Pest Odyssey 2021- The Next Generation

Detect, Respond, Recover - best practice IPM in 2021

20th - 22nd September 2021

Abstracts

DAY 1 Monday 20th September 2021

Session	Presenter		Title
Welcome	Chairperson	09:30	Housekeeping and conference programme
Tribute	David Pinniger	09:40	A tribute to Bob Child
Session 1	**Detect - Setting up an IPM Programme**		
	Alan Van Dyke	09:50	IPM Strikes Back: Reviving a slumping IPM programme
	M. van Bellegem, E. Bosetto, A. Ferreira, A. Read, F. Al Tamimi, M. Veleda.	10:05	An Oasis for pests? Setting up IPM in the Emirate of Abu Dhabi
Q&A		10:20	
Sponsor	Insects Limited	10:30	
Posters	Matthew Davies, J Binge	10:35	First occurence of *Oligomerus ptllinoides (Coleoptera Ptinidea)* in domestic premises in the United Kingdom
	Joseph Jackson, Jeanne Robinson & Ashleigh L. Whiffin	10:40	Battling Booklice
	Hiroki WATANABE, Rika KIGAWA, Tom STRANG	10:45	Seasonal changes in the distribution of head capsule size of a silverfish species
Break		10:50	
Session 2	**Detect - Use of technology in IPM**		
	Mellisa King, Nathan McMinn, Austin Senseman and Ana Martins	11:00	What's bugging you? Research involved in the development of collection-specific IPM software and pest databases
	A Doyle, F Portoni, T Marasco et al	11:15	Remote monitoring for museum pests - a 21st century approach
	V Blyth, B Shah et al	11:30	Training, tools and technology for managing IPM at the V&A
	Chris Swindells	11:45	The use of technology to manage the next generation of house mice
Q&A		12:00	
Lunch		12:20	
	Chairperson	13:30	Afternoon programme and notices
Session 3	**Detect - Insect science**		
	Patrick Kelley, Rachael Arenstein, James Feston, Jonathan Scheer	13:35	The attractive qualities of wool and larval frass on wool to the Webbing Clothes Moth, *Tineola bisselliella*
	Christian Dressen	13:50	*Ctenolepisma longicaudatum* Escherich, 1905 in a Museum of Applied Art
Q&A		14:05	
Sponsor	Historyonics	14:15	
Posters	Greg Fee	14:20	Mice and Moths – From One Infestation to Another
	V Hingst	14:25	New adventures in IPM Quarantine- Still work in progress
	Antonia Reime Aabø	14:30	Targeting *Ctenolepisma longicaudatum*: Implementing an effective IPM programme on a limited budget in a small to midsize institution'
Break		14:35	
Session 4	**Respond - Traditional treatments**		
	Angélica Isa, Carolina Parada, Eliana Quispitupac, Malú Palomino	14:45	Preserving Peruvian organic cultural heritage using *Lupinus mutabilis* (Andean Lupin) extracts
	Keith Donaldson	15:00	Novel new packaging approaches to Termite and Fire Ant Control
	Rudy Plarre, Udaya Cabral, and Pascal Querner	15:15	Screening of two plant-derived extracts from Sri Lanka for their potential to control the subterranean termite *Coptotermes formosanus*
Q&A		15:30	
Close	Chairperson	15:45	Closing of Day 1

DAY 2: Tuesday 21st September 2021

Session	Presenter	Start	Title
Welcome	Chairperson	09:30	Conference programme
Session 5	**Respond - Temperature treatments**		
	Dr. P Schumacher, Thomas Kolling, Dr E Fennert and N Wilke	09:40	Preliminary trials with reduced temperatures in humidity controlled warm-air treatment, a more gentle and efficient way to disinfest artworks and heritage objects
	Robert Entwistle	09:55	Deathwatch death wish
	Udaya Cabral, P Querner and LD Amarasinghe	10:10	Efficacy of low cost simple solar heating box to eradicate insect pests of Libraries in Sri Lanka
Q&A		10:25	
Sponsor	Total IPM	10:40	
Posters	Busch, Volker, prozell, Sebine and Scoller Mathias	10:45	Selective feeding on paper and cardboard, and limited dispersal of the long-tailed silverfish Ct*enolepisma longicaudatum* in archives
	Dr. Judith Auer, Dr. Christine Opitz, Alexander Kassel	10:50	Conservation of cultural heritage: Biological control of the common furniture beetle with *Spathius exarator*
	Elisabeth Salmon	11:00	Making room for traditional ecological knowledge in conservation: learning by example
Break		11:05	
Session 6	**Respond - Other treatments**		
	Cassy Cutulle, Matthew Vigneau, Mollie Denhard, Khanh Nguyen, Lindsay Koso, and Molly Richmond	11:15	From Discovery to Recovery: Managing a Webbing Clothes Moth Infestation at the Peabody Museum of Archaeology and Ethnology
	H Jarvis, N Blades, Martha Infray and David Loughlin,	11:30	Infestation Stations! A novel, full-cycle approach to webbing clothes moth (*Tineola bisselliella*) eradication at Blickling Hall
	Stephan Biebl	11:45	Over 10+ years using parasitoid wasps in Integrated Pest Management for Cultural Heritage in Germany
	J Wagner, P Querner and A Pataki-Hundt	12:00	Comparison of three treatment methods for archive material against the grey silverfish
Q&A		12:15	
Lunch		12:35	
	Chairperson	13:30	Afternoon programme and notices
Session 7	**Recover- Engaging Staff**		
	Helena Jaeschke	13:35	Pest partners - Increasing engagement with IPM
	Nyssa Mildwater and S Rhynard-Geil	13:50	Adjusting to fit: Shifting an organisation's approach to Integrated Pest Management to better reflect cultural protocols, legal requirements and workplace dynamics
Q&A		14:05	
Sponsor	Acheta	14:15	
Posters	S Ryder, D Pinniger	14:20	The history of Integrated Pest Management (IPM) at Natural History Museum, London
	C Booth-Downs, Y Harvey	14:25	The *Spirea* who came in from the cold: treating an entire collection, kitchen sink and all
	W Richardson	14:30	Insect Pest Underground: Managing pests in the secret war tunnels at Dover Castle
Break		14:35	
Session 8	**Recover- Reviewing established IPM Programmes**		
	Catherine Haworth	14:45	Pestily Ever After: Twenty years of IPM at National Museums Scotland
	Dee Lauder and Dave Pinniger	15:00	Eltham Palace: 900 years of history, 20 years of IPM in practice

	Rika Kigawa, Hiroki Watanabe, Ayako Izumita, Shiho Tomimatsu, Mika Matsuo	15:15	IPM of Kyushu National Museum: Developing Strategies and Cooperation
Q&A		15:30	
Close	Chairperson	15:45	

DAY 3: Wednesday 22nd September 2021

Session	Presenter	Start	Title
Welcome	Chairperson	09:30	Conference programme
Session 9	**Recover - The challenges in setting up and running a successful IPM Programme**		
	Alex Rowe, Simoní Da Ros, Katherine Curran	09:40	Instruction versus practice: Where can we improve upon IPM?
	Christian Baars and Jane Henderson	09:55	Integrated Pest Management: From monitoring to control
	E Breitung, E Goldberg, Sue Ryder et al	10:10	An International IPM survey of resources and activities conducted by MuseumPests.net working group
Q&A		10:25	
Break		10:40	
Session 10	**Recover - Collaboration**		
	Jessica Gray (She/Her) and Rehan Scharenguivel (They/Them)	10:50	Warrang/Sydney IPM Group: A Regional-Specific Digital Collaborative Forum
	D Pinniger, A Crossman, Jane Thompson-Webb	11:05	From pamphlets to websites - the evolution of IPM resource material
Q&A		11:20	
Posters	Cassy Cutulle, Matthew Vigneau, Mollie Denhard, Khanh Nguyen, Lindsay Koso, and Molly Richmond	11:30	Management of Priorities, Goals, and Training in the Execution of a Pest Mitigation Project at the Peabody Museum of Archaeology and Ethnology
	Gwenllian Thomas	11:35	Advocating for IPM during a pandemic when a local authority has bigger concerns
Closing remarks	Chairperson	11:40	
Lunch		11:55	
Workshops	**Workshop 1 - Silverfish**	14:00	
	C Harris and A Walker		And Then There Were None: The successful treatment of a silverfish (*Lepisma saccharinum*) outbreak during the coronavirus (Covid-19) pandemic
	K Mandy and S Coggins		Grey silverfish at the National Gallery – the importance of monitoring and advocacy in IPM
	P Querner		ADVION bait against grey silverfish *Ctenolepisma longicaudatum* in Museums, Archives and Libraries in Austria?
	Workshop 2 - International Collaboration	14:00	
	A.Crossman		A collaborative approach to developing an IPM programme in Myanmar
	F Portinao, S Manrique, A Mendez et al		The Pesty business of translation: A global collaboration to bring MuseumPest.net to a wider audience
	Workshop 3 - IPM training and resources	14:00	
	Christa Deacy-Quinn		Debugging Instruction for Easy and Empowering IPM

Session 1 Detect - Setting up an IPM Programme

IPM Strikes Back: Reviving a slumping IPM programme

Alan Van Dyke, MA
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In 1990 an infestation of carpet beetles was discovered in a collections storage room of the Harry Ransom Center of the University of Texas at Austin. As a result, the Ransom Center's IPM program was born. Over the next few years a robust program was developed by one of the Center's book conservators, significant improvements were made to the building, and a walk-in freezer was acquired. Over time, however, the program started to develop problems. Over trapping led to a heavy workload when traps were collected for examination. Tensions between the IPM coordinator and building manager led to poor cooperation. Lastly, fatigue was setting in, making motivation to maintain the program difficult; there were even discussions of ending IPM at the Ransom Center. As a result, the Center developed large numbers of odd beetles in the building, seasonal crickets, and an established resident Mediterranean house gecko population. In 2016, after 26 years of management and the impending retirement of the book conservator who created the IPM program, duties were reassigned to the senior preservation technician. The trap collection monitoring schedule was revamped, trap numbers were reduced to make that task more manageable, and a schedule of regular spot-treatment by a contracted company was implemented. As a result of improved communications with the building manager, additional improvements to the building have been made. The new program has shown the desired results: a significant reduction of pests and geckos in the building.

An Oasis for pests? Setting up IPM in the Emirate of Abu Dhabi

M. van Bellegem, E. Bosetto, F. Al Tamimi, A. Ferreira, M. Veleda, A. Read

In 2020 a strategy was developed for Integrated Pest Management (IPM) within the Department of Culture and Tourism - Abu Dhabi, and the first steps were taken to implement the strategy at the locations of the Al Ain Museum collection and Manarat al Saadiyat storages, and exhibition areas at Qasr al Hosn, Qasr al Watan, Jahili Fort and Al Ain Palace Museum.

This contribution will summarize the main aspects from the strategy, such as its overall aim, pest monitoring, preventing entry or spread and approach for treatment of infestations, as well as its implementation and first measures taken based on the results of monitoring.

The authors are responsible for collection management or conservation, at several venues and jointly prepared the strategy and collaborated for its implementation. The history of pest treatments at the various locations was mostly based on bulk treatment by either using pesticides against termites or more recently anoxia treatment for rare books during their transfer. Glue traps were used during a temporary exhibition in 2011 at Qasr al Hosn.
Using the new strategy, the setting up of traps was first implemented in May 2020, at the storage facility in Al Ain, and gradually rolled out to other venues. Traps used are glue traps, sometimes using pheromones for cockroach, clothes moth, and pantry moth, or with luminescent patches. Data relating to traps is recorded in the collection management system EMu. After initial 'teething problems' such as disappearing traps, the main challenge lies in the correct or full identification of the insects found in traps. This relates both to identifying what insect, as well as identifying what risk this insect poses to the collections and if preventive measures are required. Considering the collections, consisting of archaeological finds, ethnographic objects, diplomatic gifts, and rare books and thus a wide range of materials, each has its own vulnerability from different insects. Most IPM literature to support identification, usually deals with insects found in either European or North American environments. The environment(s) applicable for the locations here vary from dry and hot desert conditions to more 'usual' conditions indoors where the temperature is controlled by air conditioning. Related to this, catches of geckos, firebrats, and flying ants can be explained. Catches such as springtails, moths and woolly bears or various beetles are considered

environmental indicators or pests. The woolly bears, as the larvae of beetles form likely the highest risk for parts of the collections because old signs of infestation have been found in conjunction with damage on the horn components of *khanjar* (traditional dagger).

Although, prior to the development and implementation of the IPM strategy there were no signs of insects being present around the collections, since then cases have been identified both within the traps and some directly posing a risk to collection material. Currently the results from monitoring traps are being used to take actions to reduce the opportunities for insects within the buildings and thus reduce the risk of damage to the collections.

First Occurrence of *Oligomerus ptilinoides* (Coleoptera: Ptinidae) in Domestic Premises in the United Kingdom

[1]Matthew Paul Davies and [1]Jonathan Binge.
[1]Killgerm Chemicals Ltd, Wakefield Road, Ossett, WF5 9AJ

In 2020 the Mediterranean furniture beetle, *Oligomerus ptilinoides*, was identified in two domestic properties in the United Kingdom (UK). These records probably represent the first identifications of *O. ptilinoides*, in the UK, outside of the museum and stately home sector. One case was reported from a loft in a domestic property in Kent. A further case was associated with holes in a wooden bedframe from a domestic property in Surrey. Samples were submitted, by public health pest control operators, to the insect identification service at Killgerm Chemicals Ltd. Samples were identified by Killgerm entomologist Jonathan Binge, via microscopy and dichotomous key, with assistance from David Pinniger (DBP Entomology Ltd) and Darren Mann (Oxford University Museum of Natural History). These findings add to a 2015 record of *O. ptilinoides* at Hampton Court Palace which has since been eradicated. Potential for misidentification, of *O. ptilinoides*, is noted due to the superficial similarities with *Stegobium paniceum* and *Anobium punctatum*. Cultural heritage institutions and public health pest control operators are alerted to these findings, requested to seek appropriate identification, and encouraged to exercise vigilance.

Keywords: woodboring, pest management, timber, Mediterranean furniture beetle, identification.

Battling Booklice

Joseph Jackson[1] - Ashleigh Whiffin[2] & Jeanne Robinson[3]
[1]Assistant Preventive Conservator, NMS, [2]Assistant Curator of Entomology, NMS & [3]Curator of Entomology, The Hunterian

The aim of this short poster presentation is to raise awareness of the spread of *Dorypteryx Longipennis* across Scotland, and to provide a way of identifying this species.

Booklice identification to a species level can often be overlooked, after all there's no such thing as a good booklouse when it comes to collections care, so why bother? However, being able to identify specific species of booklice can often prove to be very beneficial when identifying issues which may be present in a particular area, as different species require different conditions in which to live. After originally being discovered in Luxembourg in 1988, to Dublin in 2004 and then Leeds in 2010, *Dorypteryx longipennis* (Winged Booklouse) has earned the title of an accomplished traveller. Creating a useful identification tool could prove invaluable in helping museum staff raise awareness of the different types of psocids in areas housing collection items. As this species has now made its way into numerous Scottish institutions, we hope this guide will assist in mapping the spread of *Dorypteryx longipennis*.

One of the most important aspects of pest prevention is knowing what types pests could be present in your local environment, so hopefully this presentation will assist in further conversations between organisations regarding the identification of pests as well as the exchange of findings.

Seasonal changes in the frequency distribution of head capsule size of a silverfish.

Hiroki Watanabe[1], Rika Kigawa[1] & Tom Strang[2]
[1]Kyushu National Museum, Japan & [2]Canadian Conservation Institute, Canada.

Modelling the population dynamics of insect pests allows projection of their seasonal occurrence and thus can be useful in implementing IPM in museums. In this study, we collected and analyzed data regarding the seasonal changes in the frequency distribution of head capsule width of a silverfish species that is prevalent in Japan. We chose a confined area in a building for the test site where, on all edges, we sprayed an insecticide and set adhesive traps to collect the silverfish occurring in the test site. The silverfish individuals lying dead on the floor or captured by the traps were collected monthly, and the width of the head capsule of each individual was measured under a microscope. This method gives snapshots of the population's demographic structure which is important for building population dynamics models of this species and examining the consequences of control programs. The monthly distributions of head capsule width seemed to reflect the life cycle and reproduction of the silverfish in an indoor environment. These data may be applied to places with a presumably similar environment, such as exhibition halls or collection storage rooms in a museum.

Session 2 Detect - Use of technology in IPM

What's Bugging You? Research Involved in the Development of Collection-Specific IPM Software and Pest Databases

Melissa King[1], Ana Martins[1] ,Nathan McMinn[1], Austin Senseman[1]
[1]Conserv Solutions Inc., Birmingham Alabama USA

Data science, improved visualizations, and methodologies to enhance the user experience have the potential to make Integrated Pest Management (IPM) more ubiquitous and accessible amongst cultural heritage collections. There are few existing tools for collecting and visualizing IPM data, which include ZPest Tracker and CollectionPests. We are uncertain of any that integrate environmental data. Most IPM practitioners working in collections utilize simple spreadsheets to complete data collection, and this data is rarely correlated to temperature and relative humidity data despite how interrelated the data are. In order to better understand the needs of conservation professionals collecting IPM data for collections preservation, researchers at Conserv sought to interview and survey practitioners about their experiences through qualitative phone calls, formalized surveys, and interaction on social media channels. This research sought responses to questions such as, "What variables are most important to collect?" "How can this data be used?" "What advantages are there for including these datasets with other forms of preventive conservation data?" The goal for this survey was to inform the design and implementation of a freely accessible integrated pest management application that will be integrated with software that is already evaluating temperature, relative humidity, and light levels. The software is being designed from direct feedback from end-users on ways to improve efficiency and accuracy in the process while also utilizing the data for more meaningful analyses. An additional goal for this work is to support the preservation community's long-term research efforts into IPM by creating two publicly available IPM databases. The first, the "Collection Pest Database" (CPDB), is a dataset of pests that includes other quantifiable variables such as diet, preferred environment, seasonal life cycle habits, geographic location, and more. The second, the "Pest Occurrence Database" (PODB), is an anonymized dataset of observations used to track seasonal and geographic trends and to establish IPM baselines for collections. Users entering data into the IPM software will be addressing their individual collection challenges while also effortlessly contributing to a rich dataset for future academic research. Transitioning from siloed IPM spreadsheet solutions to a big data structure will empower the field to use artificial intelligence and machine learning processes to develop predictive models for classification and infestation. These new models integrated with environmental datasets hold the promise for a more complete understanding of pests in collections. This survey was crucial for understanding present methodologies and hopes for future improvements for IPM in collections care.

Remote monitoring for museum pests - a 21st Century Approach

Adrian M Doyle[1] (lead author) Fabiana Portoni[2], Tatiana Marasco[3], Pat Kelley[4] & Tom Mueller[4]
[1]IPM Manager, Department of Property and Facilities Management, British Museum; [2]Preventive Conservator, British Museum, 3Head of Preventive Conservation (Department of Conservation and Collections Care), British Museum & [4]Insects Limited

Monitoring insects is a fundamental element of Integrated Pest Management, and advanced planning is crucial to enable staff suitable time to replace monitors, identify insects and respond to concerns.

As is fairly standard in Museum and other heritage collections, the British Museum, undertakes quarterly monitoring and teams of trained collections care staff check catch numbers, differentiate species and undertake actions based on 'normal' expectations derived from previous data, knowledge of their collections and experience.

As part of this planning, restricted access, loan agreements, difficult to reach and poor line of site sometimes require complex coordination and a quick response to unexpected high catch numbers can be challenging.

Remote pheromone monitors that send a daily photo image of pest captures to a software program via wireless internet signals first became available for indoor storage spaces in 2019.

The remote monitoring in this study will focus on the battery-powered SightTrap™ system and its accompanying software ForesightIPM™ used in conjunction with pheromone attractant lures for webbing clothes moths, *Tineola bisselliella*.

Entomologists employed by the manufacturer will identify, count, and record daily trap captures and then publish this information within the software program.

The recorded information and images are then sent to a smartphone app for simple review by museum staff and appropriate actions can be taken based on activity.

The British Museum is the first UK museum to pilot an innovative remote monitoring system in two selected areas, a high-profile temporary exhibition and an identified problematic area with known pest populations.

This pilot aims to inform future decisions about how to make insect monitoring more accessible and effective within the organisation.

Training, tools and technology for managing IPM at the V&A

Val Blyth, Bhavesh Shah[1], Maria Ines Carvalho, Anne Bancroft
[1]Scientist (Environment), V&A South Kensington, Cromwell Road, London, SW7 2RL

Integrated Pest Management at the Victoria and Albert museum has been established for nearly 30 years and formalised in 2006 with the creation of the Preventive Conservator post. As new sites are being added to the V&A family, using remote technology to help with the collection and analysis of data as well as the training staff is being adopted in a post-Covid working environment. The availability of state-of-the-art data science tools, low-cost sensor-camera technology and the retirement of experienced Senior Preventive Conservator Val Blyth has provided motivation for introducing these new platforms. The three emerging themes that are being explored are tools, training online and technology.

Tools to capture data are being developed with the IT department that allow inspections to be recorded remotely and the data is integrated into an online reporting platform. Online training modules are being added to the training package for V&A staff. An attempt was made to develop a mini-'security camera' using a Raspberry Pi and low cost camera technology.

The use of technology to manage the next generation of house mice

Chris Swindells
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Prevention of rodent activity has relied on a hierarchy of control measures. A good integrated pest management (IPM) programme relies on three main principles of exclusion, restriction, and destruction (ERD). When exclusion and restriction measures fail, effective monitoring and control methods (destruction) need to be in place to prevent rodent populations escalating, and posing a threat to public health, food safety, building fabric and possessions. Monitoring and control of rodent populations has been achieved with the deployment of physical traps and rodenticide baits checked on a frequent basis. Whilst control can still be achieved in many situations, treatment failures do happen. There is anecdotal evidence, particularly in house mouse (*Mus domesticus*) populations, of trap and bait box avoidance. This can cause delays in treatment or worst case provide misleading information about treatment effectiveness. In addition, resistance to certain anticoagulant rodenticides is also known. Some house mouse infestations are becoming increasingly more difficult to control.

In the last decade there has been a proliferation of remote rodent monitoring technologies offered to the pest control market. 24/7 monitoring provision, economies of scale, possible reductions in costs and time on site, environmental considerations, and perhaps existing treatment failures, has seen a gradual uptake of these systems by some pest control companies and their clients. Not all remote monitoring systems operate in the same way. 'Intelligent' mice that avoid conventional traps and bait boxes are potentially just as likely to avoid remote monitoring technologies housed in conventional boxes or those reliant on traps.

When used correctly and as part of a good IPM programme, remote rodent monitoring technology can be extremely useful in identifying activity patterns, areas requiring treatment and measuring the success of a rodent control programme in real time. Despite the potential benefits that remote monitoring technology offers, there is still a need for qualified and experienced personnel in the field to carry out proactive inspections of vulnerable and high risk environments.

Keywords: House mice, *Mus domesticus*, rodent, pest, monitoring, IPM

Session 3 Detect - Insect science

The attractive qualities of larval frass on wool to the webbing clothes moth, *Tineola bisselliella*

Patrick Kelley[1], Rachael Arenstein[2], James Feston[1], Jonathan Scheer[3]
[1]Insects Limited, Inc., Westfield, IN USA, [2]A. M. Art Conservation, Scarsdale, NY USA & [3]J. Scheer & Co.

Tineola bisselliella, commonly known as the webbing clothes moth is a damaging pest in museums and historic homes. The larvae of this species can feed on a wide range of objects that contain natural animal fibers such as wool, feather, fur, hair, hide and skin. Damage has been documented on textiles, skin, taxidermy, and entomology collections. The object of this study is to determine how larval frass accumulations on wool, influences its attractiveness to adult female moths. Data was collected using arena bioassays containing traps with test and control wool specimens. This method allowed us to quantify the response of female moths to un-infested wool, previously infested wool, and previously infested wool with 3 cleaning methods commonly used by museum

conservators. The results of this testing will be useful in determining the significance of post-infestation cleaning methods typically used in museum settings.

Ctenolepisma longicaudatum Escherich, 1905 in a Museum of Applied Art

Christian Dressen
Conservator of wooden artifacts, Museum of Applied Art, Frankfurt/ Main, Germany

Since the first detection of *Ctenolepisma longicaudatum* on December 2017 a wide range of measurements were undertaken to reduce the number of specimens in the building. To get a first impression on the distribution in the main and adjoining buildings one hundred paper tube traps by Dr. Querner were set up. After five months these were added by another one hundred fifty traps to narrow down the infected areas. The maintenance of these traps and the change interval of baits will be described.

Different bait materials were tested for the highest attraction to targeting *Ctenolepisma longicaudatum*. Also, sticky traps were custom made to fit the requirements of the room (e.g., drains, skirting board, below furniture). Furthermore, floor barriers with and without integrated traps were tested to avoid the spreading of infestation from room to room.

Special exhibitions are a big challenge when dealing with this insect. Different design and materials of showcases were evaluated while in use. The temporary protection of stored crates and packaging during special exhibition were tested. Pre-monitoring will be discussed.

The effectiveness of deep cleaning and new storage strategies was evaluated over a period of time. Furthermore, the hiding places were examined in terms of humidity ratio of materials, wall mounting and microclimate.

Mice and Moths – From One Infestation to Another

Greg Fee

Typically, museums and heritage sites have their own inhouse IPM teams and it is normal for the general pest control and prevention servicing of the site to be contracted to a third party. Often this is just a small part of a combined FM package with other soft services such as cleaning, washroom services etc. The principal contractor will normally then appoint a sub-contractor to provide the pest control services. In this format inhouse IPM teams seldom have any real association with the pest control contractor, and this can create large gaps in the accuracy of both pest monitoring and control, when different parts of the site are effectively under separate management. Commonly the pest control contractor will be responsible for specific parts of the site such as catering, waste, communal, back of house and public areas, with the IPM teams covering the collection and archive spaces. We also see a common theme of the pest control contractor being more focused on vertebrate rodent control with insects as a secondary often only reactive service. IPM teams are of course concerned with all potential pest types, but their active monitoring normally is restricted to just for insects. These differences in approach to pest management creates large gaps in the overall pest management of sites and is something we have worked with our clients to improve upon to develop a closer working relationship between the contractor and inhouse IPM teams. We will describe how we achieve this and outline some of the benefits in the collation of data, including some of our early observations when using this collaborative approach in the relationships observed between different pest species.

New adventures in IPM-quarantine - still work in progress

Volker Hingst
IPM-coordinator at the LVR-AFZ, Pulheim-Germany

Because of a detected *Ctenolepisma longicaudatum* infestation in the LVR-AFZ there was an urgent need for creating quarantine areas and rooms in a quick and easy manner. The fastest way is by sticking a double-sided pressure-sensitive adhesive tape just around a stack respectively palette or on the threshold. This is an efficient manner to stop contamination by crawling insects like the “Grey silverfish”. If the quarantine room is often used by trolleys etc. or people step on it, the adhesive tape will lose its tack quickly. In this case, you have to change it very often or you need a sufficient solution. That’s why we use an M-style barrier made from stainless steel to create a permanent rigid barrier on the threshold, including the double-sided pressure-sensitive adhesive tape. This barrier prevents the undesired contact with the adhesive tape and protects the adhesive from dust and dirt, so its tack will last longer. Because the steel barrier is assembled above the floor level, an obstacle of approx. 15 mm height must be overcome. In some cases, this may be problematic. Therefore, our quarantine barrier needs further development by cutting a slit in the screed to sink an U-style barrier into it.

(This article refers to the paper from Christian Dressen, Frankfurt-Germany)

Targeting *Ctenolepisma longicaudatum*: Implementing an effective IPM programme on a limited budget in a small to midsize institution

Antonia Reime Aabø
Preventive Conservation Advisor / IPM coordinator, IKA Østfold Interkommunale Arkivselskap, Norway

This presentation outlines practical and low-cost measures for manageing *Ctenolpeisma longicaudatum.*

Since being established in 2015, the public archive for the South-East region of Norway has recieved 6000m of records into its care. Responding to an infestation of *Ctenolepisma longicaudatum*, an IPM programme was implemented in 2018.

Our IPM programme operates on a low budget, focusing on cost effective measures that do not compromise collection safety. Using sticky traps, trained IPM staff have devloped confident ID of this species, recording age diversity within the population and providing useful data for targeted treatment, as well as assessing impact of measures. Result after twelve months: an overall decrease in *Ctenolepisma longicaudatum* by 76%.

Having built expertise in this area, other institutions approached us with their own concerns - in particular how *longicaudatum* infested dry environments, and the rapid speed at which it had inflicted extensive damage to cellulose based materials.

We were able to share our knowledge and experience in identifying and managing *Ctenolepisma longicaudatum*, providing advice on: the risks of cellulose-based packing material in bringing stowaways into storage space; our extensive use of quarantine zones, used for containing pest movement; our effective procedures for disposing of waste packing material; and our preventive low-temperature treatment of all accessions.

Session 4 Respond - Traditional treatments

Preserving Peruvian organic cultural heritage using Lupinus mutabilis (Andean Lupin) extracts

Angélica Isa, Carolina Parada, Eliana Quispitupac, Malú Chávez & Marilyn Palomino

Conserving organic materials is a special challenge in tropical climates and uncontrolled conditions. The archaeological gourds at Museo Pachacamac (Lima, Peru) are constantly threatened by a yet unidentified beetle which has been found affecting a myriad of materials (grains, vegetable fibre and wood). It has even been found on archaeological textiles and is a common presence in and around mummy bundles. Anoxia and freezing are difficult to set up in Peru, especially when dealing with large infestations. We hypothesize that the use of Andean traditional knowledge related to the use of plants as dissuasive agents against agricultural pests can be repurposed to protect organic cultural heritage. *Lupinus mutabilis* (known locally as tarwi) contains secondary plant metabolites (quinolizidine alkaloids) that act as defensive chemical compounds against predators. A tarwi extract would allow the application of a natural, sustainable solution to Peruvian Integrated Pest Management. Additionally, an entomological focus was applied to sample, identify, and artificially raise the species responsible for deterioration, which has been preliminarily identified as a *Tricorynus sp.* Our observations have shown this species to live up to 64 days as an adult, during which the females hide eggs in the substrate one by one. The full study and identification of the beetle is being carried out as part of this investigation and will be presented as a master's thesis in June 2022. Thus, this two-fold investigation was designed to extract the active compounds in tarwi responsible for pest repellence and test them directly on the taxonomically identified beetles. By using a circular economy scheme, we have considered the use of tarwi effluents, a residue from the food industry, as well as the use of hydroalcoholic extracts from tarwi leaves and seeds. These extracts were characterised, and the presence of the main alkaloids was quantified. This study will carry out a semi-quantitative comparison of the repellent and biocidal effects of hydroalcoholic extracts from leaves and seeds and washing effluents of the seeds against *Tricorynus sp.* Preliminary bioassays with termites were performed at controlled temperature and humidity during different times of exposure to the extracts. Antifeedant activity was evaluated in Petri dishes with different combinations of paper disk halves soaked in hydroalcoholic tarwi extract, 70% ethanol and clean paper. Each was repeated 5 times with 30 termites per run. Results suggest that the alkaloids in hydroalcoholic extracts of leaves from tarwi act effectively as dissuasive agents. The results allowed us to calculate the mortality rate, in terms of the mean lethal concentration (LC50), and the percentage of repellence. Bioassays using a population of *Tricorynus sp.* in the adult state will be presented and discussed. This work highlights the opportunities in reutilizing natural products from plants endemic to a defined region to protect cultural organic materials. This investigation is funded by the Peruvian National Council of Science, Technology, and Innovation (FONDECYT-CONCYTEC) and the World Bank and has so far been carried out within the context of significant COVID-19 restrictions in Peru.

Keywords: Cultural heritage, Conservation, *Lagenaria siceraris*, *Tricorynus sp*., *Lupinus mutabilis*, Natural biocide
Pest Odyssey 2021 – the Next Generation

Novel New Packaging Approach to Termite and Fire Ant Control

Keith Donaldson
President, Engineered Materials Inc.

The smallest pin holes in standard barrier protective films and bags can allow termites to enter and do their destructive damage, often without notice. Chemicals and other current termite control methods can put both personnel and the items themselves at risk. It was discovered, by accident, that a commercially available reactive barrier film provided effective barrier to termites and fire ants through a multi-year, outdoor storage of items on a beach in Singapore. The barrier material is Copper based, contains no volatiles, oils or chemicals that can contaminate or impact the items being protected while being fully recyclable. Research into how fire ants, termites and bees communicate indicate that they communicate via electrical impulses. The barrier film with an electrical activation of 0.7 volts effectively acts as an electrical shunt preventing communication, which impacts their ability to enter into areas protected by the film. Testing in Australia, University of Hawaii and LSU confirmed that termites will

not breach the barrier even if a small hole exists. The film has been approved for use by the US EPA and is currently being studied for use as effective mitigation against mildew and viruses.

Screening of two plant-derived extracts from Sri Lanka for their potential to control the subterranean termite *Coptotermes formosanus*

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The tropical environment of Sri Lanka accelerates bio-deterioration of cultural objects. Termites are one of the most damaging insect pests destroying the cellulose components of historical artefacts. Herbal extracts obtained from resin of *Vateria copallifera* (Retzius) Alston and seeds of *Madhuca longifolia* (Konig) Macbride have been used for centuries to preserve e. g. palm leaf manuscripts from insect attack. Herbal extractions of these traditional products for palm leaf manuscript were tested for their effect against the termite species *Coptotermes formosanus* Shiraki, 1909. Natural and artificial aged herbal extractions were tested to obtain a repellent index. Resin oil of *V. copallifera* caused slightly higher repellencies than *M. longifolia.* Artificially aged samples produced lower repellencies than naturally aged samples. The results indicate that the active ingredients are volatile. The potential for barrier treatment was tested only with *V. copallifera*. Tunnelling-behavior of *C. formosanus* workers through sand in the presence of *V. copallifera* resin oil was largely reduced. We suggest that these two natural products should be studied further.

Keywords: Termite control, essential oils, library pests, IPM in museums

Session 5 Respond - Temperature treatments

Preliminary trials with reduced temperatures in humidity controlled warm-air treatment, a more gentle and efficient way to disinfest artworks and heritage objects

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Reduced temperatures in the humidity controlled warm air treatment of artworks and heritage objects
Controlled humidity warm air treatment is one option of treating insect infested art works and heritage objects. Treatment temperatures are usually in the region of 50 – 55°C to ensure complete mortality of all pest insects. For some objects and materials lower treatment temperatures could be desirable. This paper introduces the results of lower lethal temperature trials carried out by the German MPA (Materialprüfungsanstalt Eberswalde), an independent entomological testing and research institute specializing on woodboring insects. For determining lethal temperatures, an accepted approach is to find out how high the temperature needs to be for the insect to die when exposed to that temperature for 1 hour. In this trial the approach is reversed. The goal is to find out how long various species need to be exposed to 43°C and 46°C respectively to achieve 99.9% mortality. The trials are at two different RH settings: 40% and 60%. Trial species are: *Anobium punctatum* (common furniture beetle or woodworm), *Lyctus brunneus* (powder post beetle), *Lepisma saccharinum* (Silverfish), *Tinea pellionella* (Case-bearing clothes moth). The implications of the results are discussed in relation to possible lower temperature treatment protocols for treatment of artworks and heritage objects.

Death-watch death wish

Robert Entwistle

This is a part 2, of a talk I gave at the Icon Conference in Belfast 2019.

In 2016 Ipswich Museums IPM system flagged up an infestation of Death-Watch Beetle in our collection of Tudor beams.

We have a large collection of wooden beams, some long and very heavy from demolished Tudor houses in Ipswich. The beams were/are too heavy and too big to move, some over 20ft long.

We considered freezing, but they are too big for our freezer. Thermo-lignum, was too expensive and the beams could not be moved.

The Borough Council decided to treat the whole store by using a company who said they could raise the temperature to over 60.C. A temperature above 60.C should kill all insect life.

Heat was introduced into the store via heat exchangers using piped hot water from a boiler parked on site.

This method was obviously a lot more convenient as hardly any objects needed to be moved. Although a free movement of air around the area and the objects had to be ensured.

After the first attempt we unfortunately still found evidence of beetles in our traps. A second more targeted attempt took place, this time with insect test samples, and a selection of different materials.

Both times RH and temperature were monitored within and outside the treated area.

This paper will discuss how the process took place, how it was done and how the raised temperatures affected a taxidermy specimen, an oil painting, bone wax and ivory. It will also detail what insects survived the second test and suggest reasons.
This paper will summarise the success of the process and, with certain provisos, what a museum should to do in order to ensure a positive result. It will also assess whether this method should be considered by museums as another tool against insect infestation.

Efficacy of low cost simple solar heating box to eradicate insect pests of libraries in Sri Lanka

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Insect pest infestation is a severe problem in public, personal and national libraries in Sri Lanka. High humidity and temperature of the region accelerate the insect propagation and worsen their damage. Hence, negatively effect on the sustainable development goals of the library sector in the country. Even though traditional and chemical measures are used against insects in libraries in Sri Lanka, none of them are sufficient to eradicate them. Therefore, this study was conducted to develop a simple low cost treatment method against insect pests in libraries with the concept of thermal death of insects at 45°C.

A thermal insulated rigifoam box (20 mm thick) measuring 470 x 405 x 362 mm with a well fitted lid was used in this study. The outer surface of the box was painted by water based black paint. A minimum maximum hygro-thermometer (Made in China) was fixed on the outer surface of the box and the probe was inserted inside. The open rigifoam box was placed at the court yard of the National Library of Sri Lanka, Colombo 07 for about one hour on a very sunny day until the inside box temperature reads to 45°C. Medium to large size library books (n=30) infested with *Lasioderma serricorne* (Coleoptera), *Lepisma saccharinum* (Zygentoma) and *Coptotermes* spp. (Isoptera) were selected and a pre count of the insect pests were recorded. Five books each were wrapped separately (six replicates) using blotting sheets to buffer moisture fluctuation and prevent moisture loss and screen out UV and visible light that harm paper materials. They were immediately placed in the heated rigifoam box and tightly closed the lid. Hygro-thermometer readings were recorded for 20 minutes and at the end, insect mortality was recorded. Control experimental set up was done at room condition (30 °C ±2 °C; RH 80% ±10%).The experiment was repeated for 40 and 60 minutes post treatment exposure. Any pH changes of the paper material due to heating were measured using chemical wood pulp paper (70 gsm photocopy paper; 210 x 297 mm^2 size) and mechanically wood pulp paper (40gsm newspaper; 449 x 597 mm^2 size) placed inside the rigifoam box, according to the standard method.
L. saccharinum showed 100% mortality after 20 minutes exposure to temperature 45 °C ±1 °C and RH 45% ±5%. When the exposure time increased to 40 minutes the mortality rates of both adult and larvae of *L. serricorne* and *Coptotermes* spp. were increased and reached to a range between 93% and 96% in 60 minutes. This method can be recommended to control insect pests of long term storage of paper material in libraries and archives in Sri Lanka. Because of the energy source is free and the operation is simple, this application can be decentralized for small scale personal and public libraries in rural areas in Sri Lanka.

Selective feeding on paper and cardboard, and limited dispersal of the long-tailed silverfish *Ctenolepisma longicaudatum* in archives

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The long-tailed silverfish is an emerging pest in Germany, and was recorded in six sites of the Academy of Arts Berlin. In order to evaluate potential damage, semi-field trials were conducted in several archive rooms. Sixteen different types of paper and cardboard (pieces 10.5 x 7.0 cm) were exposed in choice-trials to the naturally occurring population of *C. longicaudatum* for 12 months. This setup was placed in one room with chemical control with toxic gel-baits, and another without control of silverfish. For monitoring sticky traps were placed. Significant differences in damage were observed. About 60% of a glassine paper was consumed. Some types of cardboard were superficially eaten off only, others were still intact at the end of the observation period. Less damage and lower trap catches were recorded in the room with chemical control. Activity of silverfish was monitored with sticky traps on the floor vs. on shelves in archive rooms. On smooth metal shelving, not a single silverfish was caught even in areas with continued silverfish-activity on the floor, indicating limited dispersal and reduced potential for damage in the archive rooms.

Conservation of cultural heritage: biological control of the common furniture beetle with *Spathius exarator*

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Biological control using beneficial organisms gains importance in Integrated Pest Management. Here, we present a method to control the furniture beetle *Anobium punctatum* by releasing its natural enemy *Spathius exarator*. This braconid wasp parasitizes its host species by piercing the ovipositor directly through the wood surface followed by oviposition onto the beetle larva. After development it emerges as adult wasp trough a self-gnawed hole.

Between 2012 and 2020 the beneficial wasps were introduced into more than 175 different *A. punctatum* infested buildings throughout Germany, Belgium, Switzerland, Austria and Spain. At least twelve treatments over a period of three years were performed, followed by single annual treatments. Parallel, a monitoring programm was conducted and parasitism rates were calculated as the proportion of parasitized *A. punctatum*.

Here we present data of *A. punctatum* infested objects (n=42), treated and monitored up to three years. After three-year treatment, parasitism rates were significantly higher with a mean value of 0.20 when compared to untreated objects with a natural parasitism and a mean value of 0.08. The proportion of parasitized *A. punctatum* per year was 0.66, 0.67 and 0.74 for treatment year one to three, respectively.

Thus, the last years operating experience prove this biological method of pest control as efficient, sustainable and non-toxic option to manage the common furniture beetle.

Keywords: biological control, wood pest, cultural heritage, common furniture beetle, parasitic wasps

Making room for traditional ecological knowledge in conservation: learning by example

Elizabeth Salmon
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Pest management has been a focus of study for indigenous communities around the world for centuries and continues to play an essential role in reducing the detrimental effects of insects and bacteria. Several academic fields, from both the natural and health sciences, have turned to the traditional knowledge of indigenous communities to identify pest management methods that are affordable, locally sourced, safe and also capable of addressing new and evolving challenges. Yet, their potential is little explored in scholarship produced by and for conservators and allied collections care professionals. This paper draws from twenty-four journals representing a minimum of fifteen academic disciplines, including environmental conservation, biology, development, pharmacology and others to understand how cultural heritage conservation might effectively utilize traditional

ecological knowledge (TEK) for more robust and inclusive museum pest management. By looking to the literature produced in other academic fields, we can foresee the benefits and potential challenges of integrating traditional pest management practices into museum integrated pest management (IPM). Engaging with traditional and indigenous knowledge systems to learn about the local, time-tested methods of controlling insects, as researchers in other disciplines have begun to do, has potential to provide preventive conservators and collections care professionals with increasingly sustainable, non-toxic, and culturally inclusive methods of pest management to supplement existing museum IPM practices.

Session 6 Respond - Other treatments

From Discovery to Recovery: Managing a Webbing Clothes Moth Infestation at the Peabody Museum of Archaeology and Ethnology

Cassy Cutulle, Matthew Vigneau, Mollie Denhard, Khanh Nguyen, Lindsay Koso, and Molly Richmond

In 2016, staff at the Peabody Museum of Archaeology and Ethnology discovered an infestation of webbing clothes moths (*Tineola bisselliella*) in the largest storeroom for historic, organic objects. In an effort to quickly control the infestation, an emergency response protocol was successfully executed, prompting the creation of the, “Moth Mitigation Project”. This project consists of a dedicated team of conservators, collections assistants, and collections technicians, devoted to combating the webbing clothes moth infestation, in conjunction with the Museum’s pre-existing pest management program.
In this paper, we aim to discuss our mitigation approach and detail the steps undertaken, while providing the Team’s experiential insight into creating and maintaining a successful mitigation program. This paper will also provide recommendations on how to prevent pest activities and further protect collections from insect damage. Using case-studies drawn from additional, smaller incidences of webbing clothes moth outbreaks, we will discuss the causes, challenges and surprises related to the mitigation of the moths. It is our hope that through this paper we may be able to provide guidance to other museum professionals facing similar issues.

Infestation stations! A novel, full-cycle approach to moth eradication at Blickling Hall

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Webbing clothes moth, *Tineola bisselliella*, is the one of the top-two insect pests in National Trust properties, both in terms of its prevalence and potential to cause damage to collections. Whilst widely distributed, its profile is associated with large infestations at a small number of properties that have proved hard to control.
As a case in point, *Tineola* caught in traps at Blickling Hall, a 17th century mansion in Norfolk, tripled in 2016, since when they have accounted for 17% of the average annual *Tineola* catch across the National Trust.
This type of infestation has so far proved resistant to preventive housekeeping, cleaning and adhoc reactive treatments. The National Trust is therefore using Blickling Hall to investigate a new and more invasive methodology, to systematically and simultaneously target all stages of *Tineola* life cycle. This will involve enhancements to our existing approach across a 12-month period, with the addition of two new treatment options, neither of which are much documented in the heritage field: Parasitoid wasps (*Trichogramma evanescens*) and a pheromone dispersal system with electrostatic properties (Insectrac® CL Tabs) specifically designed to disrupt adult mating encounters.

The aim is to devise an effective regime where entrenched infestations pose a clear threat to vulnerable and significant collections, ensuring we continue to offer sustainable IPM at the heart of the National Trust's robust collections care programme.

The paper will present this novel IPM methodology and results from the first half of the treatment cycle, giving a preliminary evaluation of the impact of the various treatments adopted.

Over 10+ years using parasitoid wasps in Integrated Pest Management for Cultural Heritage in Germany

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The webbing clothes moth (*Tineola bisselliella)* has been increasingly common in museums and collections for many years and is often carried away with loans or touring exhibitions. Originally developed in the field of plant protection, the use of wasps against pests is already part of everyday life in the integrated pest management of many museums or collections in Germany or Austria. After several years of experience, the regular and long-term use of beneficial organisms (natural antagonists) can lead to a significant reduction of a pest population in museums.
The paper describes the permanent use of parasitoid wasps to control of the webbing clothes moth in the exhibition rooms of a technical Museum in Germany from 2007 till 2020. In certain areas with clothing moth infestation, such as smaller depots or in enclosed objects such as classic cars, the targeted use of useful people can be an effective and cost-effective alternative to conventional methods.

In addition, the use of further parasitoid wasps or parasites in the case of infestation by museum pests is reported. Common pest species in collections, historic houses or libraries are the biscuit beetle (*Stegobium paniceum*), the furniture beetle (*Anobium punctatum*) or Dermestid beetles, like the Brown Carpet Beetle (*Attagenus smirnovi*). With observed consultancy the infestation of *Anobium punctatum* and the use of the braconid wasp *Spathius exarator* was controlled and regulated from 2014 till 2020 in a Bavarian palace church, the Residence Ellingen.
In accordance with the European standard DIN EN 16790 from 2016, the release of parasitoides is also regarded as a method to reduce and control pest populations for Integrated pest management. However, the use of beneficial organisms cannot in any way replace a control in the event of severe pest infestation by means of fumigation or equivalent processes. Therefore, the use of parasitoid wasps has so far been limited to prophylaxis or regulation of a low pest infestation.

Over the last 10 years many conservators or staff from museums have already been informed about the topic of parasitoid wasps through workshops, conferences and training courses and have been convinced to practical application. Publications on social networks and a new information website-portal contribute to the exchange of information on the possibilities of biological control in the IPM.

Keywords: pest control, parasitoid wasps, integrated pest management, workshops, museumpests

Comparison of three treatment methods for archive materials against the grey silverfish

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In this study we compared the effectiveness of non-toxic treatment methods for the grey silverfish *Ctenolepisma longicaudatum* The reason was a massive spread of this collection and museum pest in Europe and therefore the need for recommendations for preventive treatment arose. In our study we focused on archive and library material as the presence of this pest increased in many institutions in Germany and Austria (and other countries across the european continent). Until now it was not clear how archive and library material

itself as well as housing material, even when recently purchased, needed to be protected against this pest. Archives face big challenges in treating the grey silverfish as often large quantities of objects or materials are introduced at once in the facilities. Until now, most archives and libraries do not do any treatment specifically against the silverfish at all. They rather focus on monitoring, cleaning and mould prevention. In this research three common, non-toxic methods were compared under laboratory conditions: cold, heat and deprivation of oxygen. Standardized test samples (archive boxes 40 x 28,2 x 11 cm) were created and all developmental stages of the grey silver fish examined: eggs, nymphs and adults. The mortality rate was determined by checking the time, temperature and oxygen values.

Our results show that for specifically controlling grey silverfish, a reduced time was needed to kill all stages. When freezing objects at -20°C usually a minimum of two weeks is recommended. We found that without first reaching the core temperature 12 hours were sufficient to kill all stages, if separate archive boxes are treated. 3 hours were needed to reach temperature below 0C in the boxes. For the investigated heat treatment 47.5°C for a time period of one hour resulted in the death of all stages. Other museum pests are usually treated at temperatures of 52-55°C for one hour. The eggs of the grey silverfish were the most resistant for both physical methods.

The anoxic treatment was tested at 22°C, 50% RH and 0,1% Oxygen level. A short treatment time of only 48 hours was found to kill all stages of the grey silverfish. Also here, the recommendations for other pests are 21 days at 25°C and much longer than our findings. Our research shows that even with short time periods and lower temperature levels the grey silverfish can be treated sufficiently.

Session 6 Recover – Engaging Staff

Pest Partners – increasing engagement with IPM.

Helena Jaeschke
Pest Partners

The Pest Partners project was created after the Covid-19 lockdown began in England in March 2020. Spring is a time when many adult pests emerge to mate and infest new areas and the lack of human activity in collections meant pests had an increased opportunity to spread unhindered.

With additional funding from Historic England the South West Museum Development team was able to invite any heritage collection in the southwest, not just museums, to take part. The project aimed to support organisations which did not monitor for pests or were not confident in pest management.

96 organisations from archives to abbeys, museums to stately homes, registered as Partners and received a Monitoring and Identification kit. They submitted data from their traps and other locations from August to December 2020 which were then analysed and mapped.

Each organisation was also supported with further pest control measures including cleaning and quarantine kits and help with creating or reviewing integrated pest management (IPM) plans.

As well as identification sheets, a card game, “Save the Museum”, was devised to encourage more staff (paid and volunteer) to become involved in pest monitoring. A short, animated film “The Secret Life of Pests” was created, with an Arts Fund Professional Network Grant to help organisations take a more holistic view of managing pests, understanding how they enter and move through a building and how pest management needs to be integrated through all the actions of the organisation to be effective.

The paper will explain how the Pest Partners project was set up and run, what worked well and what could be improved. The analysed survey data will be examined. The paper will also demonstrate some of the resources

created to help organisations increase the skills, knowledge and confidence of their workforce, especially those new to IPM.

Adjusting to Fit: Shifting an organisation's approach to Integrated Pest Management to better reflect cultural protocols, legal requirements and workplace dynamics.

N. Mildwaters and S. Rhynard-Geil
Otago Museum, Dunedin, New Zealand

Though integrated pest management (IPM) is one of the central tenants of effective preventive conservation it can take considerable effort to embed it into cultural institutions and in some cases just as much effort to maintain it. The Otago Museum has been running a formal IPM programme since late 2014. As an organisation with approximately 1.5 million collection items, an indoor tropical forest living environment and a very active commercial venues team, an effective IPM programme was an essential priority for the newly re-established conservation team at the time.

The initial focus of Otago Museum's program was to reduce risks while disrupting the museum's existing internal systems as little possible to assist with fast staff buy during a time of considerable change. However when conservation staff took the opportunity to review the programme in 2019 we found that though potential risks and possible pest issues where being managed, the program remained very much in the hands of the conservation team and a few other key staff. IPM was known to be important but was at times seen by certain staff as a peripheral activity or one that caused them issues and delays.

As a result the conservation team decided to look at how the existing program could be adjusted to ensure that it would run seamlessly through all museum activities as a truly integrated and aligned program rather than as a parallel set of requirements. The initial aim was to achieve this whilst keeping the core pillars of the existing programme, such as, strong quarantine procedures, pre-emptive treatment via freezing and on-going pest level monitoring, in place relatively unchanged. Despite having to work around the disruptions of COVID-19, the results of stepping back adjusting and adapting our approach has had a surprisingly immediate effect across the organisation.

The authors will outline how the team have gone about adapting in-house training and communications to better match Otago Museum's specific workplace dynamics, including taking into account the interplay between various internal teams. The paper will also look at how conservation staff have worked to ensure the programme compliments the various legal requirements and obligations that the museum's teams are required to comply with, beyond caring for the museum's collections, such as those to the Ministry of Primary Industry (MPI), the Wildlife Management Act (WLMA), and the Protected Objects Act (POA). Finally and perhaps most importantly the authors will discuss how working to embed cultural considerations and protocols into the existing IPM programme has required a re-evaluation of how certain core activities are approached, as well as, leading staff to grapple with uncomfortable questions such as how to balance cultural requirements and with those of budget and space.

The History of Integrated Pest Management (IPM) at the Natural History Museum, London

Suzanne Ryder & David Pinniger

The Natural History Museum, London (NHM) was one of the first Museums to formally set up a comprehensive Integrated Pest Management [IPM] programme in 2002. The Museum had been developing and using pest management strategies for many years before this. Entomology was the first department to embrace IPM and use insect pest traps soon followed by Botany in the Herbaria. The Guernsey carpet beetle *Anthrenus sarnicus* was first recorded in the Entomology building but soon spread to replace the varied carpet beetle *Anthrenus verbasci* as the main pest in the museum. These two departments with the zoology department adopted freezing as the main

treatment option to replace pesticide use. An IPM culture was promoted through example and training. A major shift took place with the elimination of DDVP/dichlorvos in the museum. An IPM champion at senior management level was appointed to promote the adoption of IPM based on risk zones. Since then, the museum has built a dedicated collections treatment facility with an operations manager. The evolution and success of the IPM programme at the museum has been the result of having an IPM coordinator working with a dedicated team of museum professionals and the backing of senior management.

The *Spirea* who came in from the cold: treating an entire collection, kitchen sink and all

Clare Booth- Downs and Yvette Harvey
1851 Royal Commission Herbarium, Royal Horticultural Society Garden Wisley, Woking, Surrey, GU23 6QB

Those who know the Royal Horticultural Society Garden Wisley will often think of the iconic Laboratory, built in an Arts and Crafts style in the early 20th Century. It is certainly an impressive sight that greets visitors as they arrive; however some visitors, those with more than four legs, are much less welcome. The RHS Herbarium has suffered from outbreaks of *Stegobium paniceum* for many years due to a combination of human behaviours and unsatisfactory storage conditions. By Christmas 2020 the building required extensive remedial care, so the collection needed to relocate.

Here we share how we grasped the opportunity of our new purpose-built herbarium to plan carefully for a pest-free future. To be rid of the *Stegobium* it was imperative that not only the specimens themselves, but also all of the associated collections, books and furniture should be treated. This involved using a commercial freezer truck that reached -30°C and innovative temperature and humidity controls to mitigate the risk of condensation on the delicate, dried plant material. As a further twist to the process, this was all carried out during the global pandemic and through successive lockdowns, with inevitable impacts on plans and implementation of safe working for the staff involved.

Insect Pests Underground: Managing Pests in the Secret Wartime Tunnels at Dover Castle

Wendy Richardson

English Heritage holds collections both on display and in storage in three levels of tunnels in the White Cliffs beneath Dover Castle. As these tunnels are excavated from saturated chalk, usual museum levels of relative humidity are impossible to achieve, however with a constant temperature of between 15-20°C and a high relative humidity of 70-90%, this environment is ideal for insect pests, particularly wood borers (*Anobium punctatum, Euophryum confine and Pentarthrum huttoni).*

The conservation and estates teams have worked together to protect the collections in this space for the past 15 years. Through effective management, regular monitoring and treatments, these wood boring species, which are also prevalent in the materials used in the construction of the Second World War tunnels, have been controlled. Managing the insect pests at this site remains critical as it would be almost impossible to eradicate them entirely. Our collaborative approach and regular IPM and maintenance programmes, combined with environmental monitoring, physical collection and building checks, help to successfully manage pests in this environment.

Session 7 Recover – Reviewing established IPM Programmes

Pestily Ever After: Twenty years of IPM at National Museums Scotland

Catherine Haworth

I would like to take you on a journey through the evolution of the IPM programme at the National Museums of Scotland (NMS). The collection at NMS covers many curatorial areas including natural science, world cultures, science and technology, history, art and design. Across these departments we hold a collection of over 12.4 million objects including of taxidermy, entomology, textiles, transport, furniture and many other items susceptible to pest attack. The museum is spread across five sites and many buildings, varying in age and complexity.

Shortly after taking on the role of Preventive Conservator in 2006 I found a small number of clothes moths on a blunder trap. Little did I know at that stage that 15 years later we would still be in a war of attrition against them. A chance conversation with our rodent contractor led him to recommend the use of the killgerm pheromone traps. Gradually over the coming months the full extent of our infestation revealed itself.

Reflecting on the work that we have undertaken in the last ten to fifteen years, communication stands out as a key factor in having improved our IPM processes. I would like to talk about the various areas where this has had a positive impact on our IPM programme.

We have increased our communication channels with other departments in the museum. We have better connection to our front of house staff via a dedicated email address for specific pest issues, and a log for any collections concerns, which can also pick up indirectly related pest activity.

Training sessions for staff across the organisation continue and the guidance documents around the quarantine process have been simplified.

Improvements in other Collections Services policies have had a big impact on the volume of material passing through the quarantine process. We have benefitted from Acquisitions and Loans policy updates streamlining procedures involving the entry of objects into museum premises.

Communication that happens outside our organisations is also important for us to grow and develop as professionals. NMS organises a successful Knowledge Exchange programme through our National Partnerships team, which has seen us run IPM courses across Scotland. Although we are there as the trainer, talking with other people about their problems and experiences is a learning process for all involved. Now, with the events of recent times, we are taking this training on-line, and hope to maintain this valuable learning experience.

Contact with colleagues across the country is a valuable tool, as support and ideas are vital when we are often the lone specialists in our organisations.

As IPM practitioners we go out and look for pests in our respective institutions, whatever size they may be. But we must be good communicators, teaching and encouraging others in our workplaces to share our enthusiasm for spotting signs of pest activity, and influence budget holders to give us the funds we need to address the issues we find.

Eltham Palace: 900 years of history, 20 years of IPM in practice

Dee Lauder and David Pinniger

This paper defines the evolution of pests and IPM procedures in a large historic house with many environments and challenges. Eltham Palace was built as a bishop's palace in the 13th C, was a royal residence during the 14thand 16th centuries and fell into disrepair during the 17th C until it was rebuilt as an Art Deco residence in 1933. English Heritage took over the management in 1995 and pest trapping was established in 2001 with many changes to the pest population observed. Initially, the main pest species found in the house were varied carpet beetles, *Anthrenus*

verbasci, and silverfish, *Lepisma saccarhina*, were also found in large numbers in the medieval Great Hall. This has a stone floor with damp micro-environments, but with very few vulnerable objects, the silverfish do not present a great risk in this area. However, large numbers of silverfish in the house containing textiles and paper caused much greater concern. Sticky traps showed most of the silverfish were caught near the windows and outside walls and also in fireplaces. Water ingress was found to be the cause of the high humidity micro-environments and was rectified by targeted building work and maintenance. Common clothes moths, *Tineola bisselliella*, were not detected in the house until 2009. Numbers gradually increased until 2016 when there was a rapid expansion in the population. A key objective has been to identify the source of the moths and prevent damage to vulnerable and historic textile collections. The initial focal point came from the rooms off the main corridor by the medieval Great Hall and a number of objects were treated. Deployment of *Tineola* pheromone traps in a targeted grid has enabled more detailed mapping of moth frequency. Recent evidence indicates that the population is breeding in debris in inaccessible voids in the main corridor. Early trapping records also showed the presence of two spot carpet beetles and larvae, *Attagenus pellio*. In 2018 a new pest, the brown carpet beetle, *Attagenus smirnovi*, was confirmed when the first adult beetles were trapped giving the first record of this species from a historic house in London. It has spread in the house and is now well established in dead spaces and voids. The key challenge with a property such as Eltham Palace is the difficulty of housekeeping in a historic structure with inaccessible areas and voids which cannot be opened up for deep cleaning. The priority of the IPM programme has been to identify pest sources and risks and take action to ensure that the historic contents are not damaged by pests. This has been successful at Eltham and the IPM programme maintained here can serve as a model for other historic properties. However, it must be recognised that this is a continuing process which requires resources including regular assistance from trained staff.

IPM of Kyushu National Museum: Developing Strategies and Cooperation over Ten Years Practice

Rika Kigawa, Hiroki Watanabe, Ayako Izumita, Shiho Tomimatsu, Mika Matsuo
Kyushu National Museum, Japan

Kyushu National Museum, Japan opened in 2005 and it has adopted an IPM policy since its construction process began. The structural design of the museum cannot support conventional chemical gas fumigation so the basic strategies of sanitation, deep cleaning and careful observation were critical policies to develop. Understanding of the IPM policies by internal staff was extremely important and systems of cooperation with external contractors and volunteers have been built up over ten years. The IPM courses for different groups: curators, outside museum staff, volunteers, and contractors such as cleaning staff were tailored to help them understand the necessity of IPM ideas in a museum. In the meanwhile, effective controlling methods to cope with occasional invasion of insect pests via incoming objects and surges of trapped insects in certain areas have been of great importance. We have tested and learned effective strategies to counter common museum pest insects such as silverfish which are sometimes difficult to cope with. In this report, we will describe our communications and technical aspects of our thorough efforts to keep a desirable museum environment.

Session 9 Recover - The challenges in setting up and running a successful IPM Programme

Instruction versus practice: Where can we improve upon IPM?

Alex Rowe[1], Simoní Da Ros[1], Katherine Curran[1]

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Mismanagement of pests in museums collections and archives represents one of the most important threats for the conservation of tangible cultural heritage. Despite the introduction and widespread uptake of Integrated Pest Management (IPM) in cultural heritage in the past decades, IPM guidance seems to lack criticism and discussion to continue to evolve uniformly. This, therefore, placing the onus on individual institutions to adapt the practice to suit them. Our paper seeks to highlight and understand these adaptations, contributing to the discussion required for the further development of IPM.

To gain the necessary insights and a rounded perspective, we have conducted interviews with ten IPM professionals from a variety of different roles and backgrounds in heritage organisations. A questionnaire was used to gather information on the participants' previous experiences within IPM, in order to understand their level of training and personal perceptions, and for obtaining overviews of current IPM practice. Once analysed, the interview responses unveiled common themes, conceptual misunderstandings, positive and negative perceptions and insightful anecdotes. This enabled us to create a picture of general practice at the participants' institutions; identify opportunities for improvement, and to assess how current guidelines are employed and what adaptations are commonly incorporated to make IPM more workable in distinct establishments.

Considering guidance in comparison to practice, the results suggest that the main obstacle to IPM practice is the contextual constraints of heritage organisations. Whether purpose-built museums designed to incorporate IPM or centuries old country estates riddled with damp inaccessible areas, the companies and locations that house cultural heritage often seem to be too varied to standardise. The rational for adaptations from IPM guidelines were further demonstrated by participants' positive and negative reflections on their specific schemes. Many were directly influenced by limitations such as resources in relation to time, money and staff, often noting issues such as a lack of automation in monitoring. These tended to dictate how IPM steps could be put into practice and where they require alterations. Therefore, these findings provide an insight into the rationale behind individual deviations between IPM standard practice.

Our findings should contribute to the development of a basis for understanding the factors most frequently encountered when troubleshooting IPM schemes, to be explored further in future research.

Integrated Pest Management: from Monitoring to Control

Christian Baars and Jane Henderson

Integrated Pest Management (IPM) is an umbrella term for a wide range of activities to protect museum or heritage collections against pest infestation. The authors have experienced some practitioners referring to pest monitoring – a method to establish the level of pest activity in a given space by collecting data on pest occurrences – alone as 'pest management'. Within preventive conservation more generally, it is not unusual for data collection to become the end point of environmental management practice. Unfortunately, the comfort and familiarity of the business of data collection can mask a lack of efficacy in pest management, because monitoring alone does not necessarily lead to any changes in practice. IPM literature sets out the elements of successful pest management, yet there appears to be a focus on pest identification and counting. Data collection without analysis, interpretation and presentation omits critical stages that provide valuable information allowing reflective scrutiny of the success of pest

management measures. One crucial element for conservators seeking support for pest control measures is the creation of appropriate messages for distinct audiences, which considers their level of expertise and issues relevant considerations. Many IPM questions identify dynamic challenges, such as the spread of an established pest within a collection over time, but data are not always comparable across rooms, collections or buildings, leading to problems with data management and potentially incorrect interpretation. Delivering a message about unacceptable levels of pest activity should lead to real change, which we define as a reduction in damage to heritage items from pest activity. By implication, these considerations would lead to a change in data analysis and communication – no more same old same old. This paper seeks to open a broader discussion about the managerial, psychological, analytical and communication practices that are in danger of being overlooked when the focus of pest management is the counting of pests.

An International IPM Survey of resources and activities conducted by the MuseumPests.net working group

Eric Breitung, Lisa Goldberg, Zoe Hughes, Suzanne Ryder, Julie Unruh, Joel Voron

The museumpests working group conducted a survey in 2018 to gather information about current trends in resource allocation and operational practices in institutions aiming to monitor and manage pest activity. The survey was posted to several different list servers resulting in 377 respondents primarily from the USA and Europe but reaching 5 continents. The survey data was evaluated using Survey Monkey's innate analytics and Tableau, an open access data visualization program. Use of Tableau allowed us to pose various questions about the data by exposing relationships between the data sets.

Using the survey data and other IPM resources the team will report on general outlines for worldwide and regional trends. The survey investigates collections pest control methods, budgetary, personnel parameters, pest populations and use (or lack thereof) of institutional policies, we hope that the data resulting from the museumpests.net survey will answer research questions posed by the museumpests working group. This information will help us refine and define where work is needed in designing IPM solutions for museum environments.

Session 9 Recover - Collaboration

Warrang/Sydney IPM Group: A Regional-Specific Digital Collaborative Forum

Jessica Gray and Rehan Scharenguivel

The varied ecologies and climates across Australia have led Australian Integrated Pest Management (IPM) practitioners to adapt research developed in the Northern Hemisphere to fit regional-specific challenges. The Warrang/Sydney IPM Group is a regional-specific digital collaborative forum developed to address these specific challenges.

The Northern Hemisphere approach is not always applicable due to the differences in climate and specifications of regional government policies for heritage institutes. Therefore, taking into account Sydney's subtropical climate and ecological variance is crucial for Sydney IPM practitioners. Developing solutions to these challenges can occur at an institutional level, however, a collaborative approach between institutes increases the sustainability of our IPM programs and allows for sharing of the importance of IPM to a wider audience.

Previously, Sydney organisations have worked individually to find solutions to regional- specific IPM problems by drawing on distinct bodies of literature predominately developed in the Northern Hemisphere. This creates unsustainable approaches as multiple institutes trial the same products and methods to find the best approach. The

authors sought to break down the silos of Sydney institutes by creating a digital platform that acts as a central repository for sharing practices and information on IPM.

The use of digital collaboration tools is found across all fields of academia, including heritage institutes, and has allowed for the profession to advocate for best practices. Research into the methodologies of their use and trialing a variety of tools informed the authors approach in developing the Warrang/Sydney IPM Group. A brief history of the development of the group will be discussed exploring the growth of the group from an email contact list to a digital forum.

This paper will investigate ongoing challenges to using online collaborative tools and encouraging input from users. A variety of approaches have been used to suit user ability and engagement with IPM.

Online regional-specific collaborative groups are by nature an ongoing and dynamic. These tools allow for an archive of collaborative efforts, which creates long term knowledge building. The collation of data is a sustainable approach for institutional resources, sharing individual knowledge and providing for best practice IPM across a specific region.

From Pamphlets to Websites – the evolution of IPM resource material

David Pinniger, Amy Crossman and Jane Thompson Webb

Before the specialist publications on museum pests, sources of accurate information on the pests could only be found in other areas such as stored products and urban pest control. A key publication was Busvine's "Insects and Hygiene" first published in 1951 and with many later editions. The principal guide to insect identification was "Common Insect Pests of Stored Food Products" first published in 1943 with the last revised edition in 1989. One of the first references to what became known as IPM in Museums was "Getting the Bugs out" by Phillip Ward published by the British Columbia Provincial Museum in 1976. Although of limited availability, it was a template for later and more comprehensive publications such as "A guide to museum pest control" in 1988, "Insects Pests in Museums" in 1989 and "Heritage Eaters" in 1997.

Papers on museum pests first appeared in a range of non-museum scientific journals such as Journal of Stored Products Research before being included in conservation and museum related journals. There was a similar picture with papers presented at international conferences with some key papers in the proceedings of Urban Insect Pests and International Biodeterioration. Museum IPM papers then started to appear in heritage related conferences of IIC, ICOM and ICON. The first international conference dedicated to museum IPM was in Sweden in 1998 and this was followed by the first Pest Odyssey Conference in London 2001. The published proceedings of this and subsequent conferences in London, Vienna and Stockholm provide an incomparable resource covering all aspects of IPM from initial research to practical case studies.

Other sources of pest information include posters and identification cards and again all the earlier ones which included museum pests were produced for use in food storage or urban pest control. The value of the poster "A Helpful Guide to Insect Pests Found in Historic Houses and Museums" produced by English Heritage in 1998, and completely revised in 2008, is on shown by the print run of over 25,000 copies distributed to more than 20 countries worldwide.

Although guides on paper have a valued and continued place, it is the rapid development of computer-based resources which have recently transformed our information base. What's Eating Your Collection was originally produced as a CD to provide a follow up resource to IPM training. As with all CD based data, it was inflexible and time consuming to update and so was revised in 20?? to create a web based resource whatseatingyourcollection.com with a guide to pest identification and IPM practice. This website has now been completely updated and includes an IPM reference database. There are now other web-based museum IPM resources in the USA, Germany, France and Japan. This year heralds the first on-line heritage IPM conference which

will allow far more of people to participate. Although this decision was made because of the global Covid pandemic, perhaps this indeed the future way forward for creating resources and sharing information.

Management of Priorities, Goals, and Training in the Execution of a Pest Mitigation Project at the Peabody Museum of Archaeology and Ethnology

Cassy Cutulle, Matthew Vigneau, Mollie Denhard, Khanh Nguyen, Lindsay Koso, and Molly Richmond

The Peabody Museum of Archaeology and Ethnology at Harvard University cares for and houses important cultural heritage collections, of which many are constructed of composite, organic-based materials. In 2016, an infestation of webbing clothes moths (*Tineola bisselliella*) was detected in the largest storeroom for historic organic objects, posing a high-risk threat to the objects housed within. With the successful execution of an emergency response protocol, focus was turned towards the recovery of objects within the storeroom. To do this, an Assistant Conservator was appointed to manage overall project objectives and supervise a team of dedicated collections professionals in the examination, assessment, and cleaning of the affected objects.

This paper will detail both the overall approaches employed and the strategies utilized for implementing this mitigation project, including drafting protocol and training manuals, prioritizing and achieving project deliverables, and executing successful training. Also discussed will be specifics on the object recovery efforts such as treatments, condition assessing, and the decision-making process.

Advocating for IPM during a pandemic when a local authority has bigger concerns

Gwen Thomas
Collections Care Officer, Museums & Galleries Edinburgh

At the start of the National lockdown in March 2020, City of Edinburgh Council directed all but essential staff to work from home. All 7 museum sites and our store were shuttered and unstaffed except for mandatory security checks, and as restrictions eased this did not change. As a council, the organisation's other functions took priority – schools, care homes, and establishing new Covid resilience centres. Museum buildings Security, fire and RH&T can be monitored remotely but pest activity must be monitored in person. However, with security and water ingress the main concerns, ensuring that monitoring pest traps was factored into the weekly checks was not simple. All requests for access and resources had to be submitted to and approved by a central panel. Furthermore, most of the staff carrying out the site checks were non-collections staff. As the sole conservator in the organisation, it was my role to disseminate an understanding of museum pests and to champion the value of IPM within the wider museum service so it could be relayed upwards.

A carpet beetle outbreak was identified in two galleries of the Museum of Childhood five months into its closure. A case was then made to senior management for a small team of staff to carry out object checks, cleaning and treatment, framing the essential nature of the work and the potential for loss if no action was taken. The Childhood collection comprises a huge variety of objects and materials, and the affected galleries contained at-risk objects including soft toys, costumed dolls of all kinds, costume, samplers and hobby sets. A rota of three staff undertook the task of checking, treating and cleaning the contents of the cases, over 1100 objects, with estimated Covid age and transport restrictions taken into consideration. Risk assessments were compiled and a standard operating procedure to ensure that Covid-safe practice was observed as well as sector standards of collections care in a challenging environment. Managing equipment and resources, spread across multiple sites that were closed or inaccessible, required significant planning ahead of time. While working on gallery, social distancing was straightforward. However, mealtimes and preparation time posed difficulties due to cramped office and kitchen

spaces. Progress was also reported upwards throughout, and the potential impact of further restrictions assessed, so senior managers could continue to support the work and lobby for it to continue, as the council's work from home edict extended.

Workshop 1 – Silverfish

And Then There Were None: The successful treatment of a silverfish (Lepisma saccharinum) outbreak during the coronavirus (COVID-19) pandemic

Catherine Harris[1] and Alexandra Walker[2]
[1]Assistant Preventive Conservator, [2]Preventive Conservator, Bodleian Libraries, University of Oxford, UK

December 2019 saw the advent of a significant outbreak of common silverfish Lepisma saccharina in a publicly accessible area of the Bodleian Libraries, University of Oxford, UK. Housekeeping and preventive conservation methods were quickly employed to try to halt the outbreak, along with attractant traps for enhanced monitoring and control. Regular and targeted monitoring showed that these methods were not having a significant effect and so a suitable chemical treatment was researched.

A product that was new to the market was selected as being highly suitable for the type of space involved, as it was not water based so would have no detrimental effect on collections, was very long lasting and had low toxicity to humans. This was deployed by an external pest control contractor, using the Bodleian as their first trial site for this groundbreaking product which uses a new active ingredient and attractant technology. Immediate results were very positive, and several months later the outbreak remains fully under control.

The majority of the monitoring and all of the treatment were carried out during the Coronavirus pandemic of 2020, mainly during the first strict UK wide lockdown period. This resulted in a number of advantages such as no access by the public and the possibility of increased testing, but also logistical challenges such as remote working and staff not being able to carry out work together. These were successfully overcome to produce a very satisfactory outcome which provides a template for best practice should this type of outbreak occur again.

Grey silverfish at the National Gallery, London – The importance of monitoring and advocacy in IPM

Kristina Mandy and Sarah Coggins
The National Gallery, London

Like many galleries and museums, the National Gallery has been faced with the challenge of maintaining its IPM programme during the COVID-19 pandemic. The Gallery was forced to shut down for periods in the spring and winter months of 2020 and 2021, and staff access to the Gallery was very limited during lockdown periods. In order to maintain monitoring, staff members unfamiliar with specific IPM duties were recruited, some traps were swapped late for monitoring schedules, and traps had to be checked for insects in working-from-home environments. With the increased dark hours and lack of human activity, numbers of certain pest species have been seen to increase compared with previous years, especially booklice, silverfish, grey silverfish, and firebrats. This has also been experienced and reported by other institutions.

The grey silverfish (*Ctenolepisma longicaudatum*) was first identified at the National Gallery in 2018, and numbers have been increasing since. This species is well known in London museums after first being identified at the Museum of London in 2015 and its spread to the UK from mainland Europe can be linked to global trade and climate change, as the species often prefers warmer climates. In 2020 the Gallery began trialing an amorphous silica desiccant, Vazor®DE, to see its effect on reducing the numbers of this pest species. The Gallery is also investigating key

published research and alternative options to eliminate this species, including toxic baits used for cockroaches, which some results indicate to be effective.

Additionally, the importance of advocacy and communication across the National Gallery has been highlighted by experiences of working on IPM tasks throughout the COVID-19 pandemic. The spaces where higher numbers of grey silverfish have been detected include Gallery rooms as well as back of house spaces used by different collection-based departments. Working alongside these departments and sharing skills and knowledge has been key in starting to reduce these high pest numbers. Also vital to our cross-departmental communications has been the work of the Preventive Conservation Working Group (PCWG), which meets every two months and whose membership includes colleagues from all departments in the National Gallery. This forum is important in spreading the message of preventive conservation, including that of our IPM work.

This talk will present our recent pest data and the impact of our decision to use targeted pest control on grey silverfish numbers as a measure of success. We will share with the wider audience difficulties we encountered with conducting IPM tasks during the COVID-19 pandemic. We will also discuss how the PCWG has contributed to spreading the message of our IPM work day-to-day and in relation to a newly-built office suite inside the National Gallery building.

ADVION bait against the grey silverfish *Ctenolepisma longicaudatum* in museums, archives and libraries in Austria

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The grey silverfish *Ctenolepisma longicaudatum* is an important museum pest today and is still spreading across Europe. It thrives in new museum buildings, storage depositories, apartments and office buildings. Especially collections of graphic art, modern art with paper, photographs, archives and libraries are increasingly worried about this pest. Damage on paper objects was already reported by different authors and institutions across Europe. Ten years ago, at the last Pest Odyssey conference 2001, it was not reported as an important museums pest, but today many institutions in UK, Netherlands, Norway, Austria, Germany or Belgium are infested. The grey silverfish *C. longicaudatum* is the most abundant and problematic pest species in Austrian museums, but we also find the silverfish *Lepisma saccharinum*, the four-lined silverfish *Ctenolepisma lienata* and a further species *Ctenolepisma calva*. Only few treatment methods can be used against silverfish problems: As the animals are found during daytime in cracks and dead spaces inside the rooms and not in/on the objects themselves, the room needs to be cleaned, gaps sealed, desiccant dust can be applied or different baits are available. In the past, most silverfish baits were of very low efficiency. Since a few years the ADVION poisonous bait, originally developed for ants and cockroaches, is used against the grey silverfish in Norway. Strong secondary poisoning by animals feeding on the dead silverfish is believe to be one of the keys to success. Its application was tested in different museum, storage, archive and library settings in Austria against *C. longicaudata, C. lienata*, *C. calva* and *L. saccharinum*. Good results were found for all species resulting in a significant reduction of the infestations. For a successful application only very small bait drops need to be applied (10-20mg = hardly visible), but every 50-100 cm along the walls, making the application in large rooms or museum buildings very time consuming. Only in areas with a high infestation the application of poison in museums is suggested, therefore a good monitoring with tarps is essential to locate hotspots inside of each building. Observations of such hotspots and the species in the field and laboratory are reported.

Workshop 2 – International Collaboration

A collaborative approach to developing an IPM programme in Myanmar

Amy Crossman

This paper provides an overview of the state of integrated pest management within the Myanmar cultural heritage sector, using the British Council's International Museums Academy: Myanmar 2014- 2021 programme as the basis. Three conservation sessions have been delivered: the first two in preventive conservation delivered in March 2018 and January 2019 identified Integrated Pest Management (IPM) as a priority area of training by the British Council. This resulted in an intensive Integrated Pest Management programme 'A risk-based approach to IPM' in October 2019.

There are many unknowns surrounding the climate, environmental conditions and biology and diversity of insect pests in Myanmar. There is little known entomological data available on economic, agricultural, and urban insect pests, let alone the more niche insect pest threat posed to museums and cultural heritage. Due to the dearth of available data, devising an IPM training programme suited to the needs of the country was challenging. The aim was to develop trapping and monitoring practices to generate the necessary datasets to inform targeted future practice. The first two more general training sessions in preventive conservation paved the way for the final in-depth IPM training session.

Initial monitoring and trapping at three of Myanmar museums in different regions have yielded some interesting results at National Museum Yangon National Museum Nay Pyi Taw and Bagan Archaeological Museum. Given the large geographic expanse and varied climatic conditions across the country it was expected that there be some variation in insect pest incidence and distribution across the country, and this was borne out in the relatively limited amount of insect pest data obtained. What is clear is the occurrence of less familiar insect pests, such as *Gastrallus indicus* means that the need for specialist entomological support is essential.

The development of IPM within the Myanmar cultural heritage sector is in its early stages. More work needs to be done to determine pest species, distribution, and risks to collections. Myanmar has been designated as a highly vulnerable country to climate change and pest trapping has been initiated to start recording insect pest species and monitor change over time. As IPM pervades so many conservation activities, it was found to be an effective method to introduce wider concepts of preventive conservation into the training. IPM was successful in gaining the interest and attention of all staff and engaging them with wider preventive conservation issues.

Keywords: Cultural diplomacy, training, integrated pest management, IPM, identification, new species, *Gastrallus*

The pesty business of translation: A global collaboration to bring MuseumPests.net to a wider audience

Fabiana Portoni, Laura García-Vedrenne, Silvia Manrique, Jessica Lewinsky, Beatriz Haspo, María Castañeda, Christian Untoiglich, Amparo Rueda, Sandra Joyce Ramirez, Armando Mendez, Rachael Perkins Arenstein and Paloma Mujica

The MuseumsPests.net website launched in 2007 by an ad hoc group of museum and entomology professionals. Since then, it has become one of the core resources promoting best practice in Integrated Pest Management (IPM) for collections and heritage institutions. However, to fully benefit from the comprehensive information provided, a good command of the English language is needed. To reach a wider audience and to connect with the IPM community in other regions of the world, MuseumPests.net began a project in 2020 to translate the website, including all its training materials and resources, into Spanish.

The translation project saw founding members from MuseumPests.net working together with bilingual (Spanish-English) professionals who work in the IPM field around the world, and APOYOnline - Association for Heritage Preservation of the Americas. These professionals volunteered to translate the site, bringing their technical

knowledge and expertise. The group worked collaboratively across great distances to complete the scheme, allowing Spanish speakers everywhere to access the information on this useful web-based tool.

The translation started during the early stages of the Covid-19 pandemic and has therefore been undertaken completely online. The team worked together to allocate tasks, create a bilingual glossary of terms, and ensure translated sections had different proofreaders to standardise the overall tone and the use of language across the site. The team also considered challenges such as regional language variations, including insect common names, treatments, or materials, to facilitate the use of the finished text by professionals in all Spanish-speaking countries. Additionally, the translation efforts resulted in the correction of broken links, typos and other errors that benefitted the English language site. Other logistical challenges included organising online meetings for people across nine time zones. Nonetheless, the commitment and enthusiasm of everyone involved made the project an enriching experience.

An ongoing aim of the project is to encourage further discussion and collaboration amongst professionals in Spanish speaking countries. In line with the intent of the original English website, the Spanish version aims to be a dynamic work in progress that can be regularly edited and updated. The translated site will allow the MuseumPests community to highlight new research, work practices and issues drawn from local communities and a broader audience.

This venture is part of a comprehensive effort to expand the MuseumPests.net community by creating additional Working Groups to educate, inform and collaborate with colleagues in the global IPM profession.

Workshop 3 – IPM training and resources

Debugging Instruction for Easy and Empowering IPM

Christa Deacy-Quinn

My first professional experience with pests was almost thirty years ago when I worked in a museum located in a historic multi-use university building. The building itself, including the museum, was heavily infested. At that time the university facilities' answer to pest problems was to use pesticides, not just for the structure, but also for the artifacts. I was able to stop pesticides from being applied to the artifacts but was unable to limit pesticide use in/ around the building.

After moving to our new museum building in 2000, I instituted a robust IPM program, emphasizing teamwork among the staff within the museum. I set up the museum's IPM policy and procedures and co-created two Filemaker databases to track both pest issues and locations. I continued my study through observation, correspondence courses, and earned my Pest Management License for Structural Pest Control and my Mold Remediation Certification, and experimentation.

The IPM program I developed led to the Spurlock becoming the first museum awarded the prestigious Green Shield Certification of the IPM Institute of North America.
With Green Shield Certification we were able present the museum as a model for IPM to the rest of the university, so that the latter has dramatically reduced its use of the older, widespread practice of relying on pesticide applications and has switched to the more progressive IPM procedures instead.

I now serve on the university's Integrated Pest Management Working Group. I have found that education about IPM is the best way to convince others of its value, and thus have presented lectures, demonstrations and workshops for departments, classes, alumni events and committees on campus concerning artifact preservation and IPM. I add my voice on campus and in local print and broadcast media, which has emphasized the importance of sustainable artifact preservation to the general public and have taught workshops at the regional, national and international level since 2010 to over 375 preservation specialists.

ABSTRACTS DAY 3

While teaching at workshops and conferences on the topics of collections management and preservation, I have pondered on how best to introduce IPM to peers and aspiring museum professionals.

While there are wonderful resources out there, often these are geared towards those who are already familiar with IPM. Basic foundation of IPM is good housekeeping to reduce potential risk. It's as simple as making sure your museum is clean, sealed and clutter-free. When it comes down to it, IPM is between you, your building and your artifacts.

Thanks to a generous grant from the North Central IPM Center, I have published a book, *FUNdamentals of Museum IPM,* intended for museums without professional IPM staff members. It is distributed free to those requesting it. Since it became available in December 2019, over 325 hard copies have been requested and sent to museums and the pdf version available free online has been downloaded over 620 times by heritage-collecting institutions from over 48 countries. This paper's focus will be on making IPM accessible and enhancing staff involvement.