a table of pest control records. The table is titled 'All Access Objects' and contains the following data:

Trap/Location	Area	Location	Traptype	Currently/Status	Notes
H 001	Collections Area	Outside doors to Collections Storage Area	Mound Trap	<input checked="" type="checkbox"/>	
H 002	Collections Area	Inside doors to Collections Storage Area	Mound Trap	<input checked="" type="checkbox"/>	
H 002.1	Collections Area	Under Collectors Whiteboard	Mound Trap	<input checked="" type="checkbox"/>	
H 002.2	Collections Area	Inside doors to Collections Storage Area	Carpet Beetle Lure	<input checked="" type="checkbox"/>	Trap added 5/11/2017 to monitor increased
H 003	Collections Area	Inside Electrical Room	Mound Trap	<input checked="" type="checkbox"/>	
H 004	Collections Area	YW Corner - under womens restroom	Mound Trap	<input checked="" type="checkbox"/>	
H 005	Collections Area	Corner of PS.5A.04.02	Mound Trap	<input checked="" type="checkbox"/>	
H 005.1	Collections Area	Fire Safe 1	Mound Trap	<input checked="" type="checkbox"/>	
H 005.2	Collections Area	Fire Safe 2	Mound Trap	<input checked="" type="checkbox"/>	
H 005.3	Collections Area	Fire Safe 3	Mound Trap	<input checked="" type="checkbox"/>	
H 006	Collections Area	At near end of section PS.5A.04.02	Mound Trap	<input checked="" type="checkbox"/>	
H 006.1	Collections Area	At near end of section PS.5A.04.02	Carpet Beetle Lure	<input checked="" type="checkbox"/>	Trap added 5/11/2017 to monitor increased
H 007	Collections Area	At far end of section PS.5A.04.01	Mound Trap	<input checked="" type="checkbox"/>	
H 008	Collections Area	At near end of section PS.5A.04.05	Mound Trap	<input checked="" type="checkbox"/>	
H 009	Collections Area	Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.1	Collections Area	left side of Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.10	Collections Area	Louise Reh File Storage - underneath PS.5A.CR.02	Rovent Trap	<input checked="" type="checkbox"/>	lures for both Webbing Clothing Moths and
H 009.11	Collections Area	Louise Reh File Storage	Carpet Beetle Lure	<input checked="" type="checkbox"/>	Trap added 5/11/2017 to monitor increased
H 009.2	Collections Area	Right side of Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.3	Collections Area	Beneath Pickett boat 9.30(right) and 9.31(left)	Mound Trap	<input checked="" type="checkbox"/>	
H 009.4	Collections Area	Far left side of Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.5	Collections Area	On top of Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.6	Collections Area	Far right side of Louise Reh file storage	Mound Trap	<input checked="" type="checkbox"/>	
H 009.7	Collections Area	Access hall from 9.6 - Louise Reh	Mound Trap	<input checked="" type="checkbox"/>	
H 009.8	Collections Area	Access hall from 9.2 - Louise Reh	Mound Trap	<input checked="" type="checkbox"/>	
H 009.9	Collections Area	Access hall from 9 - Louise Reh	Mound Trap	<input checked="" type="checkbox"/>	
H 010	Collections Area	At far wall under end porch	Mound Trap	<input checked="" type="checkbox"/>	
H 010.1	Collections Area	At far wall under old porch	Carpet Beetle Lure	<input checked="" type="checkbox"/>	Trap added 5/11/2017 to monitor increased
H 011	Collections Area	on section PS.5A.06.02	Mound Trap	<input checked="" type="checkbox"/>	
H 012	Collections Area	Far end of green shelving	Mound Trap	<input checked="" type="checkbox"/>	
H 013	Collections Area	Clothing moth trap - PS.5A.06.04	Clothing Moth Lure	<input checked="" type="checkbox"/>	
H 014	Collections Area	At near end of PS.5A.06.05	Mound Trap	<input checked="" type="checkbox"/>	
H 015	Collections Area	Under PS.5A.06.10	Mound Trap	<input checked="" type="checkbox"/>	
H 016	Collections Area	At door to HVAC closet	Mound Trap	<input checked="" type="checkbox"/>	

Microsoft Access Database from the Puget Sound Navy Museum, Naval History and Heritage command. Courtesy of Megan Jablonski

ZAKS Zpest Tracker

Subscription expires in -673 days

[Logout](#)

Demo Mode

Zaks Pest Test

[Add/Edit](#) [Browse Data](#) [Reports](#) [Utilities](#) [Help](#)

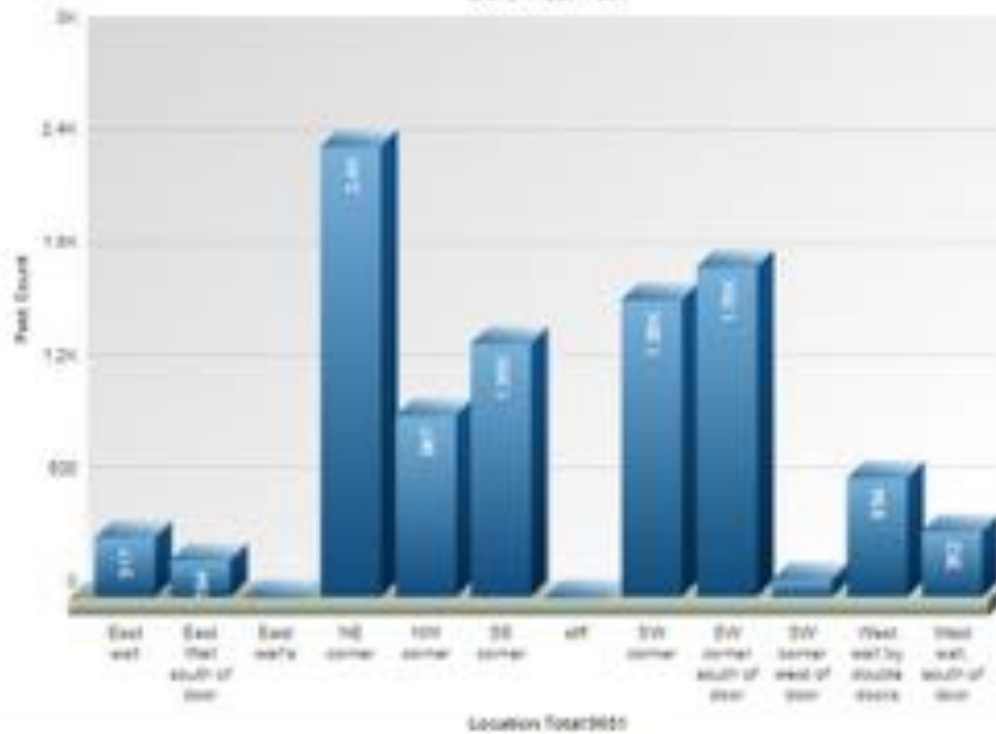
14 of 2342 Sorting by: Inspected order is Descending

TRAP ID	INSPECTED	COMMON	SCIENTIFIC	CNT	STAGE	RISK
	AREA	BLDG	FLOOR	ROOM	LOCATION	ECO TYPE
<input type="checkbox"/> B-7-550	06/02/2018	Ant	something	3	Adult	Indicator
	North Chili Campus	BE-6	2	Room 1	NE corner	External
<input type="checkbox"/> BE-6-01-2	06/01/2018	American Cockroach		4	Adult	Incidental
	North Chili Campus	BE-7	2	Room 3A	SE corner	Damp
<input type="checkbox"/> B-7-550	06/01/2018	asdf		2	Adult	Indicator
	asdf	asdf	asdf	asdf	stff	External
<input type="checkbox"/> BE-6-01	06/01/2018	American Cockroach		2	Adult	Incidental
	asdf	asdf	asdf	asdf	East wall	Damp
<input type="checkbox"/> B-7-550	10/06/2016	Black Larder Beetle	Dermeestes ater (De Geer)	2	Adult	Incidental
	North Chili Campus	BE-6			East wall	External
<input type="checkbox"/> B-7-550	12/16/2015	Firebrat	Thermobia domestica	2	Adult	Incidental
	North Chili Campus	BE-6	Ground	Room 1	East wall's	
<input type="checkbox"/> B-7-550	12/02/2015	American Cockroach	Periplaneta americana (Linnaeus)	2	Adult	Pest

Single Trap Type count:

Single Eco Type count:

Pest Count by Location 01/01/2005 -> 06/02/2018  
Zaks Pest Test



Zpesttracker.com



# Record Keeping

- Take photos of damage and insect activity
  - It will make it easier to differentiate new damage from old
  - Photos can be used for staff education



Insect damaged glass plate negative, photo courtesy of Greg Hill, the Canadian Conservation Institute

# Environmental Monitoring

- Micro-organisms (mold, fungi) flourish in environments that can attract other pests
- Pest activity can occur from 4-37°C with optimal growth at 20°C
- Mold growth occurs at RH 70-75% and in areas with poor air circulation

# Environmental Monitoring

- Multiple environmental monitors are ideal
- If you notice a spike in RH complete a physical inspection of the room
- Wear PPE when necessary



# Pest Activity and Light

- Some larvae shun light
- Some adults are attracted to it



# Working with a Pest Management Professional (PMP)

- Useful for large sites lacking staff resources
- Resources for selecting and working with a PMP on [MuseumPests.net](http://MuseumPests.net)
- Make health and safety a priority - discourage the use of pesticides

# When do you have a Problem?

- Record keeping allows you to pinpoint spikes in activity
- Finding a live insect on a museum object (although this could be a stray)
- Finding live larvae on an object

# Staff Education

- Educate all staff and volunteers on your IPM program and their involvement (even non-collections care staff)
- Create easy system for insect notification

# Vizcaya Museum and Gardens IP-P-M Case Study



Vizcaya Museum and Gardens, Miami, Florida



# Vizcaya Museum and Gardens Case Study



Vizcaya Museum and Gardens Interior with live plant Collections

# Vizcaya Museum and Gardens Case Study



Vials of pest evidence used for staff and volunteer education

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# With Thanks!

