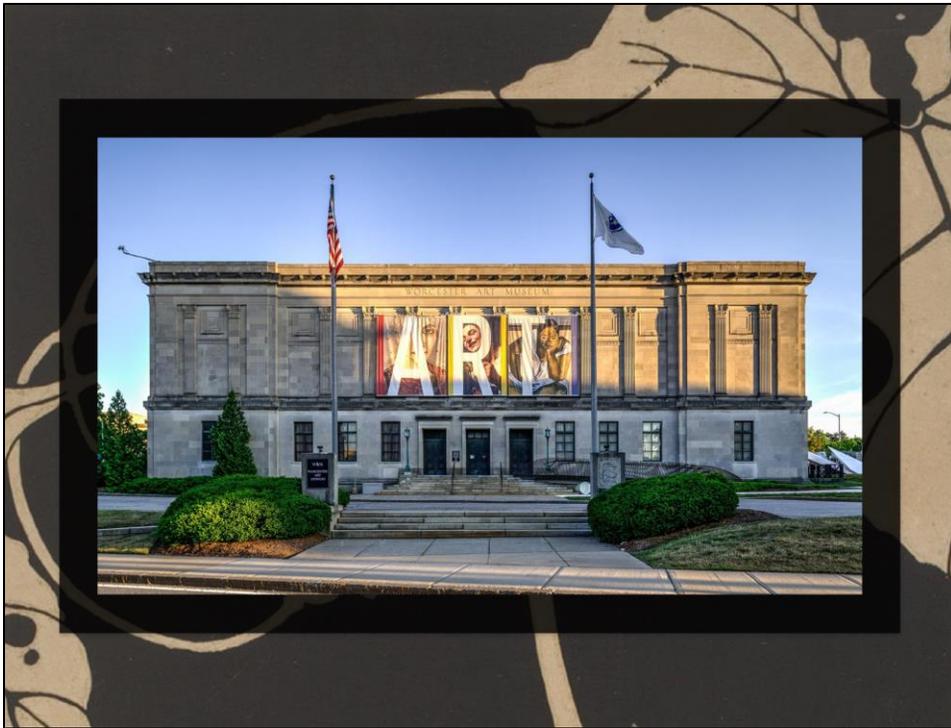
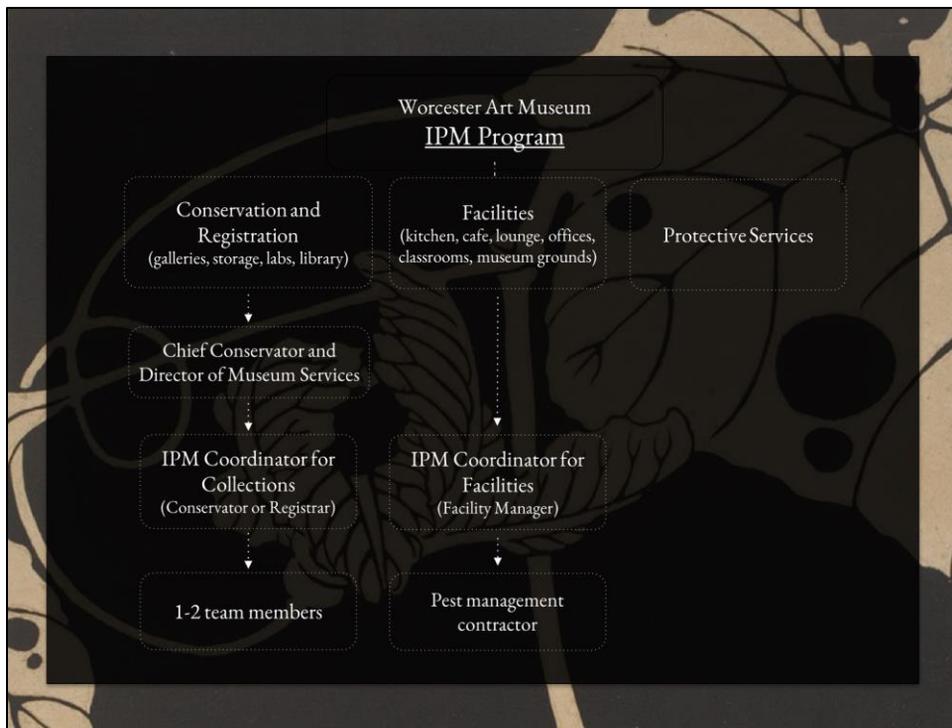


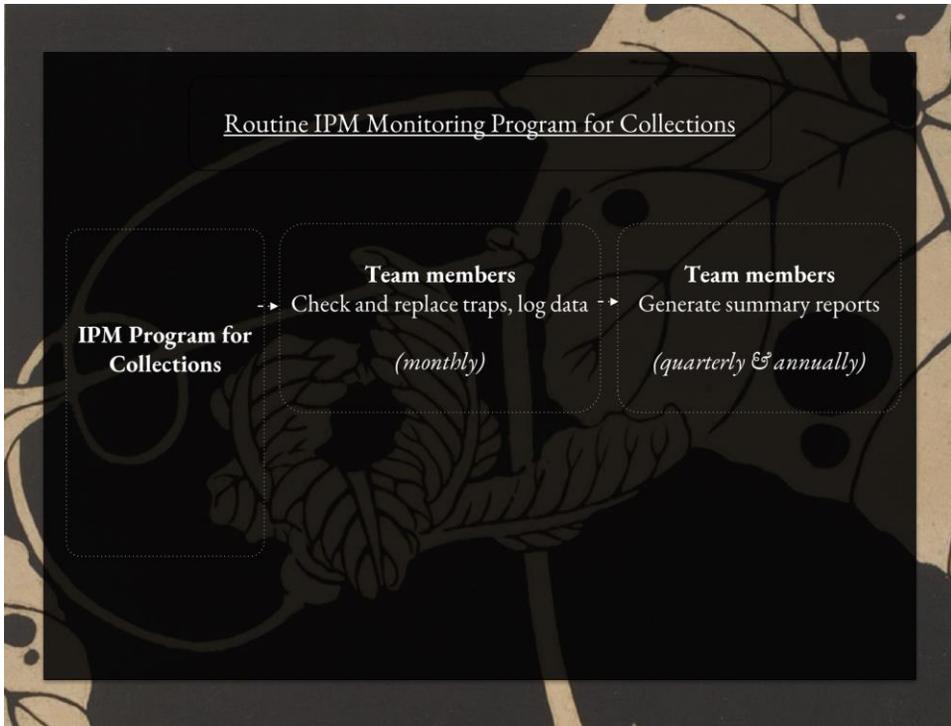
Good afternoon, my colleague, Hae Min Park and I are excited to be with you all today to share how the COVID-19 pandemic has impacted the Integrated Pest Management Program at the Worcester Art Museum. Hae Min is the Andrew W. Mellon Fellow in Paintings and an IPM Team Member. I am the Paper Conservator and current IPM Coordinator for Collections. Thank you so much to Rachael and Matt for organizing us all and giving us the opportunity to gather and share information.



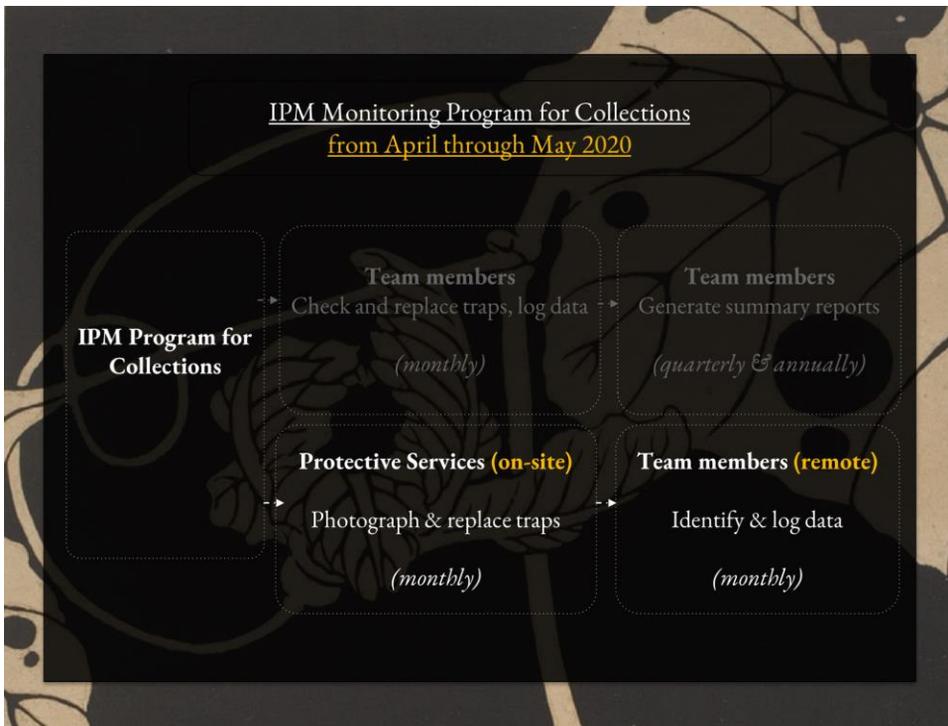
For folks who may be unfamiliar with the Worcester Art Museum, it is located in Worcester, in the center of Massachusetts, and opened to the public in 1898. It is a mid-sized museum with about 68 full-time and 58 part-time staff and is about 152,000 square feet in size. Not unlike many museums, its facility has been expanded multiple times, and each expansion has its strengths and challenges from a building envelope perspective. In this image you can see the museum's main entrance and facade from 1933. Its collection is comprised of approximately 38,000 objects and is nearly encyclopedic in breadth.



At WAM, the IPM program currently is co-managed by Conservation, Registration, and Facilities with assistance from Protective Services. Conservation and Registration oversee areas of the museum with collection material, including galleries, storage, conservation labs, and the library, and Facilities oversees all other areas of the museum, including the kitchen, cafe, offices, classrooms, and the museum grounds. Within Conservation and Registration, an IPM Coordinator for Collections, who is a Conservator or Registrar is appointed by the Chief Conservator and Director of Museum Services and works with 1-2 team members. Within Facilities, the Facility Manager works with a pest management contractor. Collectively, we each monitor traps monthly. Protective Services also is extremely dedicated to the care of the museum, and monitors for pests during their security rounds. All members of conservation, registration, and facilities come together either at periodic Collections Care meetings to discuss IPM, among other topics, or the IPM Team meets independently for more focused conversations as needed.

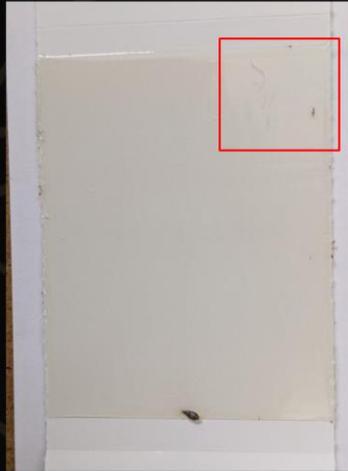


The IPM Team for Collections monitors 49 glue traps in areas of the museum with collection material monthly, examines each trap through a stereomicroscope, and records the data in our Excel database, which facilitates generating quarterly and annual reports. We identify and record both museum and non-museum pests.



In the early months of the pandemic from March to June 2020, limited staff were permitted at the museum. During this time, our Protective Services and Facilities staff were primarily on site protecting the museum and the collection and performing enhanced cleaning of the facility. To ensure continuity of the IPM program, we collaborated to a greater degree than usual with Protective Services to develop a hybrid monitoring program in which Protective Services checked the traps, took pictures of them on a cell phone, and replaced the traps with new ones following floor maps of the museum with trap locations. They then uploaded the images to a shared drive so Hae Min, our former pre-program intern, Elle Friedberg, and I, who were all remote, could check them and record the data in our Excel database, which we transferred temporarily to Google Sheets to facilitate working remotely.

Example of an image of a trap taken with a Pixel 4XL cellphone with a camera with a 1/2.55-inch sensor with a 12.2 MP resolution and 1.4  $\mu\text{m}$  pixels, coupled to a 27mm-equivalent f/1.7 lens with optical image stabilization



Zoomed in detail

There were several features that worked well with this temporary protocol: it was user friendly for Protective Services to take images of the traps on a cell phone, the images were clear enough that we were able to identify the majority of the pests on them by zooming into the images, and Hae Min, Elle, and I were able to share the work of recording the data remotely through the Google Sheets database. The most problematic feature was the lack of clarity in some of the images, which prevented us from being able to confidently identify all pests on traps.

Example of a pest trap in the Worcester Art Museum's Southeast Asia Gallery



Beginning in June 2020, the museum established safety protocols so essential staff could return to the museum on a limited basis, which has continued to the present. Since this time, Hae Min and I have been able to resume monthly rounds of checking traps in collections based areas, recording data in our Excel database, and meeting remotely with the museum's Facility Manager to share information and discuss strategies.

## Database for tracking pest sightings using Excel and Google Sheets

### 12 field list:

- Inspection date
- General location (32)
- Specific trap location
- Trap type
- Common name of insect (26)
- Species (especially for beetles)
- Life Stage
- # observed
- Pest Status
- Collection risk factor
- Month
- Year

#	Inspection Date	General Location	Specific Location	Trap Type or ID	Common Name of Insect	Scientific Name	Life Stage	# Observed	Pest Status	Collection Risk Factor	MONTH YEAR	year
1335	2/27/2021	Library	basement	glue trap	housefly		adult	1	dead		February 2021	
1336	2/27/2021	Library	basement	glue trap	springtail		adult	1	dead		February 2021	
1337	2/27/2021	Library	basement	glue trap	spider		adult	1	dead		February 2021	
1338	2/27/2021	Paper Conservation	window 1	glue trap	beetle	Chamaelea, light brown	adult	1	dead		February 2021	
1339	2/27/2021	Paper Conservation	window 2	glue trap	red velvet mite		adult	1	dead		February 2021	
1340	2/27/2021	Galley 206	2	glue trap				0			February 2021	
1341	2/27/2021	Galley 84		glue trap				0			February 2021	
1342	2/27/2021	Galley 86		glue trap				0			February 2021	
1343	2/27/2021	Galley 92		glue trap				0			February 2021	
1344	2/27/2021	Galley 93		glue trap				0			February 2021	
1345	2/27/2021	Galley 206		glue trap				0			February 2021	
1346	2/27/2021	Galley 20		glue trap				0			February 2021	

#	Inspection Date	General Location	Specific Location	Trap Type or ID	Common Name of Insect	Scientific Name	Life Stage	# Observed	Pest Status	Collection Risk Factor	MONTH YEAR	year
439	4/17/2020	Paper Storage	East wall	glue trap	Lichens		adult	1	dead		Apr-20	2020
440	4/17/2020	Paper	Southwest wall	glue trap			adult	1	dead		Apr-20	2020
441	4/17/2020	Paper	Southwest wall	glue trap			adult	1	dead		Apr-20	2020
442	4/17/2020	Paper	window 1	glue trap	spider		adult	1	dead		Apr-20	2020
443	4/17/2020	Paper	window 1	glue trap			adult	84	dead		Apr-20	2020
444	4/17/2020	Paper	window 2	glue trap			adult	2	dead		Apr-20	2020
445	4/17/2020	Paper	window 2	glue trap	bark lice		adult	27	dead		Apr-20	2020
446	4/17/2020	Library	basement	glue trap			adult	5	dead		Apr-20	2020
447	4/17/2020	Library	basement	glue trap	beetle		adult	3	dead		Apr-20	2020
448	4/17/2020	Library	basement	glue trap	bark lice		adult	1	dead		Apr-20	2020

We'd now like to share some key features of our database and take a closer look at the information collected during the early months of the pandemic to gain a preliminary sense of its impact.

As Eliza mentioned, we developed a database on Excel to record our pest data and to monitor trends over time in a budget-friendly way. We then used a web-based alternative from April to May to facilitate remote recording of data, and reverted back to Excel in June when we were able to be back at the museum. The top image is a screenshot of the database in Excel; the bottom is in Google Sheets.

As you can see, our database is organized by 12 fields across the columns with individual pest sightings logged in the rows. We have a dropdown list for each of the fields so that the database is user-friendly and we can record the terms consistently. This system also allows information to be filtered and refined by any categories in multiple fields.

**Q2 Apr 2020**

	Total sightings	Conservation Lab	North Storage	Object Storage	East Storage	Textile Storage	Gallery 104	Gallery 105	Gallery 106	Gallery 110	Gallery 113	Gallery 121	Gallery 206	Gallery 208	Upper third floor
ant	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bark lice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
beetle	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
book lice	36	1	14	7	0	11	0	0	0	0	0	0	0	0	0
Centipede	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cockroach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
concrete mite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
daddy long leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
firebrat	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
fly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mosquito	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
moth	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mouse	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red velvet mite	131	18	0	0	0	0	0	0	0	0	0	0	0	0	1
silverfish	16	0	1	0	1	4	0	0	2	0	0	4	0	0	0
spider	23	8	1	0	2	0	0	0	0	0	0	0	0	0	2
sowbug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
unknown	11	0	0	0	2	1	0	0	0	0	2	2	0	0	0
wasp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western conifer seed bug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sprngtail	13	2	0	0	0	0	0	0	0	0	0	0	0	0	1
gnat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
winter firefly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
midge	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
woodlice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>total</b>	<b>230</b>	<b>29</b>	<b>17</b>	<b>7</b>	<b>5</b>	<b>18</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>1</b>	<b>6</b>

Pest Data | 2019 | 2020 | 2021

We also keep a separate worksheet of tables that are prefilled with formulas. These generate data (monthly, quarterly, and yearly counts) such as the [total pest counts per insect type per location per month]. The tables are linked to the database, so they are updated automatically with every new pest entry.

**ADDITIONAL NOTES:**

Sumif formula instructs Excel to take the sum of values if they meet certain criteria (conditional sum). For instance, Excel can be instructed to add all values in Column H (# observed) in the [Pest Data] spreadsheet, **IF**

- Column B (Location) in the same entry row is "Gallery 210" and,
- Column E (Common name of Insect) is "ant" and,
- Column K (Month pest was found) is "April" and,
- Column L (Year pest was found) is "2020"

**Types of total monthly/quarterly/annual counts generated:**

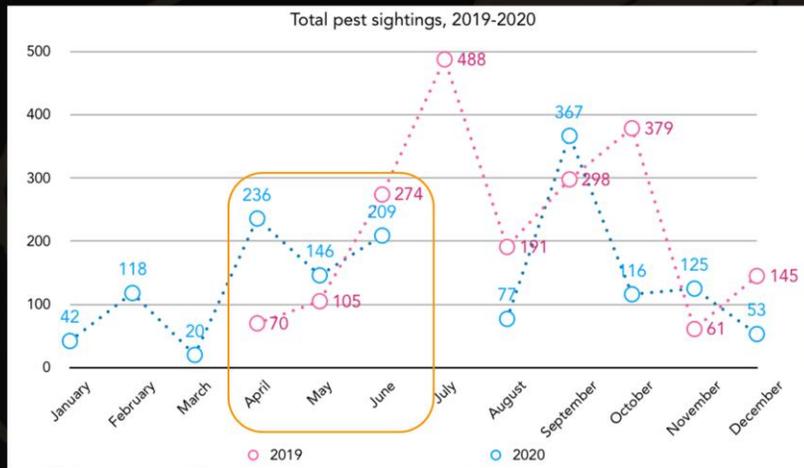
- Overall pests in all collection areas
- Pest categories (i.e. museum vs. non-museum pests)
- Individual insect type
- Location categories (i.e. galleries, lab vs. storage)
- Individual trap location
- Mix of these criteria (i.e. Individual pest found per specific location)

**Graphs we often generate for quarterly/annual reports:**

- *Total count per month (all collection area)*
- *Total count per month per location*
- *Total museum-pest count per month*
- *Total museum-pest count per month per location*
- *Total individual pest (i.e. springtail) count per month*
- *Comparisons to previous quarter/year*

## Total pest in Q2 (April-May-June) 2019 vs. 2020

449 pests found in 2019: 591 pests found in 2020



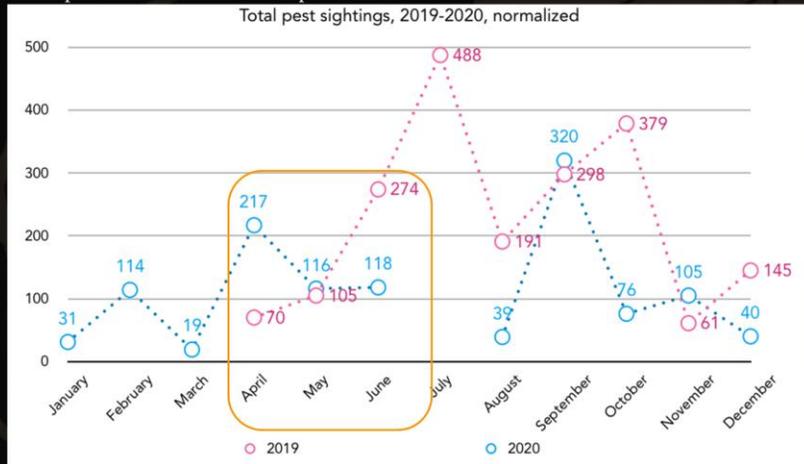
At the beginning of the pandemic, we were curious, probably like many of you, about how reduced foot traffic may impact pest activity at our institution.

Looking at the data from April to June when the museum was quietest, we found more pests in 2020 than in 2019.

But the difference actually is not statistically significant, because we added more traps in 2020 (based on a one-tailed T-test at a 99% confidence level).

## Total pest in Q2 2019 vs. 2020 (normalized)

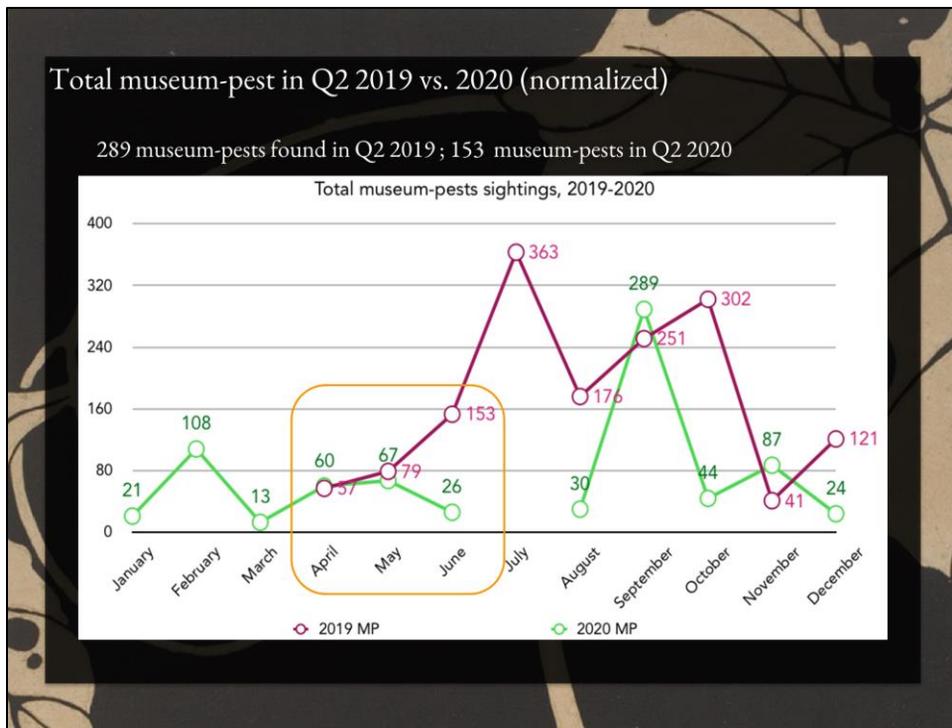
449 pests found in 2019: 451 pests found in 2020



In fact when we normalized the data, and by that we mean dismissing data from the traps placed after June 2019, we found the total counts for the second quarters of 2019 and 2020 were nearly identical (only varying by just 2 pests).

### ADDITIONAL NOTES:

*This could be interpreted to suggest that the pest activity at WAM between April and June was not dependent on foot traffic. However, it is not so straightforward, because when we compare the data by individual months, we saw a larger pest incident in April; close to equal number in May; then a substantial drop in the monthly total in June 2020 ( $\Delta 161$ ).*



As for the overall museum-pest incidents, there definitely fewer insects in 2020 than in 2019.

We are not seeing a clear trend from our overall monthly graphs<sup>\*\*\*</sup> and it is definitely hard to make a definitive cause-and-effect type of conclusion about the impact to the museum as a whole, especially since we only have one set of Q2 data for comparison; we had made so many changes to the number of traps and locations over the year; and have variables like enhanced cleaning efforts during the period, all influencing the data. (\*\*\*)[should I mention that 2020 data is still out of norm because we normally expect to see increase in pest activity from April to June with warmer temperature, like we did in 2019? something is happening but we are not sure what](#)

But perhaps most importantly, we have not observed any pest-related damages to our collection materials before and throughout the program, and we are pretty confident that the pest activity at WAM appears to be more heavily influenced by the porous building envelope and the climate (and this is something that the IPM team and facilities are tackling first).

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**ADDITIONAL NOTES:**

*Just as the overall pests per month graph, we didn't find a clear trend in this graph: there were nearly comparable numbers of incidents in April and May, then a significant drop in June 2020 ( $\Delta 127$ ). We also noted a mix of reductions and increases, but more reduction across the board in the total incidents for specific locations and certain pest types per locations during the closure in 2020 versus 2019.*

## Applications of IPM data at WAM

### Updates to the Collections Care Policy:

- Established Food and Beverage Guidelines
- Updates to the cleaning protocol

### IPM data is being used to justify facility projects:

- Building envelope improvements
  - IPM Coordinators checking the building's envelope, starting with locations that have the highest overall pest counts & identifying entry points
  - Door sweep installation
  - Capital improvements to the roof and windows
- Designation of an Art Receiving Room

We have applied our IPM data to improve our collections care practices (with the IPM members and staff staying more vigilant, creating and enforcing new food and beverages guidelines and the cleaning protocol for collection areas), and we are using our data to justify prioritizing certain facility projects, like installing door sweeps and making improvements to the building envelope, roof and windows, as well as as the designation of an art receiving room.



## Acknowledgements

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Frank Pozzi, *Protective Services Supervisor*

Protective Services Department

Gareth Salway, *Director of Museum Services*

Enrique Vega, *(Former) Senior Manager of Protective Services, Guest Services, and Technology*

# Thank you!

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