



SMITHSONIAN INSTITUTION ARCHIVES

PRESERVATION PROTOCOLS

Integrated Pest Management: Freezing

There are a variety of non-chemical treatments that can be performed to exterminate pests in collections. One of the safest and most effective methods is controlled freezing. Exposure to low temperatures can be lethal to insects, including *silverfish*, *firebrats*, and *book lice*, which are common pests found in libraries and archives. The Smithsonian Institution Archives has had documented cases of silverfish infestations in the past. In many cases, these infestations have been successfully mitigated using continual monitoring, the destruction of live insects on records, and reducing infestation opportunities through the use of a controlled environment. Controlled freezing can be used not only as a destruction method, but also as a preventive measure on selected incoming collections that may be more prone to insect infestation.

Incoming collections from the following units *must* be treated using freezing before integrating into general collections storage:

- The National Zoological Park (NZIP), Rock Creek and Front Royal facilities
 - *exception*: Education and Administration Building
- Smithsonian Environmental Research Center (SERC)
 - *exception*: Mathias Lab

Materials that should not be frozen, based on published literature and the collective experience of trained collections care professionals, include:

- plant specimens that are not completely dried
- audiovisual material
 - computer media (tapes, discs, optical media)
 - magnetic media (reel to reel, cassettes, VHS, Beta)
 - audio grooved media (cylinders, discs)
- photographic material
 - cased photographs (daguerreotypes, ambrotypes, tintypes)
 - glass prints/plate negatives (collodion and gelatin [wet and dry plate methods], color transparencies [autochromes], lantern slides, mounted slides)

Previous storage conditions also need to be considered when determining if a collection should undergo freezing for pest management. Collections taken from the following conditions should be considered for freezing:

Basements: High levels of humidity and little light exposure make basements ideal spots for mold growth. Many insects, such as book lice, will feed on the mold. Silverfish and firebrats also thrive in high humidity environments, but typically enjoy warmer temperatures.

Attics: Silverfish and firebrats can often be found in bookcases, on closet shelves, behind baseboards, wallpaper, window or door frames, and in wall voids, attics, and subfloor areas. Be especially attentive to areas where moisture may be present – pipes, windows, and bathrooms.

Outdoor Sheds/Small Buildings: Any small outdoor structure without environmental controls or sealed entries/exits will be a prime location for pests. They can easily gain access and thrive in the high humidity and temperature environments often maintained in these structures during the spring, summer, and autumn months.

General Procedures

Standard freezing of room-temperature collections can be accomplished using the on-site, walk-in freezer currently located at Capital Gallery (Room 3210). To achieve 100% mortality of insects and larvae, collections must be maintained at **-15°C (5°F) for 14 days**. The most commonly reported successful treatments have been carried out at -29°C (-20°F) for 72 hours.¹ However, the on-site freezer at Capital Gallery is also used for long-term storage of audiovisual materials. To reduce cooling costs and maintain an appropriate environment for all collections stored in the freezer, the higher temperature of -15°C will be used. Ed Kunickis, entomologist, has recommended that freezing times should be extended to 14 days based on this decision.²

If a collection has been identified as requiring low-temperature treatment, follow these guidelines for packing and treatment:

1. Place boxes in plastic bags. Garbage bags can be used, as long as there are no holes in the plastic. Place one sheet of Art-sorb³ on top of the box lid to help regulate the humidity inside the bag.
2. Remove as much air as possible before sealing the bags. Seal the bags using waterproof tape (3M #313) or a heat sealer.
3. Place the box on the black metal rack in the freezer for 14 days at -15°C.
4. After 14 days, remove the box from the freezer. Allow to acclimatize to room temperature for 24 hours. **Do not** remove the box from the bag until it has fully acclimatized.
5. Remove the box from the bag. If there was known insect activity before the collection was treated, contact the Preservation Team to inspect the box(es) and folder(s). Vacuum and rehouse as needed. If the collection was treated as a preventive measure, inspect carefully while rehousing and contact the Preservation Team with any evidence of pests.

Last modified: October 2016

¹ Johanna G. Wellheiser, *Nonchemical Treatment Processes for Disinfestation of Insects and Fungi in Library Collections*. (Munich: K.G. Saur, 1992), p. 27.

² Ed Kunickis, *Treatment of Thysanurans in Collections*. Report compiled 28 February 2002.

³ <http://cameo.mfa.org/wiki/Art-Sorb>