SURVEY AND MITIGATE FOR EFFECTS OF SWALLOW NESTS AT COLTER BAY VISITOR CENTER AND INDIAN ARTS MUSEUM, GRAND TETON NATIONAL PARK

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Summary. In order to alleviate the negative effects of swallow colonies at Colter Bay Visitor Center and Indian Arts Museum, old nests have been removed, and a protective netting has been installed over the main buildings. Monitoring of the insect nuisance and pest fauna has been accomplished using sticky card traps and Malaise trap collections. Based on the results of this survey, recommendations for the Integrated Pest Management of different groups of pests that present potential hazard for human health and museum collections have been developed.

Introduction.

Background.
Swallow colonies represent nuisance for the visitors of the Colter Bay Visitor Center by creating unsanitary conditions and attracting insect pests which are potentially hazardous for human health. Inside the Indian Arts museum, insect may damage valuable exhibition artifacts.

Goals and Objectives.

1. Install the protective bird netting to prevent the swallows from nesting in the Visitor Center.
2. Conduct the survey of the insect fauna in the Museum territory.
3. Develop recommendations for efficient management of pests to prevent potential risks for human health and museum collections.

Expected Results.
The first, most vital, step in Integrated Pest Management (IPM) is to survey for the pests of concern in order to identify where and at what population levels those pests can be found. Any action that can impact the insect pest populations, whether it is habitat modification or an insecticide application should be monitored. In this case, the exclusion of swallows (Family *Hirundinidae*) and their nests from building eaves could impact the presence of insects both inside and outside the buildings.
Swallows are insectivorous birds that feed heavily on flying insects during the daylight hours. As effective predators, they play an important role in reducing the numbers of such pest and nuisance insects as mosquitoes and different kinds of biting flies. At the

same time, they attract parasitic insects and contaminate the environment with the products of their metabolism. Bird feces lure numerous dung-feeding and scavenging insects which may present potential hazard for human health. The exclusion of swallow nests means the birds would have to find other buildings to nest on and would not be feeding in the immediate vicinity of the Visitor Center and Museum. This could affect the population of insects that fly in the day time around the buildings. Hypothetically, the removal of the nests would also impact the insects species that have adapted to the habitat those nests provide. This would include insects such as:

- the **swallow bug** (*Oeciacus vicarious*), an ectoparasite of the swallow nestlings that sometimes invade buildings from the nests after the birds depart at the end of summer;
- various **filth fly species** that utilize the copious quantities of feces produced by the nestling swallows;
- **scavenging fly species** that can utilize the decomposing bodies of young birds that die in the nests.

The proposed diverse survey techniques assure that the collected samples of insects will be representative of the local entomofauna and serve an adequate basis for pest management recommendations.

Methods.

1. *Swallow nest exclusion*. In order to prevent the birds from nesting in the Visitor Center's buildings, a protective net has been installed over the critical areas.
2. *Insect survey outside the Visitor Center*. To survey the flying insect fauna in the immediate vicinity of the Colter Bay Visitor Center and Indian Arts Museum a Malaise flight intercept trap was setup during the daytime near the swallow nest area. A Malaise trap is a large tent like structure made out of insect netting that catches flying insects passively. When an insect flies into the trap it clings to the vertically-posed netting and then, instinctively starts climbing up. The design of the trap funnels the now crawling insect up into a collection jar. Depending on the time period the trap is setup, the sampling can be selective for either diurnal or nocturnal insects. Some flightless ground-dwelling insects like ants can end up in Malaise trap collections when they encounter the bottom of the trap and climb up the netting walls into the collection jar. The Malaise trap was setup for 12 hours on May 5, 2004.
3. *Insect survey inside the Museum.* To monitor for the presence of insects inside the Museum, eight insect sticky card monitoring traps were placed in various display cases and rooms as early as in September, 2002. Sticky card traps are passive traps that capture insects with a constantly sticky adhesive coating applied to one side of card stock paper. The sticky surface traps insects or any other small arthropod that crawl on to it. The sticky traps can remain in place for a long time and are a good way to monitor for the presence of insect pests.
4. *Insect identification.* After the monitoring period was over, the insects that were collected by both trapping methods were sent to the University of Wyoming,

Cooperative Extension Service Insect Diagnostic Laboratory for identification. Identification was done using microscopic examination, taxonomic keys, and reference specimens from the University of Wyoming Insect Museum collection. Identification was done to the species level for the barn swallow bug and the family level for all other insects. In most cases, family level identification is sufficient for management of non-human health related insect pests.

Results and Discussion.

The total number of arthropods collected by both trapping methods inside and outside the Museum buildings was 702 individuals belonging to >20 families.

The complete list of arthropods (123 individuals) that were collected **inside the buildings** with sticky traps is shown in Table 1.

In the process of monitoring the impact that excluding swallow nests had on insects at the Colter Bay Visitor Center and Indian Arts Museum only two insects were found that could pose a certain risk to human health. The **barn swallow bug** (*Oeciacus vicarious,* Figure 1) of the family *Cimicidae,* can take blood meals from humans but usually only attack relatively immobile animals (i.e. swallow nestlings). Cimicids are not known to vector any diseases to humans but a bite from one of these insects could be a source of infection.

The only other sampled insects that can present risk to human health and were found both inside and outside the Museum were **filth flies** of the family *Phoridae* (Figure 2). Phorid flies are commonly called humpbacked flies. Humpbacked flies can become a nuisance in buildings where drains allow access to the sewer system or were garbage is not disposed of properly. The flies are a risk to human health through the mechanical transmission of pathogenic bacteria from the sewer drains to humans, cooking, and eating utensils.

Alarmingly, insects from two families of the **stored product pests** which can damage museum specimens were captured by sticky traps. These families are the *Liposcelidae* (booklice) and *Dermestidae* (carpet beetles). Booklice can damage the starchy bindings and pages of books. Carpet beetle larvae can feed on almost any animal products such as wool, leather, rawhide, or feathers.

None of the other insect species sampled from inside the buildings are known to present any type of risk to human health.

Figure 1. General form of the *Cimicidae*. Swallow bugs are generally less than 6 mm long, brown in color, and dorso-ventrally flattened.

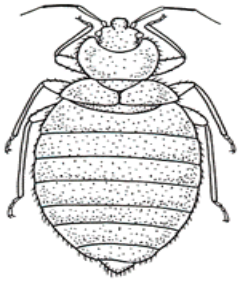

Figure 2. General form of *Phoridae*. Humpbacked flies are generally 2 mm long, and have a distinctive humpback profile. They are quick moving and will often run instead of flying when threatened.

Figure 3. General form of *Liposcelidae*. Booklice are generally less than 5 mm long, have no wings, and are quick moving.

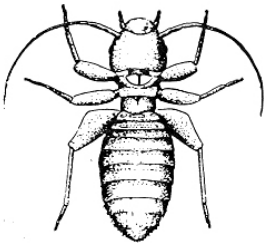

Figure 4. General form of the adult beetle of carpet beetles, family *Dermestidae*. They are generally less than 12 mm, many are much smaller. They are often hairy or scaly and black or brownish in color with short clubbed antennae.

Figure 5. The larvae of a Dermestid beetle. The immature carpet beetle does most of the damage to stored products or museum collections. They are distinctive for their subcylindrical shape, brown color, and long hair. They are active crawlers.

Table 1. Sticky card trap collections from inside the buildings of the Grand Teton Natinal Park Colter Bay Visitor Center and Indian Arts Museum.

Date Placed	Location	Order	Family (common name)	# trapped
9-2-02	Medicine Rm.	Psocoptera	*Liposcelidae* (Booklice)	9
		Aranea	Badly damaged spider	1
9-2-02	Cruciform (Cntr. Display, Upper Flr.)	Hemiptera	*Cimicidae* (swallow bug) *Oeciacus vicarious*	7
	"	Coleoptera	*Dermestidae* (Carpet beetle)	1
9-2-02	Sosh. Ex.	Hemiptera	*Cimicidae* (swallow bug) *Oeciacus vicarious*	1
	"	Psocoptera	*Liposcelidae* (Booklice)	1
	"	Coleoptera	*Ostomidae* (Bark-gnawing beetles)	1
	"	Diptera	*Phoridae* (Humpbacked Flies)	1
9-2-02	Pipe Ex.	Psocoptera	*Liposcelidae* (Booklice)	1
6-28-03	CJL	Diptera	*Phoridae* (Humpbacked Flies)	1
	"	Collembola	*Entomobryidae* (Springtails)	6
	"	Diptera	Badly damaged, no ID	1
6-28-03	UD	Diptera	*Phoridae* (Humpbacked Flies)	2
	"	Collembola	*Entomobryidae* (Springtails)	11
	"	Psocoptera	*Liposcelidae* (Booklice)	3
	"	Acarina	*Tetranychidae* (Plant mite)	2
	"	Hymenoptera	*Formicidae* (Field ant)	1
	"	Neuroptera	*Chrysopidae* (Lacewing)	1
6-28-03	CJL	Diptera	*Phoridae* (Humpbacked Flies)	3
	"	Collembola	*Entomobryidae* (Springtails)	2
	"	Coleoptera	Badly damaged, no ID	1
	"	Collembola	*Entomobryidae* (Springtails)	12
	"	Diptera	*Phoridae* (Humpbacked Flies)	1
7-24-03	CJL 17	Psocoptera	*Liposcelidae* (Booklice)	7
	"	Nueroptera	*Chrysopidae* (Lacewing)	1
10-2-03	Clothing Ex.	Psocoptera	*Liposcelidae* (Booklice)	45
			Total	123

The arthropods collected **outside the building** with the Malaise trap (579 individuals) represent a typical sample for the region and time of the year and are listed in Table 2. Of the 14 different families of insects collected only three families pose a potential risk to human health through mechanical transmission of pathogenic bacteria by contamination of surfaces that they walk, feed, or defecate on. The three are the: *Phoridae* (humpbacked flies) (Fig. 3), *Scatopsidae* (minute black scavenger flies), and *Psychodidae* (moth flies). If the area has no sewage leaks, open garbage, manure, or decomposing animals then even these insects pose little risk of disease transmission. Fungus gnats (*Mycetophilidae*) were by far the most numerous captures (almost 50% of the total). They do not present any risk for human health although their larvae, developing in the soil, may seriously damage house plants.

Table 2. Malaise trap collection identifications from outside the buildings of the Colter Bay Visitor Center and Indian Arts Museum (May 5, 2004).

#	Insect Order	Family (common name)	Number Trapped
1	Homoptera	*Aphididae* (aphid)	2
2	Diptera	*Dolichopodidae* (long-legged fly)	37
3	Diptera	*Mycetophilidae* (fungus gnat)	286
4	Diptera	*Phoridae* (humpbacked fly)	82
5	Diptera	*Scatopsidae* (minute black scavenger fly)	123
6	Diptera	*Cecidomyiidae* (gall gnat)	1
7	Diptera	*Chironomidae* (midge)	29
8	Diptera	*Psychodidae* (moth fly)	5
9	Hymenoptera	*Formicidae* (field ant)	1
10	Araneae (non–insect)	Spider, too badly damaged for further ID	3
11	Lepidoptera	*Noctuidae* (miller moth)	2
12	Diptera	*Sciomyzidae* (marsh flies)	5
13	Diptera	*Syrphidae* (flower flies)	1
14	Diptera	*Asilidae* (robber flies)	1
15	Hymenoptera	*Ichneumonidae* (parasitoid wasps)	1
		Total	579

Conclusions and IPM recommendations.

Only a small number of the insect taxa collected during the sampling period pose a human health risk. From the sticky card traps only the swallow bugs and humpbacked flies could potentially cause human health problems. Outside the buildings, the Malaise trap caught the humpbacked, moth, and the minute black scavenger fly which all can mechanically transmit pathogenic organisms. These flies can be termed filth flies whose management is similar regardless of species.

The management of **filth flies** is based on the sanitation of places where the flies breed. The humpbacked and moth flies often can reproduce around kitchen, restroom, and street

sewer drains. The adult flies lay their eggs in the drains and the maggots feed on the bacterial slime layer that forms on the internal surface of slow flowing drains. A single adult female humpbacked fly can produce over 400 eggs in her lifetime.

Drying the outside surface of the drain and partially covering the drain overnight with sticky tape should help to identify the drains that are the source of the flies. As the adult flies emerge from the drains, some will get stuck on the tape. It only takes a very small amount of rotten organic material to produce a lot of flies and thorough inspection to locate it all takes a lot of time. Once the filth sources of the flies are identified thorough cleaning will often mitigate their presence. One of the most commonly used products to clean drains is Drain Gel (http://www.pestproducts.com/drain_gel.htm). This product contains biologically active substances (bacteria) which destroy the film accumulating inside the drains and providing substrate for the flies.

The minute **black scavenger flies** often breed outdoors in decaying organic materials and manure and then find their way indoors and are often only noticed around windows. Sanitation around dumpsters, garbage cans, and animal runs can help eliminate the outside breeding areas of all filth fly species. If this is not done then the flies can spread to the inside of buildings.

The **swallow bugs** can infest buildings when they move from the nest of the swallows to the inside through small cracks under the eaves. The best way to deal with swallow bug infestations is through the removal of inactive swallow nests and installation of netting to deter new nesting. This avoids the necessity of insecticide applications to the interior of the buildings. The nest removal and screening was done after the sticky card traps were placed so any sampling one year subsequent to nest removal should not capture any more swallow bugs.

To mitigate the impact on the local **swallow** population, structures that make suitable nesting habitat for the different species of swallow are available for purchase from many vendors. One vendor is Shaw Creek Bird Supply, (2019 Co. Rd. 137, Cardington, Ohio 43315 (http://www.shawcreekbirdsupply.com/swallow.htm). By placing these structures on trees and/or poles in more remote areas of the visitor center and museum grounds, the benefits of the birds and their insect feeding can still be enjoyed.

Fungus gnats may be a real annoyance, their larvae developing in the soil, damaging the roots and killing the house plants. Overwatering is a typical cause of fungus gnats outbreak. They love moist environments and populate the pots faster than you can think of. In order to reduce their negative impact, make sure you do not water too much. The pots should get dry in between watering intervals. If you recognize many tiny flies around your plants, you must react immediately: stop watering, and put some flytraps or sticky cards near your plants. Those traps will kill the fungus gnats flies and therefore prevent them of lying eggs with larvae into the soil again.

IPM of **booklice** and **carpet beetles** requires that stored products be frequently inspected for the presence of these pests. Sanitation and manipulation of storage and display room

environmental conditions are good ways to minimize problems with these ubiquitous pests. **Booklice** feed on the starchy glues sometimes used in book bindings hence the name. They also feed on mold, mildew, and other dead animal, fungal, and vegetable matter. Sanitation is the first step to control this pest. Booklice prefer warm and damp conditions, so lowering humidity in areas where they are found is also a good way to minimize the populations of these pests. **Carpet beetles** are one of the most damaging insects found in homes and buildings in the Rocky Mountain region. Twenty species of these beetles can be commonly encountered in buildings. They are ubiquitous in the natural environment and do the final clean up of all dead animal matter in nature. In buildings, the carpet beetle larvae can live on build ups of household lint, which is often composed mainly of skin flakes. Any product of animal origin such as: wool, leather, or feathers can also be chewed up. The detection of the adult beetles or their distinctively hairy larvae is the first step in management. Clean up and discarding, if possible, of infested materials is next. Freezing for 96 hours at zero degrees F or exposure to over 130 degrees F for more than 20 minutes will kill adult and larval beetles. For heavy infestations, insecticides labeled for carpet beetle control indoors may need to be applied but usually careful sanitation and frequent inspection is adequate to manage carpet beetles.

Monitoring for stored product pests, like the booklice and carpet beetles should be continued year around in the museum to protect valuable artifacts from damage.

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