Policies and Procedural Manual

Biodiversity Research and Teaching Collections
Department of Ecology and Conservation Biology

Texas A&M University

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INTRODUCTION

The Texas A&M Biodiversity Research and Teaching Collections (BRTC) is curated by staff and faculty of the Department of Ecology and Conservation Biology and is one of several important natural history collections within the Texas A&M University system. The collections at the BRTC are comprised of preserved specimens of fishes, amphibians, reptiles, birds, mammals, parasites, and marine invertebrates that are available for use by the scientific community.

The BRTC was established in 1936 by Drs. W.P Taylor and William B. Davis of the Department of Wildlife Management (later Ecology and Conservation Biology) at Texas A&M University. The collection was established to meet the needs of a growing department, faculty research and undergraduate education. Today, we are one of the largest University based natural history collections in the United States. Natural history collections, such as this one, have a wealth of information - specimens and their associated data - that, as technology advances, science continuously finds new ways to exploit. This often involves using specimens to ask how populations have changed and adapted through time, how they are responding to current conditions, or how they may respond to future environmental challenges. As such, growing these collections continues to build the library of specimens and data that can address the past, present and future.

As a resource for the Department of Ecology and Conservation Biology at Texas A&M University, collegiate level laboratory courses are hosted on-site including Natural History of the Vertebrates, Ichthyology, Herpetology, Ornithology and Mammalogy. In addition, we partner with courses outside the department to provide specimens that enhance the student's learning experience. We support

community science and education through our involvement with the Texas Master Naturalists and other organizations.

We work closely with Texas Parks and Wildlife Department, US Fish and Wildlife, museums, and other Universities and are consistently engaged in national and international research projects. Our faculty and staff regularly obtain external funding for collections improvement from the National Science Foundation, and for sponsored research projects with Texas Parks and Wildlife Department, Texas Comptroller of Public Accounts, the National Science Foundation, Texas Ecolabs, Texas Department of Transportation, USDA Forest Service, US Bureau of Land Management, US National Parks Service, Texas Parks and Wildlife Department, New Mexico Game and Fish Department, US Department of Defense, Sea Grant Texas, and Texas Parks and Wildlife Foundation to name a few.

The purpose of this manual is to review, document, and standardize curatorial procedures used at the BRTC, to maximize specimen preservation, and to ensure that data remain associated with the specimens. The workflow is summarized in Figure 1. In the next section, the specific procedures for curating and managing specimens are outlined.

MISSION STATEMENT

Texas A&M University's Biodiversity Research and Teaching Collections are dedicated to the curation of vertebrate specimens and their data in support of education, research, and conservation. The BRTC enhances collaborative and global reach through sharing digitized data sets broadly and publicly, welcoming use of our data and specimens in developing new understandings through research. Furthermore, the BRTCs mission is to support the Department of Ecology and Conservation by providing an interactive hands-on venue and resources for graduate and undergraduate research, education, and job training to prepare and grow the next generation in conservation science that will be able to assume roles in leadership, responsibility and service to society.

VISION STATEMENT

Texas A&M University's Biodiversity Research and Teaching Collections vision is to be a world-class natural history collection that supports Texas A&M University and Department of Ecology and Conservation Biology's unified visions of advancing interdisciplinary research, elevating graduate and professional education, and engaging with Texas and beyond to enhance our impact.

COLLECTIONS MANAGEMENT

Collections Management is a relatively new specialization in natural history museums. It has come into being as a direct result of both collection growth and the increasing research and teaching demands put upon curators. There are three main functions of Collections Management:

1. The permanent association of individual specimens with the data concerning their collection and status.
2. The maintenance of the specimens in optimum condition.
3. Making the specimens and data available to qualified researchers.

Until recently, not much careful thought had been given to how long specimens will last in museum collections. It was always assumed (1) that specimens were replaceable [in the sense that more of the

same taxon could always be collected]; or that (2) the preserved specimens would continue to be usable forever; or even (3) that both of these were true. We now know that none of these assumptions are true. We recognize that scientific specimens are an irreplaceable resource, not a renewable one, and that specimens in natural history museums have a limited shelf-life. This is the heart of Collections Management—caring for specimens in ways which will keep them scientifically usable as long as possible. The guiding principles for Collections Management are:

1. The integrity of the specimens and data must be maintained.
2. Specimens are not replaceable.
3. Specimens react continuously to fluctuations in their environment. The stability of the storage environment is critical to caring for collections.
4. New processes and materials should be evaluated to determine how they will affect specimens before they are used in the collection and old practices should be monitored and re-evaluated periodically.

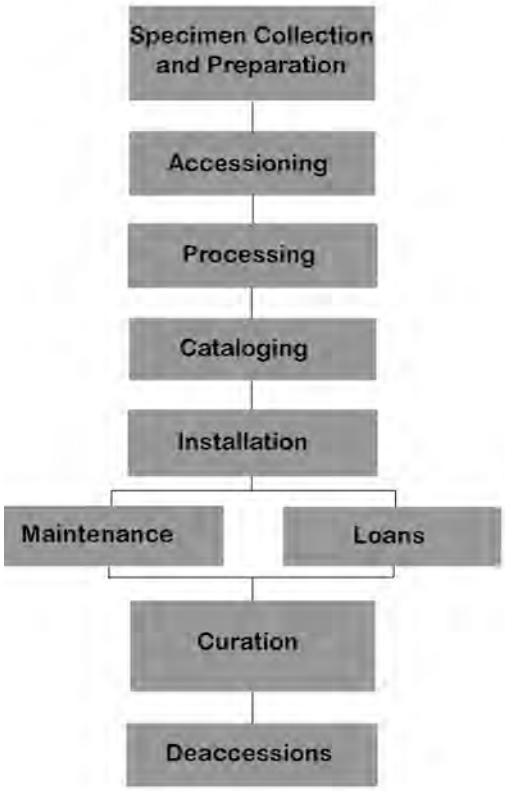

Figure 1

ACCESSIONING

Assigning an accession number is the first step in the process of incorporating a new collection of specimens into the BRTC (Figure 1). This step facilitates the keeping of records, permits, legal documents, and all other scientific materials associated with them (Schmidly *et al*, 1985). Accessioning is the process involved from the receipt of specimens in the museum through their preparation for cataloging. Specimens may also be obtained as part of a repository agreement

whereby ownership of the material is maintained by the donor. Accessions and repository agreements are together called acquisitions. All collection data should be checked for completeness and clarity to avoid delay during the cataloging process. Each collection of one or more specimens is assigned an accession number by the Curator.

Within the Collection, the following guidelines are considered when deciding to accession a collection. The curator of each receiving division must formally approve each acquisition. Considerations for accessioning include:

- Does the material fall within the categories identified as important to collection growth?
- Is the material appropriate for the collection, or could it be of more use in another institution?
- Is the material well prepared and preserved?
- Are field notes adequate and specimen tags in good order?
- Are the proper permits and other documents for collecting, exporting, and importing the collection with the specimens?
- Is there a clear understanding with the donor regarding terms of deposit of the collection?
- Is the accession of this material ethical? Does it represent the last chance to preserve specimens, or lend encouragement to the destruction of a population? Are similar specimens available in other institutions?

An acquisition can range from a single specimen to large collections resulting from a field trip or cruise. Each acquisition is assigned a unique number for cataloging purposes that is known as its accession number. Each accession number has a corresponding folder that contains original field notes from the collector(s) as available. Electronic copies of permits, data, and acquisition related materials are stored on the computers of staff curators and backed up on a regular basis. The Accession Checklist (Appendix A) is utilized to ensure all materials related to the acquisition are included with the specimens.

A Master Accession File records the accession number, which is assigned consecutively, and includes a general description of the associated material (Figure X). “Open accessions” are utilized for specimens that are collected and prepared as part of a long-term research project, and for small, miscellaneous acquisitions from a single individual or institution, which might occur over the course of one year. In these instances, the accession remains open until the completion of the project or end of the year.

The BRTC adheres to the following guidelines for maintaining professional standards in acquiring and managing collections: (1) respect for all laws and regulations; (2) having a purpose for collecting specimens; (3) limited collection efforts to avoid adverse effects on populations of species; (4) avoiding excessive collecting (beyond the needs of the collecting purpose); (5) obtaining maximum use and information from all specimens collected; (6) insuring proper care and availability of all specimens collected; (7) promoting accuracy and order in systematics collection; and (8) maintaining and improving relations with people associated and concerned with the collection of biological specimens.

Initial Processing

Incoming material may be in the form of a gift or a repository agreement. Unpack incoming material with care, watching for loose specimens, ruptured containers, information written on specimen containers, field notes stuck between the packed specimens, or slips of paper containing specimen data tucked in with the specimens.

The following information should accompany all incoming material:

- Date received. The date the collection was received by the museum.
- Description of the material, including a general description of the material and the number of specimens.
- Name, address, telephone number and email of the donor, seller or other source of the specimens.
- Type of collection: regular museum fieldwork, gift, exchange, orphan collection or purchase.
- Correspondence. Any additional correspondence with the donor – emails, letters etc.
- Collector. Include full names of all collectors involved.
- Field notes. Copies of all field notes relating to the collection.
- Locality. Full locality information including field number, date of collection, gear used, country, state/province, county/area, locality name and georeference information.
- Permits. All permits pertaining to the collection including import/export and collecting permits.
- Preservation history. Ask the donor to specify as fully as possible, the exact conditions the specimens have encountered.
- Notes. Condition of specimens and any other pertinent information not already noted.
- Deed of Gift: A standard form signed by the donor giving the museum free and clear ownership of the collection unless the material is part of a repository agreement. Copies of this form are available from the Collection Manager.

COLLECTIONS CARE AND MANAGEMENT

Collections care and management are carried out within the framework of the conservation of specimens. Conservation means preserving each specimen in a way which retains as completely as possible its original composition. Considerations for Care and Management of each Division at the BRTC are detailed in the appropriate sections of this document.

Agents of Deterioration

Intrinsic factors are those resulting from the nature of biological material (e.g. autolysis).
Often referred to as “inherent vice.”

- **Physical neglect** includes failure to maintain fluid in jars, losing data, and overcrowding.
- **Thieves, vandals** and the damage they may cause in a collection are obvious.
- **Handling** specimens is necessary, but **mishandling** can be avoided. Students and staff new to the collection must be taught how to work with specimens to avoid damaging them.
- **Fire** and heat are very dangerous around specimens in ethanol. Smoking is not allowed in the division.
- **Water** damages papers, books, photographs, and skeletal material. Water damage can come from flooding, leaking roofs, broken pipes, and fire fighting. Items which can be damaged by water should not be stored beneath overhead pipes, sprinkler system, near sinks, or other water sources.
- **Pests** (such as insects, rodents, fungi and mold) include those that prey directly on specimens and those that serve as a food source for others. Although fluid-preserved specimens are not subject to damage by most pests, skins, skeletons, and documents in thecollection are. The museum’s Integrated Pest Management plan will be followed so that these collections and others in the building will not be adversely affected.

- **Pollution** comes in many forms, such as building dust, and acidic gases given off by certain plastics, resin compounds, wood, and other sources. Skeletons, slide mounts, and color transparencies are kept in closed boxes and cabinets to protect them from dust, because many dust particles are abrasive and/or acidic. In the presence of moisture in the air, dust particles form a coating on specimens that will etch the surface it adheres to.
- **Light** (ultraviolet, visible, and infrared) triggers photochemical reactions. Light is energy and will cause the fading and chemical breakdown of specimens. Light damage is cumulative. Fluorescent lamps in the offices, collection room, and the preparation area give off significant amounts of ultraviolet (UV) radiation, which is very damaging to specimens. Sunlight, which has even more UV radiation, is far more damaging to specimens. In the collection room and division, lights are shielded with tubular UV filters, but even so, lights should be turned on in a collection area only when necessary. These UV filters are to be re- used each time a light is replaced in the collection rooms or in the preparation laboratory. Keep specimens away from unfiltered fluorescent lights, and light entering through the windows.
- **Temperature and relative humidity** cause problems at extreme highs and lows. We try to maintain a mean temperature for alcoholic collections of 70°F. An increase in temperature means a corresponding increase in the rate of the chemical processes of deterioration. More importantly, collections should be protected as much as possible from *fluctuations* in temperature and relative humidity. All proteinaceous materials in the collection are affected by these fluctuations—the paper that the field notes, labels, and catalogs are written on expands and contracts, breaking along binding seams; skeletal material expands and contracts, teeth fall out of skulls; the emulsion comes loose from photographs; inks fade.
- **Exposure to water** is detrimental to specimens stored in alcohol. Alcohol preserved specimens are hygroscopic. Specimens removed from their containers to be examined,must be kept submerged in a tray of the preservative they are stored in, *not* in water. The specimens may absorb enough water while being examined that when they are returned to the jar, they will dilute the alcohol preservative to a dangerously low concentration. Water absorption can also cause tissue damage in preserved material.

Consumptive Use

It is a paradox that specimens are for researcher's use, but also must be conserved. Unfortunately, many of the techniques and procedures employed to study specimens in the collection also destroy them. The Curator and the Collections Manager must balance current use of the collection against future needs. Consumptive procedures should never be undertaken without the permission of the Curator or Collections Manager.

Data Management

Until 1989, specimens were only cataloged in hand-written ledger books. Currently, each division of the BRTC maintains its own separate electronic MS Access database each of which is backed up daily (utilizing a manual backup system). Each collection serves data upward to a variety of biodiversity data portals including Vertnet.org, iDigBio.org, gbif.org, ggbn.org, FishNetII.net, and others.

Field notes from the collections are digitized, electronically backed up, and stored in the on-site library. As of 2011, field notes can also be made available via the Texas A&M University Library, allowing free access to these materials. Once digitized, this electronic repository will be fully searchable and available at http://repository.tamu.edu/.

COLLECTION OF AMPHIBIANS AND REPTILES

The collection of amphibians and reptiles is among the most important herpetological collections in the country, which are routinely used by researchers from all over the world. Our holdings from Texas, Mexico, Peru, and Venezuela are particularly noteworthy for their historical relevance and importance for documenting dramatic changes in herpetofauna in the Southwest and in tropical areas that have undergone extensive development and habitat loss. Our collection is known for its broad representation of amphibian and reptile diversity such as our large collections of turtles, lizards, and snakes. The collection continues to grow and increase in use based on our ongoing research and teaching programs and the acquisition of regional collections. In recent years, we have incorporated collections from West Texas A&M University, Midwestern State University, the University of North Texas, Witte Museum and the Houston Museum of Natural Science. We serve as the repository of specimens from several national parks and we routinely accession material from a number of researchers and collaborators.

COLLECTION OF FISHES

Specimens in the Collection of Fishes are the result of expeditions and environmental surveys conducted by faculty, students, and biologists at Texas A&M University since 1937. The oldest specimens in this collection (a cichlid from Nicaragua) were originally collected in the 1800s and later acquired by the collection through donation. This collection houses one of the most important collections of marine fishes from the Gulf of Mexico in the US, amassed through the activities of the Texas A&M University Research Vessel Alaminos, which conducted surveys throughout this basin in the 1960-70s. This material formed the basis for "Fishes of the Gulf of Mexico" a monumental two volume ichthyological guide authored by Curator Emeritus John D. McEachran and artist Janice D. Fechhelm. More recent collections made by faculty, students and staff of Texas A&M University and other local institutions, including state and federal agencies, have greatly increased the taxonomic and geographical coverage of the Collection of Fishes. The majority of specimens in the Collection of Fishes are fluid preserved and stored in glass jars, but over-sized specimens up to 12 feet are stored in larger tanks. Tissue samples suitable for genetic studies, cleared and double stained specimens, dry skeleton preparations, otoliths, field notes, x-rays, illustrations, digital photographs and CT scans make up some of the additional ichthyological resources housed within the collection. Researchers at Texas A&M University and other institutions study this unique material to further our understanding of fishes, including (but not restricted to) their anatomy, taxonomic diversity, geographic distribution, ecology, and evolution.

COLLECTIONS CARE AND MANAGEMENT

The prime consideration for ichthyological collections is the nature and quality of the fixative and preservative in use, but there are several important environmental factors to consider. Ichthyological collections currently include the following: specimens preserved in ethanol, cleared-and-stained specimens preserved in glycerin (C&S), dry skeletons, dried skins, frozen tissues, photographs and their associated data. The biggest threats to material preserved in ethanol are inadequate fixation, loss of fluid preservative, heat, and light.

Specimen Preparation

Specimens to be deposited at the BRTC are generally prepared by the collector. Fishes are typically preserved in 70% ethyl alcohol, but depending on the study, condition of the specimen, or size of the animal other preservation techniques may be used. Other preparations include ethanol preserved lots, dry skeletons, cleared and double stained specimens.

Alcoholics

Specimens are usually euthanized and preserved in 10% buffered formalin when they are collected in the field. “Formalin” is currently used to refer to “full-strength” formaldehyde (commercial aqueous formaldehyde = 37%). It is then further diluted with water, usually to a 10% solution (resulting in a 3.7% solution of formalin). Preparation of 10% formalin is achieved by adding 9 parts of water to 1 part of full-strength formalin at 36%. Large specimens, such as sharks and billfishes are injected at the time of capture with 20% buffered formalin (8 parts water to 2 parts of full-strength formalin).

Specimens are soaked in the formalin solution for 3 days to one month depending on size. Once preserved in formalin the specimens are transferred to water and allowed to soak for one day to a week (depending on the size and number of specimens) to remove excess formalin. During this stage, water should be changed daily. Specimens are then transferred to a 50% solution of ethanol for XXX time. The final step is to move the specimens to 70% ethanol.

Large specimens that cannot be processed in the above manner are frozen until proper preparation procedures can be followed. Once the specimen has thawed, the preparation technique is essentially the same as for the smaller specimens except that the body cavity is slit on the right side to allow thorough circulation of the preservative. In addition, the dorsal muscle wall, head, and caudal regions are injected with 10-20% formalin. Specimens are placed in tanks, positioned, and allowed to harden for a minimum of one week. Specimens are checked regularly during this time to ensure that they are being properly preserved. If they are floating in the preservative, they must be re-injected with 10-20% formalin. After fixing in formalin, specimens are soaked in water for several days to a week to remove the formalin. They are subsequently stored in an appropriately sized container filled with 70% ethyl alcohol.

Allocation of Specimens to Containers

In the Collection of Fishes, all specimens of a single species from a particular collection constitute a single lot. Each lot is stored in an appropriately sized container (jar, drum, or tank) and properly labeled (Figure X). There is a limited set of jars utilized in the Collection of Fishes, all are finished with a plastic lid fitted with a foam liner.

Volume (ounces)	Finish (mm)	Thread
4	48	400
8	58	400
12	70	400
16	63	400
32	89	400
64	83	400
128	110	400

Using jars of only these sizes makes the process of stocking and replacement of lids easier, allows for neat organization on the shelves, and enables more accurate estimations of shelf usage for expansion and rearrangement of the collection.

Use the smallest jar that will reasonably hold the specimens ensuring that the specimens are not compressed and do not fill more than 80% of the jar. The jar should be large enough that specimens do not protrude above the level of the alcohol, but not so large that excess fluid and shelf space are used in excess. The jar should be filled with the proper strength preservative to the neck of the jar, so that the specimens are well covered. When all the jars are filled to the same level, those which have lost fluid by evaporation or leakage will be detected readily. In the event that an exceptionally long specimen protrudes beyond the fluid level, cover the protruding portion of the specimen with a layer of cheesecloth which has its edges well below the level of the preservative, so that the specimen remains moist.

A variety of sizes of vials are kept in stock including screw-cap vials which are used in the field, for storing specimens in glycerin, and for shipping small specimens. Shell vials (straight sided vials without threads for a cap) are used inside larger glass jars for small lots of specimens. They are also used within a single lot for small specimens to be separated from other individuals in the lot for a variety of reasons. They are used in the situation where tissues have been sampled from multiple individuals or when the specimens are extremely small and at risk of damage if not subcontained.

Larger specimens are stored in several different style coffins. Some of which are manufactured in two sizes and made of stainless steel with a neoprene gasket and clamp-type fasteners for the lid. Contact with alcohol and repeated opening and closing of the lid contribute to wear and chemical deterioration of the gaskets. Polyethelyne tanks fitted with gasketed stainless steel lids are utilized to house specimens up to 2 meters in length, and one oversized wooden casket is used for our largest specimens. Inspection of gaskets takes places regularly and are replaced as needed.

Tissue Samples

Tissue samples associated with formalin fixed specimens are deposited at the same time as the formalin fixed specimens and receive the same TCWC catalog number. These fin clips are moved to 2 mL cryovials and stored in the ultra-cold freezers on site.

Recent collections may also be field preserved and stored directly in 95% ethanol, which will allow for subsampling in support of genetic analysis. For these specimens, ideally tissues are sampled from each lot and stored in the ultra-cold (-80°) freezers on site. Prior to cataloging, tissues are sampled from the right side of the specimen or from paired fins. In the case that an entire specimen will fit into a cryovial (2 mL), the entire specimen is installed into the freezer.

Cleared and Double Stained

Cleared and double stained specimens are prepared as a result of specific research projects. Cleared and double stained specimens are maintained in 90% glycerol with a crystal of thymol added to retard organic growth. Each jar is labeled properly using plastic tagging material and the lots are stored in designated shelving apart from the alcoholics.

Dry Skeletal Preparations

Skeletal preparations are prepared in accordance with the BRTC Dermestid Beetle Colony Protocol that can be found in Appendix E of this document.

Cataloging

Fish collections are accessioned after the collections have been sorted to individual lots of a single species. This step is necessary to organize and retrieve data that accompany the collection. Cataloging is the process by which a specimen is assigned a unique permanent reference number and is only performed by the Collection Manager. The catalog number associates the field data with the specimen and makes it possible to retrieve the specimen and its data from the collection. A mistake in the cataloging procedure may be perpetuated in the collection, so the utmost care must be taken to assure the accuracy of the cataloging process. Cataloging protocols for the fish and tissue collection are contained in documents of the same name available from the Collection Manager.

Cross-reference to field notes. The TCWC number assigned to each lot should be recorded in the field notes (if field notes were taken) by the cataloger next to the field number as well as on the accession paperwork. If the museum is not able to retain the original field notes, make sure the museum number is recorded on the museum copy of the notes. These notes are important archival material. Handle them carefully, and keep them away from spills, wet counter tops, and chemicals. Shield these notes from exposure to light when they are not in use—UV radiation causes paper to age very fast. Do not keep field notes in acidic folders or binders.

Data entry

Data is not entered into BRTC databases without permission from the Curator in charge of the collection. When possible, electronic data should be requested from the collector in Excel format. This allows for formatting and batch entry into Access databases. Data must be uniformly formatted to allow for quick and easy searching, sorting, queries, and re-formatting when necessary. Formats and criteria for fields in the Collection of Fishes database can be found in Tables X. General criteria for all entries are as follows:

- No wildcards or special characters in any field.
- Questionable identifications should be noted in the remarks field, not the genus or species field.
- Date ranges should be noted in the Locality Remarks field, use the first date of the range to enter in the date field.
    - For example: Fishes collected 8-9 March, 2011 would be entered in the Locality Remarks field and 05/08/2011 would be entered in the date field.

The fish database contains a separate entry table for new records. To catalog specimens, open New Accession Table and enter records, either one at a time or copy and paste from the collector's excel file. Assign the proper BRTC catalog number to the records and close the table. Choose Update New Accession query to fill in higher taxonomy and scientific authority fields. Records that do not update contain errors or are new to the collection. To add new scientific names to the database you must first open Master Genera Table and enter all taxonomy and scientific authority information. Close this table and re-run the Update New Accession query. When all higher taxonomy is updated, select all rows from this table, copy and paste to tblFishMaster.

Field Name	Entry Criteria	Example
TCWCID	Decimal number. Whole number represents station, date, and collector. Decimals are assigned to lots by species.	12000.01, 12000.02
AccID	Accession number assigned to collection.	1752
Station	Station number, or special number provided by collector.	CGM-10-359
Kingdom	Automatically updated by update query when genus and species are found in Master Genera List table.	Animalia
Phylum		Chordata
Class		Actinopterygii
Order		Perciformes
NelsonFamilyID		330
Family		Centrarchidae
Genus	Genus name.	*Lepomis*
Species	Specific epithet.	*punctatus*
Determiner/date	Last name and initials and year of person providing the identification.	Conway, K.W./2021
Cataloger/date	Initials and year of person entering data to database.	HLP/2021
Storage	Specimen preparation type	95% EtOH, 70% EtOH, SK, C&S
Count	Number of specimens, in whole number format.	51
Date	Date collected	8/1/2011
Country	Locality information provided by collector. Use whole names for all fields (no abbreviations).	United States
State		Texas
County		Brazos
WaterBody		Little Brazos River
SpecificLocality		Little Brazos River at Highway 21.
Latitude	Latitude of collection site, entered in decimal deg	27.894561
Longitude	Longitude of collection site, entered in decimal de	-95.789153
Depth	Depth at time of capture, entered in meters.	56
Gear	Gear used to capture specimens.	Seine, otter trawl, etc.
Collector	Last name and initials of collector(s).	McEachran, J.D.
Primary Remarks	Remarks other than for locality (ie. specimens with questionable identification, cf. or otherwise)	cf. *longispinosus*
Locality Remarks	Notes for locality including environmental data when available.	Collection date is Summer 1974.
Recuration Notes	Notes relating to changes applied post cataloging (ie. specimen lot split into two due to misidentification)	Environmental data added to specimen record 2010.
Georeferencing Notes	Notes for coordinates when not provided by collector and later georeferenced.	Geolocate used to georeference, confidence rating "High".
Loan number	Filled only when specimens are actively on loan.	2011-12
Tank locality	Location of specimen, when in tank.	LST or SST followed by number
Tissue Box	Location of tissue when available.	Fish 10
Tissue Location	Specific location of tissue tube within tissue box.	A1

Labelling Specimens

Each specimen container in the collection, except oversized specimens in coffins, should have a label bearing the lot's TCWC number, scientific name, family name, locality of collection, number of specimens in lot, collector(s), date collected, and field number. Labels are printed and installed in each cataloged lot (Figure X). A Datamax thermal transfer printer is used with a resin ribbon to print on polyethelene plastic tag material. To locate the information that is included on the labels, you must run the Label Query of the database.

To print labels, query for the records for which labels are needed using the Label Query. Preview and save your results. The Fish Database currently includes three label styles to differentiate the three typical fluid preparation types in the Collection of Fishes, 70% EtOH, 95% EtOH, and Cleared and Stained. Highlight the appropriate Label type depending on the preservative and click "Open." A window will open showing the first label in the query. To view all labels, click on "Print Preview" to double-check that the labels are aligned correctly. Click on the "Print" option when you are ready to print the labels.

TCWC 20293.15 **Cyprinidae**
N= 5 Family ID: 96

Notropis volucellus

Locality: USA; Texas; Montgomery; West Fork San Jacinto River; West Fork San Jacinto River at McDade Park, Conroe

30.31724, -95.51174

Date: 11/15/2020 Depth:

Collector: K.W. Conway & K.D. Keith

Station: KWC-20-08 Determiner: Conway, K.W./2021

Collection of Fishes
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TCWC 20083.01 **Poeciliidae**
N= 1 C&S Family ID: 251

Poeciliopsis jackschultzi

Locality: Mexico; Sonora; ; Rio Concepcion; Rancho Las Playas, tributary of the Alisos-Bambuto branch of the Río Concepción, near town of La Providencia

30.91926, -110.8606

Date: 4/20/1999 Depth:

Collector: Mateos, M., Hurtado, L.A. & Vrijenhoek, R.C.

Station: Determiner: Conway, K.W./2019

Collection of Fishes
Texas A&M University

Label installation

The highest care should be taken when installing the labels, as damage to specimens is irreversible. Labels should be installed into the jars horizontally with any original collector notes or ID slips stacked behind. The label should be placed flat against the inside of the jar, without overlapping any part of the specimens. Save all previous labels for the lot to the inside of the current label. When updating old labels, computer generated labels may be discarded, but typewriter generated or handwritten labels should be kept with the lot and stacked neatly behind the new label.

Installation

Specimens stored in jars are arranged on the open shelving in the collection in the following order:

1. Families are arranged systematically within orders according to Nelson (1994). This number appears on the top right of the label.
2. Species are arranged alphabetically within families.
3. Undetermined species within a genus (sp.) are arranged at the beginning of the appropriate genus.
4. Multiple jars of the species in the same size are placed in rows close together at the back of the shelf to reduce the effect of ambient light.
5. Jars are positioned so that labels face outward.
6. Cleared and stained specimens and skeletal material are arranged and shelved in an identical manner, but they are stored in a separate area.

Collection Maintenance

A primary risk to ichthyological collections as stated above is the nature and quality of the fixative and preservative in use. Preservative evaporation within containers steadily occurs in the collection environment. Several measures can be implemented to slow evaporation rates, such as buffering the collection space from fluctuations in temperature and humidity through use of environmental controls, and placement of the store within an interior space rather than adjacent to exterior walls that are more vulnerable to climactic variations. Use of best practice housing materials can also reduce within-jar evaporation rates. Polypropylene lids are less prone to embrittlement than harder plastics such as Bakelite, and can be lined with a polyethylene or Teflon insert to act as a mild oxygen barrier. Although formerly common in the Collection of Fishes, rubber gaskets used with wire-bail jars are not recommended due to the fact that they may dissolve or embrittle when coming into contact with ethanol, risking contamination of container contents in addition to negating the efficacy of the seal.

When fluid levels have noticeably dropped inside jars, it is necessary to add more preservative, or “top up” to maintain the desired concentration of the preservative and ensure that all parts of a specimen remain submerged in the preservative. It is common practice for collections to routinely top-up through loose approximation of the preservative strength needed to return containers to target concentration, by adding storage-grade preservative (e.g., 70% ETOH).

Specimens at the BRTC preserved in 70% or 95% ethanol stored either in jars on shelves or in large tanks are checked minimally once a year for proper alcohol levels, alcohol concentration (using a hydrometer), and/or specimen deterioration. Old ethyl alcohol is drained from containers and fresh ethanol is added if:

1. A third or more of the alcohol has evaporated.
2. The alcohol is yellowed from oils leached out of the specimens.
3. The alcohol percentage is below its designated storage grade.
4. The specimens show distinct signs of deterioration.

Alcoholic specimens are stored in the dark as much as possible to prevent color fading and specimen deterioration. The lights over the fluid-preserved collection remain off unless there is someone working in that area.

Collection Use

Specimens in the BRTC may be used for research and educational purposes by scientists, teachers, and students who conduct themselves in a professional manner and handle specimens with due respect. The BRTC reserves the right to deny access to the specimens to anyone who does not conduct himself/herself in a professional manner (Schmidly *et al* 1985).

Each person in the Collection of Fishes is responsible for adhering to the safety guidelines outlined in the Texas A&M University's Laboratory Safety course. All staff and students using the BRTC are required to complete the course before they begin work on-site. Current MSDS sheets for all chemicals used in the laboratory areas are maintained at the BRTC.

General Curatorial Procedures

1. The lights over the fluid-preserved collection should remain off unless there is someone actively working in that area.
2. When working with fluid-preserved specimens, do not allow the specimens to become dry. If you must leave your work area, cover the specimens with a piece of cheesecloth wetted with the proper preservative, or return them to their jar.
3. When you have finished working with fluid-preserved specimens and you return them to the jar, top off the jar with fresh alcohol and secure the lid tightly.
4. Handle cataloged specimens with care. Do not return a container with very dark or cloudy alcohol to the shelves. Replace with fresh alcohol.
5. If soaking out formalin-fixed specimens in the sink, please change the water daily or arrange to have someone do it for you. Specimens left soaking in water for too long may be damaged. See the curators for proper soaking-out timetables.
6. Please take care to shelve specimens correctly. A misshelved specimen may be impossible to find.

Handling of Specimens

Specimens should always be handled carefully. Many are fragile and easily susceptible to physical damage. Care must also be taken not to dislodge specimen tags from specimens, which renders the specimen useless for research purposes. The user or curator should immediately reattach a tag that has become separated from a specimen.

Check-out slips (Figure X) should replace any specimen removed from a shelf, tank, or drum. These slips serve two purposes: (1) they mark the specimens' exact locations that they may be easily returned to the proper spot; and (2) if other users are interested in the same material, the specimens can be easily located. The check-out slips are removed and discarded when the specimen is returned to the collection (Schmidly *et al* 1985).

Consumptive Use of Collections

Some researchers such as ecologists, anatomists, parasitologists, and paleontologists, consumptively use museum specimens. They remove gills and/or intestinal tracks to obtain parasites (parasitologists) or to obtain data on food items (ecologists), dissect specimens to reveal muscles and skeletal structure (anatomists), or remove otoliths to compare with other otololiths from fossil beds (paleontologists). These activities must be carefully monitored because they damage, and in some cases, destroy specimens. Permission to consumptively use the fishes collection must be requested from the

academic curator in writing, and the approval must also be in writing. The following restrictions apply.

Cannot be applied to specimens that are not identified to species.

1. All dissected materials must be returned for storage with original specimen.
2. Specific to fishes:
    a. Can only be conducted on lots with multiple specimens, and only on a maximum of two specimens per lot (depending on the number of specimens per lot).
    b. Dissections should be performed only on the right side of specimens

Specimen Loans

Specimens loans from the Collection of Fishes at the BRTC follow the BRTC Loan Policies in Appendix B. The Loan Guidelines below are in addition to and specific to the collections management in the Collection of Fishes.

Loan guidelines

1. A lot removed from the collection shall be replaced by a check-out slip designating their current location (Figure X).
2. A loan invoice (Figure X) is prepared listing the total number of specimens, scientific names, BRTC catalog numbers, method of specimen preparation and condition of each specimen. One copy is packed inside the shipping container with the specimens and the other copy remains in the division's outstanding loan file. An e-mail is sent to the borrower to notify them of the incoming shipment. For specimens from the teaching collection are loaned to local elementary and secondary schools, only two copies of the invoice are prepared: one for the borrower, and a signed copy for the files.
3. Fluid-preserved specimens should have the type and percentage of alcohol noted on the loan invoice.
4. All transport must conform to state, national, and international regulations (49 CFR Parts 100-149; IATA Regulations).
5. Upon receipt by the borrower, specimens are checked, and any damage is detailed on the invoice form. This form is signed, returned to the BRTC, and stored electronically in the division's outstanding loan file.
6. When a loan is returned to the BRTC, each specimen is checked against the invoice for possible damage resulting from transport or usage. If damages have occurred or all specimens are not returned, the curator is notified immediately.
7. The specimens are then returned to their appropriate locations in the collection and the check-out slips discarded. Slips for any specimen retained by the borrower should remain in place until they are returned.
8. Invoices for partially returned loans are kept in the outstanding loan file. Following completion of the entire transaction, the invoice can be placed in the return invoice file.
9. Notification of arrival of loan can then be sent to borrower.

Packing and Transportation Procedures

1. Sturdy shipping containers are used to send specimens. If a cardboard box is used, it is sufficiently reinforced to prevent damage to specimens.
2. One copy of the loan invoice is placed inside the box with the specimens.

3. A letter verifying the pending arrival of the loan specimens along with the white copy of the invoice is mailed to the person requesting the loan. This copy is signed by the borrower and returned to the BRTC upon satisfactory receipt of the specimens.
4. U.S. packages are sent ground by UPS and insured for $50.00 - $400.00 unless otherwise specified by the lending or receiving institution.
5. The Texas A & M University Post Office is contacted for information on customs forms and shipping classes. Generally, international packages are sent via Air Parcel Post.
6. Loans to other departments at TAMU are packed in a similar manner.

Fluid-Preserved Material

1. Jars are not sent to outside institutions on loan. The specimens are removed from their jars and wrapped in cheesecloth. Special care is taken in wrapping spines or other protuberances to prevent puncturing shipping bags and damaging other specimens.
2. For fishes, a duplicate label is inserted in the first bag with the specimens facing outward to allow for final proofing before shipping.
3. Shipping bags are 3 mil. gauge plastic and come in the following sizes: 4” x 12”, 6” x 13”, 6” x 15”, 9.5” x 18”, and 12” x 24”.
4. Cheesecloth-wrapped specimens are placed in a plastic bag and moistened with enough alcohol solution so that the specimen will not dry out during shipment, making sure that the correct preserving fluid is used. No more than 50 mL of preservative should be in any single inner package.
5. This bag is heat-sealed and placed into a second bag to protect the specimen.
6. The doubled bags are placed into a sturdy container with enough packing material to prevent shifting.
7. All loans must be shipped using UPS or FedEX, with e-mail notifications sent to the Curator in charge, Collections Manager, and loan recipient.
8. A label must be applied to the outside of the box denoting “This package conforms to 49 CFR 173.4 for domestic and highway or rail transport only”
9. For specimens being shipped outside the United States, specimens may be placed in 20% EtOH and shipped via FedEX. For these shipments, the loan invoice must state “Museum specimens preserved in non-hazardous 20% EtOH (UN 1170) and are safe for shipment according to IATA regulations.”
10. International shipments must be registered through the USFWS eDecs system and cleared by Agrilife Export Controls.
11. All international loans must be accompanied by a cleared USFWS 3-177.
12. All documentation is filed electronically in the appropriate year Loans folder.

Special Procedures

13. Cleared and stained fishes must be transferred, if necessary, to small glass vials for shipment. Each vial is double bagged to protect the material.
14. When an exchange or gift is made to another institution, the same procedures as for a loan are used except the invoice designates the shipment as either an exchange or gift in the blank normally containing the loan number.

Outgoing Loans – On Campus

Loans made to TAMU faculty, staff, and students should follow the procedures outlined above, except that it is necessary to complete only two copies of the invoice. Since these loans are hand-

carried, one copy is inspected and signed when the loan is picked up. The other copy accompanies the specimens for the borrower's use.

Incoming Loans

Staff and students in the Department of Ecology and Conservation Biology at Texas A&M University often utilize specimens from other collections and museums. These loans are processed under the direction of the curators as follows:

1. The student or staff members requesting the specimens usually process the loans. The curator should process any general exchanges or gifts that are received.
2. Care and maintenance of specimens received on loan are the responsibility of the person requesting them.
3. Specimens should not be unpacked until the shipping invoice is received. Then the specimens are checked immediately for damage against the invoice.
4. If a specimen has been damaged or is not recorded on the invoice, it is added to the invoice at this time. Once it has been reviewed, the invoice is signed by the curator and returned to the lending institution.
5. The specimens are kept in the collection area under conditions specified by the lending institution. Alcoholics are maintained in the kind of alcohol in which they were sent. All loan specimens are adequately labeled and stored to prevent losses and provide accessibility to the material.
6. Specimens to be returned are checked against the original invoice and packed in the proper manner.

COLLECTION OF BIRDS

Some of the earliest specimens at the BRTC are birds that were brought to Texas A&M University by Dr. WP Taylor from Arizona. Since then, research projects by faculty, students and staff at Texas A&M University have provided most of the material in this collection. One important way the collection also grows is through a strong salvage network across the state, this allows us to opportunistically incorporate specimens that would not otherwise be collected.

Recent international expeditions to Armenia, Benin, Democratic Republic of the Congo, Italy and South Africa have increased the number of species and geographic diversity represented in the collection. Additionally, our collection has grown through acquisition of the ornithology collections of Austin College, Southern Methodist University, Midwestern University and the University of North Texas. Historic and modern collections from the National Parks System (Guadalupe Mountains National Park, Carlsbad Caverns National Park, Padre Island National Seashore) also contribute to the growth and importance of the collection.

COLLECTIONS CARE AND MANAGEMENT

The prime consideration for ornithological collections is the potential for insect pests to infest the specimens, but there are several important environmental factors to consider. Ornithological collections currently include the following: dry skins preserved as study skins, specimens preserved in ethanol, dry skeletons, frozen tissues, and their associated data. In addition to insect pests other threats include material preserved in ethanol are inadequate fixation, loss of fluid preservative, heat, and light.

Organization

Specimens in the Collection of Birds at the BRTC are organized by family according to Birds of the World (2014). Within family, the specimens are organized alphabetically by species to facilitate use of the collection by students that may not be familiar with phylogeny finer than family. Two sizes of specimen cabinets manufactured by Steel Fixture Manufacturing Company are in use at the BRTC; GLV (28-15/16"W x 37-15/16"D x 40"H) and GLX (58”W x 32”D x 78”H). We employ separate methods for our large and small case organization for study skins.

Installation

Specimens are delicate, irreplaceable and should be always handled with care. Specimens should never be picked up by their feet or beaks. Small birds should be moved by picking them up from the sides - thumb and forefinger on opposite sides. Larger birds should be moved using two hands - one on each side. New specimens are installed into the cases in the manner specified below. Each time a case is opened, it should be assessed for potential pest infestation, spot cleaned, and mothballs refreshed. Cases and specimens are not to be left out for an unnecessary amount of time. If an infestation of insect pests is suspected, the Curator of Birds and Staff Curator should be immediately notified. If the infestation is confirmed, the protocol for fumigation found in the Integrated Pest Management Plan should be followed.

Specimen Case Organization

Within family, specimens are organized alphabetically by genus then species.
Within species, specimens are arranged as follows:

1. Males from Texas organized by TCWC #
2. Females from Texas organized by TCWC #
3. Juveniles from Texas organized by TCWC #
4. Following this, specimens other states (alpha by state), same Male, Female, and Juvenile scheme organized by TCWC #
5. Then specimens from other countries (alpha by country), same Male, Female, and Juvenile, organized by TCWC #
6. Appropriate space should be left between the groupings outlined above to allow for ease of installation of new specimens in the future.
7. Specimens are placed in the drawer with their beaks facing left.
8. Avoid starting any of the groupings toward the back of the drawer or splitting series across drawers.

COLLECTION OF MAMMALS

Specimens from the original US Biological Survey made up the original set of specimens for the mammal collection at the BRTC. With WB Davis as the Department Head and Chief Curator, the collection quickly grew to include specimens from his many field trips to Mexico. Geographically, the collection focuses on material from the southwestern United States, Mexico, and Central America. The majority of these specimens consist of skins and skeletal material prepared by standard museum procedures. Modern researchers now deposit their specimens as skins with skulls plus post-cranial material, tissue samples, and ectoparasites. This collection continues to grow through field work, funded research projects, and recent agreements with the National Parks System, which designates the BRTC as the official repository for vertebrate specimens from Big Thicket National Preserve, Carlsbad Caverns National Park, Guadalupe Mountains National Park, Padre Island National Seashore, and San Antonio Missions National Historic Park.

COLLECTIONS CARE AND MANAGEMENT

The prime consideration for mammal collections is the potential for insect pests to infest the specimens, but there are several important environmental factors to consider. Mammal collections currently include the following: dry skins preserved as study skins, specimens preserved in ethanol, dry skeletons, frozen tissues, and their associated data. In addition to insect pests other threats include material preserved in ethanol are inadequate fixation, loss of fluid preservative, heat, and light.

Specimen Organization

Mammal specimens are arranged by Order according to Mammals Species of the World, with Orders of larger species (Didelphimorphia, Pilosa, Cingulata, Primates, Carnivora) located in the large specimen cases.

Within each Order, specimens are arranged alphabetically by Family, then Genus, then Species. If species are unknown, these are usually placed at the end of the all the species within the genus, designated with “sp.”

Within each Species, specimens are arranged alphabetically by Country (e.g., Costa Rica, Mexico, United States). Within each Country, organization is alphabetical by State/Province, and then specific locality. If there are many specimens from the same locality, these are organized by TCWC number.

Within this organization scheme, most specimens are skin and skull but skin only and skull/skeleton only can also be organized this way. Oftentimes, if there are large series of skull/skeleton only, these are placed at the end of the species to which those specimens belong.

This general organization is represented by labels on the outside of the cases as well as drawer descriptions on the inside door of each case. On each drawer, organization is generally in 3 columns (especially for the smaller specimens). It starts on the left and moves backwards, then to the center and moves backwards, and lastly the right column moving backwards, following the taxonomy and geography organization described above.

Any time you're in cases: make sure specimens are in order, make sure things look nice and organized, make sure there are no "floating" vials. Put vials into rectangular trays or little boxes next to the skin. No stacked vials (space out as necessary). Any time you see specimens needing new labels, add them to the shared google sheet like so under "Needs new skin labels": 12345 or 23456 or 56501 or 103

Space out specimens anytime they look too crowded.

Installation

Specimens are delicate, irreplaceable and should be always handled with care. Each time a case is opened, it should be assessed for potential pest infestation, spot cleaned, and mothballs refreshed. Cases and specimens are not to be left out for an unnecessary amount of time. If an infestation of insect pests is suspected, the Curator of Birds and Staff Curator should be immediately notified. If the infestation is confirmed, the protocol for fumigation found in the Integrated Pest Management Plan should be followed.

Install specimens in the collection in the arrangement described above. This may involve shifting specimens to make room. Existing specimens may need to be adjusted to accommodate for new specimens. In this case, adjust the drawer description on the inside door and label on the outside of the case as needed. All files for internal and external case labels are available in a shared Google drive folder.

If you come across an old loan slip, please check the drawer to see if the specimen is actually missing. If so, make a note for the curators if the date on the slip is especially old. If the specimen is in the drawer toss the slip out. An excel sheet to note Specimens on Loan is available in a shared Google drive folder.

Make a note of any specimens needing box or vial labels or any other additional care.

Case Checks

The purpose of case checks is to find any sign of possible insect infestations and stop the insects before they become a massive problem. Although museum specimens, like mammal skins, are dried out for the most part, they can still attract insects that preferentially feed on decaying material (like museum specimens). Left unchecked, these insects can cause irreparable damage. At least once a year, the entire mammal range (all dry specimens) needs to be checked for possible insect infestations. These insect checks will help ensure that our invaluable mammal specimens will be available for research and teaching purposes indefinitely. To try to keep these insect pests in checks, we will check all specimens within a two-week time period.

Signs of infestation include:

1. Lots of dirt/debris underneath a specimen
2. Actual, living/moving insects. The specific insects we are looking for are called cigarette beetles. They are little brown beetles, about 2 mm in length.

The process:

1. Select a case to check using the sign-up sheet on the case tops (sign-up sheet should remain located by the entry-way into the mammal collection). Put your name/initials next to a case number, indicating that you will check this entire case for insect infestation.
2. Go to your selected case, open it, and begin working from the top drawer down (or vice versa). Carefully slide out each drawer (WARNING: THERE IS NO AUTOMATIC STOP. IF YOU PULL OUT TOO FAR, THE DRAWER WILL FALL) and lift up each specimen.
    a. After you lift the specimen, look for any debris/dirt under that specimen **on the drawer itself**.
    b. If there is no debris/dirt, move on to the next specimen. When there is not debris/dirt, this process can move pretty quickly.
    c. If there is debris, gently tap the specimen a few times on the drawer or case top and see if more debris falls off the specimen. Check to see if any insects fall off the specimen.
        i. If no insects, but just debris, please vacuum/dust-bust up the debris (vacuum is plugged in by the windows).
        ii. If insects, check the "squish factor." Smash the insect with your finger.
            1. If the insect disintegrates, it is an old infestation. Vacuum it up.
            2. If an insect is "juicy" or if it moves, we have a current infestation. Stop checking the case. Make a note on the log on the inside of the case "Live bugs" and inform the Curator of Mammals and staff curators.
3. Complete this process through all skin specimens on every drawer of the case.
4. Make a note on the log on the inside of the case of your findings (debris, clean, etc.) and put the date and your initials.
5. While you are checking the case, you will come across a jar lid with moth balls. Please make sure there are sufficient moth balls on the lid (add more if necessary).
6. Be sure case is completely closed before moving on to the next case.

A few things you can do to make the process easier on you:

1. Carefully pull the tray completely out and rest it on top of the case.
2. Find a chair or stool to sit on while you work.
3. Use a ladder (may need to walk around bird and mammal collection to find one) to reach higher drawers.
4. The specimens are safe to touch, but feel free to use gloves if you would like (available on the case top near the entry way into the mammal range).
5. Listen to music, podcasts, etc., while you work

APPENDIX A

BIODIVERSITY RESEARCH AND TEACHING COLLECTIONS - ACCESSION CHECKLIST

The following checklist is to be completed and approved before any specimen or object may be accessioned by the BRTC. Check boxes ONLY if the required documents are in hand. 'NA' signifies 'Not applicable'.

FOR RECEIPT OF SPECIMENS PREVIOUSLY CATALOGED IN ANOTHER INSTITUTION (by donation, exchange, gift, abandonment, or purchase)	Yes	No	NA
Transmittal form or letter from appropriate authority at the institution of origin	☐	☐	☐
Signed Deed of Transfer form	☐	☐	☐
Export permit (if from a non-US institution)	☐	☐	☐
Import permit (if from a non-US institution)	☐	☐	☐
CITES permits (if transaction involves CITES-listed specimens)	☐	☐	☐
APHIS certification	☐	☐	☐
Other:_____	☐	☐	☐

FOR RECEIPT OF SPECIMENS NOT PREVIOUSLY CATALOGED IN ANOTHER INSTITUTION (field work, gift, exchange, purchase, donation, bequest, or contract)	Yes	No	NA
Original or copy of collecting permit(s)	☐	☐	☐
Original or copy of export permit (if from a non-US locale or institution)	☐	☐	☐
Signed Deed of Transfer form	☐	☐	☐
US Fish and Wildlife Service ESA permit	☐	☐	☐
Copy of 3-177 form (if from a non-US locale or institution)	☐	☐	☐
CITES permit(s) (if transaction involves CITES-listed specimens)	☐	☐	☐
Migratory Bird Treaty Act permit	☐	☐	☐
APHIS certification(s)	☐	☐	☐
Original or copy of field notes for specimens in this accession	☐	☐	☐
Originals or copies of any correspondence relating to this accession	☐	☐	☐
Antarctic Conservation Act permit	☐	☐	☐
Bald Eagle Protection Act permit	☐	☐	☐
Bureau of Land Management permit	☐	☐	☐
Controlled Substances Act	☐	☐	☐
Feather Import Quota	☐	☐	☐
Federal Noxious Weed Act	☐	☐	☐
Fur Seal Act	☐	☐	☐
Marine Mammal Protection Act permit	☐	☐	☐
Plant Pest Act	☐	☐	☐
Plant Quarantine Act	☐	☐	☐
State Collecting permit	☐	☐	☐
US Fish and Wildlife Salvage permit	☐	☐	☐
Other:_____	☐	☐	☐

Description of Accession: ☐ See attached complete

I hereby attest that to the best of my knowledge the above information is correct and accurate and that thespecimens and/or objects comprising this accession were obtained legally and are suitable for accession.

Signature_____Title:_____Date: _____

Printed name: _____

Accession Number: _____

BIODIVERSITY RESEARCH AND TEACHING COLLECTIONS - DEED OF TRANSFER

Date _____

Received from: Name _____

Address _____

_____

_____

_____

Telephone _____

Description of Accession:

AGREEMENT I hereby acknowledge that I have read the terms of acceptance (below), and that to the best of my knowledge, the specimens and/or objects comprising this accession were obtained legally and further, that I have the authority to transfer their ownership to the Texas A&M University Research and Teaching Collections. Signature of agent/donor:
Date:

Terms of Acceptance

1. Signing this document legally transfers ownership of all specimens and/or objects listed on the accession form(s) to the Biodiversity Research and Teaching Collections (BRTC). By the execution of this Deedof Transfer the donor or agent represents and warrants that he/she has full power and authority to transfer or give the specimens and/or objects to the institute. All donations, exchanges, gifts, purchases, bequests, and receipt of specimens or objects from regular fieldwork are considered outright and unconditional accessions to be used at the BRTC's discretion.

2. The donor or agent acknowledges that the institute has not promised, and is in no way obliged, to exhibitor restrict the use of these specimens and/or objects and may deaccession or dispose of these specimens and/or objects, if appropriate.

3. Donations to the institute may be tax deductible. Although the institute is unable to provide appraisals ofdonations, the staff will provide a list of qualified appraisers upon request.

4. The institute shall have the absolute and unconditional ownership of the specimens and/or objects listedon this Deed of Transfer form.

BIODIVERSITY RESEARCH AND TEACHING COLLECIONS - REPOSITORY CHECKLIST

The following checklist is to be completed before any specimen or object may be accepted under a repository agreementby the Biodiversity Institute. Check boxes ONLY if the required documents are in hand. "NA" signifies "Not applicable."

FOR RECEIPT OF SPECIMENS PREVIOUSLY CATALOGED IN ANOTHER INSTITUTION (by donation, exchange, gift, abandonment, or purchase)	Yes	No	NA
Transmittal form or letter from appropriate authority at the institution of origin	☐	☐	☐
Export permit (if from a non-US institution)	☐	☐	☐
Import permit (if from a non-US institution)	☐	☐	☐
CITES permits (if transaction involves CITES-listed specimens)	☐	☐	☐
APHIS certification	☐	☐	☐
Other:_____	☐	☐	☐

FOR RECEIPT OF SPECIMENS NOT PREVIOUSLY CATALOGED IN ANOTHER INSTITUTION (field work, gift, exchange, purchase, donation, bequest, or contract)	Yes	No	NA
Original or copy of collecting permit(s)	☐	☐	☐
Original or copy of export permit (if from a non-US locale or institution)	☐	☐	☐
US Fish and Wildlife Service ESA permit	☐	☐	☐
Copy of 3-177 form (if from a non-US locale or institution)	☐	☐	☐
CITES permit(s) (if transaction involves CITES-listed specimens)	☐	☐	☐
Migratory Bird Treaty Act permit	☐	☐	☐
APHIS certification(s)	☐	☐	☐
Original or copy of field notes for specimens in this accession	☐	☐	☐
Originals or copies of any correspondence relating to this accession	☐	☐	☐
Antarctic Conservation Act permit	☐	☐	☐
Bald Eagle Protection Act permit	☐	☐	☐
Bureau of Land Management permit	☐	☐	☐
Controlled Substances Act	☐	☐	☐
Feather Import Quota	☐	☐	☐
Federal Noxious Weed Act	☐	☐	☐
Fur Seal Act	☐	☐	☐
Marine Mammal Protection Act permit	☐	☐	☐
Plant Pest Act	☐	☐	☐
Plant Quarantine Act	☐	☐	☐
State Collecting permit	☐	☐	☐
US Fish and Wildlife Salvage permit	☐	☐	☐
Other:_____	☐	☐	☐

Description of acquisition on repository agreement: ☐ See attached complete description

I hereby certify that to the best of my knowledge the above information is correct and accurate, and further that the terms of this repository agreement have been met.

Signature:_____ Title:_____ Date:_____

Printed name: _____

This acquisition is approved by the Biodiversity Institute of the University of Kansas.

Signature:_____ Title:_____ Date:_____

Repository: _____

Repository Acquisition Number: _____

APPENDIX B - LOAN POLICIES

BRTC LOAN POLICIES AND PROCEDURES

Specimen Loan Policies

Scientific Use
For scientific research. The BRTC will ship specimens to researchers in the USA or Canada (other countries may be considered by the curator in charge of the division) underthe following conditions:

7. BRTC receives a formal request addressed to the Curator of the appropriate Division on letterhead stationery explaining briefly why the specimens are needed, who will be responsible for their care, how they will be cared for, and which specimens are needed. Please be as specific as possible with respect to taxa, localities, dates, ages, and sex. Our collection databases are available to search online via VertNet, iDigBio, GBIF, and GGBN. Requests made by e-mail (with the formal request on letterhead stationery included as an attachment) are acceptable.

8. The request is counter-signed by the museum curator who will be responsible for the loan (unless the requester and the curator are the same).

9. In any publications resulting from the use of BRTC specimens, we request that museum numbers (BRTC specimen number) be included. The requester agrees to acknowledge the appropriate BRTC Division in publications that use the specimens and to be responsible for sending the BRTC a PDF of such publications.

10. Loans are normally for a period of 12 months. Requests for extensions of this period should be secured before the loan period is over.

11. We do not send specimens to private individuals or institutions that lack proper facilities for housing specimens.

12. Large requests will be broken up into several shipments, with subsequent shipments dependent on return (in good condition) of previous shipments. No more than half of a series from a locality will be loaned at a time. If possible, we highly encourage researchers with large requests to visit the BRTC to do their work.

13. Because loans are so costly in terms of processing time, shipping expenses, and insurance, we may ask for reimbursement of these costs if the researcher is not directly associated with an active museum.

14. For scientific illustration: policy same as above, except that we require the illustrator to sign an agreement in advance that includes a guarantee that the BRTC will receive a gratis copy of the book or article in which the illustrations appear.

15. For commercial or personal artwork: We do not loan specimens for these purposes. However, we are more than willing to let artists use certain specimens if they arrange to visit the collection and to use them on-site.

Educational Use

1. The BRTC will provide specimens for educational purposes for TAMU courses (e.g., WFSC 302, 401, 402) with the following expectations:

- ❖ It is the responsibility of the course professor to instill in their teaching assistants (TAs) an appreciation for the value of natural history collections and museum specimens. TAs are then responsible for instilling these values in their students prior to laboratory meetings and ultimately responsible for the proper use and careof specimens during laboratory exercises.

- ❖ We will loan specimens from the research collection to augment what is available in the teaching collection. At the beginning of each semester, the curator will be available for an orientation/primer to the collections designed for TAs. For our records and to avoid conflicts with other courses, we ask that requests for specimens from the research collection be submitted by the professor of the course a minimum of two weeks before the specimens are needed (email requestsare sufficient). All specimens must be returned immediately when they are no longer needed or at the end of the semester.

- ❖ Requests for any specimen (teaching or research collection) to be taken outside of BRTC (e.g., to main campus) should be submitted by the professor a minimum of 1 week before the specimens are needed. As with in-house loans, it is the responsibility of the TA to retrieve, properly package, and return all specimens.

Information requests

The BRTC is willing to send information to researchers on label data from specimens and occasionally measurements, provided that the request is not excessive (i.e., not more thanan hour or two of work). As with loans, we must receive a formal, signed request on letterhead stationery explaining briefly why the data are needed, and how they will be used. An email message is not sufficient for the formal request. Please be as specific as possible with respect to taxa, localities, dates, ages, sex, etc. Students must have this request co-signed by their advisor. Requests made by e-mail (with the formal request on letterhead stationary included as an attachment) are acceptable.

Loan Procedures

Loan guidelines

1. Specimens removed from the collection shall be replaced by a check-out slip designating their current location.
2. A loan invoice is prepared listing the total number of specimens, scientific names, TCWC catalog numbers, method of specimen preparation and condition of each specimen. One copy is packed inside the shipping container with the specimens and the other copy remains in the division's outstanding loan file. An e-mail is sent to theborrower to notify them of the incoming shipment.
3. All transport must conform to state, national, and international regulations (49 CFR Parts 100-149; IATA Regulations).
4. Upon receipt by the borrower, specimens are checked and any damage is detailed on the invoice form. This form is signed, returned to the curator, and stored in the division's outstanding loan file.
5. When a loan is returned, each specimen is checked against the invoice for possible damage resulting from transport or usage. If damages have occurred or all specimensare not returned, the curator is notified immediately.
6. Following freeze-fumigation (see the BRTC Pest Management document), the specimens are then returned to their appropriate locations in the collection and the check-out slips discarded. Slips for any specimen retained by the borrower should remain in place until they are returned.
7. Invoices for partially returned loans are kept in the outstanding loan file. Following completion of the entire transaction, the invoice can be placed in the return invoice file.
8. Notification of arrival of loan can then be sent to borrower.

Packing/unpacking loans

Care must be taken while processing specimen transactions to prevent infestation of both our and other museums' collections. Use the following procedures when dealing with loans:

1. Specimens should be inspected for any sign of damage or signs of insects. Any damage should be noted on the invoice and the other museum should be altered.
2. Specimens should be freeze-fumigated prior to return to the collection (see the BRTC Pest Management document)
3. Inspect packing materials for signs of insects
4. Packing materials should be treated (i.e, freeze fumigation) before being reused
5. Freeze or dispose of incoming packing materials
6. Store packing materials in a clean and organized manner
7. Packing areas should be kept tidy and free of excess debris

APPENDIX C – GRANT POLICIES

BRTC GRANT POLICIES

Policy Regarding Requests for Destructive Sampling of BRTC Specimens

We are receiving increasing numbers of requests for use of specimens involving varying degrees of destructive sampling. These include requests to excise small pieces of skin, hair, feathers, bones, and fluid-preserved specimens for biochemical analyses, to dissectfluid-preserved specimens, and to remove feathers or hairs for coloration, pigment, and trace mineral studies. Subsampling of frozen, buffered, or alcohol-preserved tissue specimens also fall into the category of destructive sampling.

Because specimens used in these kinds of studies cannot be returned in the condition in which they were lent, we have a formal loan request protocol for destructive sampling. We follow the terminology suggested by other collections of genetic resources and usethe term "grant" instead of loan to apply to these types of specimen use.

Guidelines for Grants

The following guidelines are to assist us in evaluation of proposals involving destructive sampling to specimens.

Please be aware that requesting specimens from our collection is an explicit acknowledgment that you support legitimate scientific collecting efforts, and that you value the time and effort that goes into collecting, preparing, and maintaining museum collections. In exchange for granting these specimens for research, we may call on you to provide verbal or written support of scientific collecting and our collections.

We generally do not charge for shipping these specimens. Unfortunately, our access todry ice for shipping frozen specimens is limited; therefore, we prefer researchers to accept buffer or ethanol-preserved methods of storing the tissues for shipping.

We also require a transport permit (VS FORM 16-6A) from the USDA in order to be ableto legally ship bird blood or tissues to researchers in the US. If your institution does not have this permit, access the USDA's web address (http://www.aphis.usda.gov) and download and fill out VS FORM 16-3. Please be aware that USDA can take more than two months to process a transport permit request.

To initiate a Destructive Sampling Grant:

1. Requests for destructive sampling of specimens should be made in writing. Please submit letters on institutional letterhead, addressed to the Curator of the appropriate division. Letters from students should be co- signed by faculty advisors. Requests made by e-mail (with the formal request on letterhead stationary included as an attachment) areacceptable. Requests for grants should contain:
    a. a brief summary of the proposed research with sufficient detail to allow us to assessits scientific merit

b. demonstration that the techniques being used will likely be successful (for example,the genetic system to be evaluated should have a high probability of resolving theparticular research question)

c. demonstration that the researcher is proficient in such techniques (provide details ofpreliminary analyses using similar kinds of museum materials or tissue samples)

d. why destructive sampling of specimens is necessary

e. availability of material from wild or captive sources

f. justification of numbers and types of specimens being requested from our collection(consider the overall rarity of specimens in the wild and in collections)

g. the amount of tissue required

h. availability of funding to complete the project

i. an estimate of the time frame of the study

2. For grants of frozen, buffer, or alcohol-preserved tissue specimens, we prefer to provide supplemental material to researchers who have demonstrated a willingness tocollect some material for themselves (see above). Grants of large numbers of tissues across many taxa will be rare.

3. Requests for samples to be taken from study skins for biochemical or other analyses involve additional issues. These requests should address the following:

    a. what is the minimal amount of skin that can be used for a particular technique?

    b. can other materials be used instead? For example, could cartilage or tissue left onthe underside of the skin or scraped off a skeleton be used?

4. Requests for samples of fluid-preserved specimens should address the following:

    a. for biochemical analyses, can the biomolecules be extracted despite the fact that thespecimen has been fixed in formalin?

    b. for dissection of specimens, there needs to be additional justification for any project involving the dissection of both sides of a specimen.

After a Grant is Approved

- Please provide detailed instructions for shipping specimens, including contact people and their phone numbers and whether the specimens can be shipped in alcohol or buffer.

- We request return of any unused portions of samples when the project is over. If slidesof sectioned materials are made, we request representative examples be returned.

- Written permission is required if, 1) the samples are to be used in a study other than that for which they were initially requested (i.e., a new project outline is required, or 2) prior to transfer of material to another institution or researcher, even if that researcher ispart of the initial request.

- We request detailed protocols for the extraction of DNA from our museum specimens(both successful and unsuccessful). We will use these successful and unsuccessful protocols to assist researchers with what we know can be a difficult task.

- In any publications resulting from the use of BRTC specimens, we request that their TCWC museum numbers be included. An acknowledgment of the grant is expected to appear in any publication, and we require PDF's of any work wholly or partially based on BRTC material send via email to the appropriate curator.

- We also request a complete list of GenBank numbers (or accession numbers from equivalent genetic databases) from each specimen, and for each gene sequenced per specimen.

APPENDIX D – INTEGRATED PEST MANAGEMENT PLAN

PROPER HANDLING OF SPECIMENS

Storage and handling specimens

Proper storage and handling techniques helps not only with pest management, but also to serves protect the archival integrity of the specimens. These guidelines should be followed for the proper management of the collections.

- Specimens should always be handled carefully. Many are fragile and easily susceptible to physical damage. Care must also be taken not to dislodge specimen tags fromspecimens, which renders the specimen useless for research purposes. The user orcurator should immediately reattach a tag that has become separated from a specimen.

- Specimens should be stored on metal, acid-free trays. Trays should be kept clean to provide a good background when looking for signs of infestations.

- Cases should be kept closed as much as possible. Closed doors create a physical barrier to pests as well as damaging light. Closed doors also keep dust/and debris out of the cases, which may provide food for pests/insects.

- If a case is left open overnight or longer, it should be closed immediately and treated if infestation is suspected.

- Specimens are not to be removed from the collection without approval of the curator.

Handling specimens by staff and visitors

- Wash hands before and after handling specimens.

- Gloves (latex or nitrile) are available to protect users from exposure of previous specimen treatments and to prevent oils, residues, etc., from getting on and damaging specimens.

- Specimens should not be out of the cases longer than necessary.

- Trays should be made available to place specimens on to protect them from dirty work areas and to help identify infestations. Trays should always be used to transport specimens from cases to work areas and back. Specimens should be returned to their appropriate case or holding area at the end of the day.

PEST PREVENTION AND FUMIGATION

Prevention is the first line of defense against pests accessing specimens in the collection. To prevent pests from entering the collection and specimens, barriers must be created, and all pests must be eliminated. Collections staff often rely on prevention as the main tool to keep pests out of the collection. The best ways to prevent pest infestations include a combination of pesticide exposure, cryo-treatments, proper handling of specimens/shipments, and cleanliness.

Pesticide Exposure

Application of pesticides is one way to keep collections free of pests. However, many pesticides such as Vapona (the active ingredient in No-Pest strips) are considered dangerous to humans. Mothballs containing either paradichlorobenezene or naphthalene are employed in each case as a means of year-round prevention and control. Mothballs are placed into open topped plastic containers and refreshed every 6 months.

On a yearly basis, cases are to be chemically fumigated for a minimum of a 1-week period with Ethyl-acetate. Ethyl-acetate is placed into each case in a shallow glass bowl filled with cotton balls and allowed to dissipate. The cases are to remain closed during this procedure.

Cryo-treatment

Freezing, or Cryo-treatment, is used to prevent insects from coming into the collections from the outside (e.g., loans and recently prepared specimens from field expeditions, etc.). Freezing can be thought of as a first line defense against pests as it is designed to kill any pests before they have a chance to come in contact with the collections. If insects/pests are frozen quickly and at extreme temperatures, internal insect fluids are crystallized and cause cells to burst thus killing the pest (Denlinger and Hallman, eds. 1998. *Temperature Sensitivity in Insects and Applicationin Integrated Pest Management*. Westview Press. Boulder, Co. 311 Pgs.). However, if insect pests are not cooled quickly enough or for a long enough period of time, they can form “anti- freeze” and are more difficult to kill. For this reason the treatment must not be interrupted or must be repeated at least two times.

Two effective procedures (specified below) can be used for cryo-treatments. Before treatment, specimens should be placed in heavy duty polyethylene bags or good quality “Tupperware” containers to prevent both desiccation of the specimen and to prevent condensation from forming on specimens post-freezing. Bags and containers should be sealed tightly with tape formulated with withstand ultra-cold temperatures.

Procedure 1 (large infestations):

1. Place specimens in -30° C walk-in freezer for 7-10 days
2. Remove specimens from freezer and keep them in bag/container
3. Allow to come up to room temperature to prevent condensation forming onspecimens (condensation will form on outside of bag/container)
4. Remove from bag/container and distribute accordingly

Procedure 2 (infestations detected early; loan materials):

1. Place specimens in -30° C walk-in freezer for 7-10 days
2. Remove specimens from freezer and keep them in bag/container
3. Allow to come up to room temperature to prevent condensation forming onspecimens (condensation will form on outside of bag/container)
4. Freeze again; Place specimens in 30° C walk-in freezer for 7-10 days
5. Remove specimens from freezer and keep them in bag/container
6. Allow to come up to room temperature to prevent condensation forming onspecimens (condensation will form on outside of bag/container)
7. Remove from bag/container and distribute accordingly

In addition, Cryo-treatments should be used on other prepared specimens, to include:

- ❖ All new materials from field expeditions or other new preparations
- ❖ Incoming shipments (loan returns, borrows, etc.)
- ❖ Specimens loaned to the Teaching Collections, regardless of time on loan

Cleanliness

Cleanliness is a vital tool in collections management for a number of reasons. Cluttered areas can provide hiding and potential breeding places for insects, and unsanitary conditions can act as a food source for these pests. Pests are harder to detect in unclean areas. Below are some guidelines for keeping the collection and adjacent areas clean.

Offices

Food is allowed only in office areas and the kitchen. Food should not be eaten in the collection areas or when handling specimens. Many of the older specimens contain Arsenic or other compounds that can poison the skins, and ingestion of food nearby may not be healthy. Also, eating food near specimens may transit oils, residues, etc., to the specimens which could attract insects or discolor specimens. If food is consumed in the designated areas, then it is the responsibility of the "consumer" to dispose of unused food items in a trash receptacle that gets emptied regularly or to close the trash liner until trash pick up is made. The "consumer" is responsible for cleaning up after eating, and special assignments may be needed for cleaning after social activities.

As mentioned before insects can use clutter to hide/reproduce/forage. Reduce clutter as much as possible. A clean office allows access for cleaning and reduces the chances of pests using clutter.

Along with reduction of clutter, regular cleaning can reduce pest/insect occurrences. Although daily cleaning is not necessary, people should at least do the following:

- ❖ -Empty trash receptacles on regular basis
- ❖ -Sweep/mop occasionally
- ❖ -Vacuum and dust as necessary

Collection or Common Areas
Food is forbidden at all times in the collections areas. Common areas are of the most concern for cleanliness. Each user needs to take the time to make sure common use areas are clean and clutter free when they are finished using them.

MONITORING

In establishing and performing an effective Integrated Pest Management program, consistent monitoring is essential. Consistent monitoring is an overall gauge to the effectiveness of our program, allowing us to determine the presence and trends of pest activity and the effects of preventive measures. We will modify our procedures and preventative measures to meet the changing results from the monitoring. Below are the procedures set forth for the monitoring program:

Trapping

Insect monitoring using Light traps will be regularly employed. Light traps will be located throughout the collections to attract/kill insects. Traps will be checked and cleaned monthly by Curators, staff or interns. The following data are collected from the traps and are stored in a Microsoft Excel spreadsheet:

1. Date checked
2. Location of trap
3. Number of insects
4. Type of insect (Pest, Predator, or Misc.)

If a given trap(s) has large numbers of insects, all cases in the immediate vicinity will be checked for potential infestation.

Case inspections

Specimen cases are inspected by the curatorial staff on a yearly basis. During case inspections, personnel look for any signs of pest activity; thus these yearly assessments are vital for the discovery of new infestations. Live pests, insect frass, shed insect casings and/or an unusual amount of loose feather fragments all indicate recent pest activity. To undertake yearly inspections, each individual active in the collections is assigned a proportionate number of cases by the Curators and are given a time frame to complete their inspections. For each caseassigned, the inspectors must look in every drawer and move an appropriate number of specimens to search for signs of infestations. The inspectors are to report findings (positive or negative) to the Curators who will summarize the findings. Appropriate action is decided on a case by case basis. Results from previous inspections, fumigation, and cryo-treatments also will be posted on the outside of each case.

At Large Monitoring

Personnel, volunteers, and collection visitors perform this type of monitoring during routine activities. During their normal duties, these individuals are asked to watch for signs of infestations and insect activity. Personnel should be aware of any discussions of increased pest

activities in other parts of the building, and report this to the Curators. Visitors using the collections are a great resource for finding potential infestations as these individuals are in the position to observe certain specimens closely

DEALING WITH INFESTATIONS

No matter how effective our preventative measures are, there is always a chance of pest infestation to a part of our collection. When an infestation is found, the below procedure should be followed:

1. Identify infestation
    a. As soon as an infestation is found, alert Curators. The Curators will identify the type of pest involved and determine extent of infestation.

2. Deal with infestation
    a. First, clean the area affected by sweeping and/or vacuuming frass and casings from the drawers and clean infested specimens with the HEPA vacuum or dustbuster. While using the vacuum gently tap the specimen to free loose materials/pests to be sucked away with the vacuum. Replace the soiled case paper and/or unit trays, and dispose of the HEPA vacuum collection bag.

3. Kill pests
    a. The affected specimens should be isolated and treated using the Cryo-treatment method outlined above. This is the most appropriate method for infestations affecting a whole case of specimens.
    b. Following Cryo-treatment, specimens are to be returned to their case and fumigated with Ethyl Acetate for 2 weeks.

4. Monitor for signs of re-infestation
    a. After the infestation has been handled, the infested area(s) should be rechecked carefully for signs of re-infestation at least once within six months. If the original infestation was severe, the area(s) should also be checked again periodically for at least 12 months.

APPENDIX E – DERMESTID BEETLE COLONY PROTOCOL

INTRODUCTION

Dermestes maculatus, commonly known as the hide or dermestid beetle, is notorious for feeding on carrion. This has led them to become an excellent method for cleaning bones and skulls. This method is used in forensics, by taxidermists, and here at the BRTC to clean specimens for the collections.

Figure 2. Dermestes maculatus, the main beetle in the colonies.

Dermestid beetles are very good at cleaning carrion because it plays an extremely important role in their life history. It is their food source, natural substrate, and place to raise their young. Adult beetles form large aggregations on carrion by the male releasing pheromones, attracting females. The males and females will mate, and the female will lay her eggs in the crevices of the carrion. The larvae will hatch and will also feed on carrion, just as their parents. Larvae are the ones that clean the bones, as they are constantly eating to grow. In a healthy colony, there will be larva of all stages, allowing them to reach every crevasse of the skulls and bones. They will develop through 5 to 11 instars, before finding a place to pupate, usually in nearby wood. In our case, they will pupate deep in the substrate or between the layers of a cardboard box.

In the colonies is another beetle, *Necrobia rufipes*, or the red-legged checkered beetle. Despite the name, they are metallic blue with yellow to orange legs. These beetles are common museum pests, feeding on skins and other prepared specimens. Often, you can naturally find them on nature cleaned bones and skulls. They have accidently invaded the dermestid colonies here at the BRTC and reproduce alongside the dermestids, but in much smaller numbers. They do not hinder the bone cleaning process nor negatively affect the colonies, and therefore are harmless.

Generally, we maintain two to six colonies at a time in the bug room. They are each in plastic storage bins with a modified lid with mesh wiring. The number of colonies can fluctuate depending on what kind of specimens are going through and how many need to be cleaned. When a large project comes in, such as many turtles, colonies can be split to allow for more specimens to be cleaned at a time so the project can get done quicker. Putting multiple turtles in a bin at one time will cause them to rot and attract flies if the colony is not large enough (See the additional page on turtle tips). Also, with larger specimens, you can usually only fit two to three in a bin at a time, unlike with mice where you can fit up to ten in a colony at once. A specimen

will be cleaned in the colony, soaked in a water and dawn dish soap solution to degrease, and then boxed and cataloged into the collection.

Colony Upkeep

General Care

Figure 2. Four colonies set up in the bug room. You can see commonly used tools, such as the spray bottle and forceps.

Colonies should be checked 3 to 5 times a week. Each colony should be inspected for flies and their progress on specimen cleaning should be examined. Mist the specimens lightly with water each time they are checked, keeping the water away from the substrate. Moisture on the substrate can increase the risk for a mite infestation.

As a rule of thumb, one small rodent(mouse) will last the colony about a day depending on the size of the colony and the temperature. Cold weather causes the beetle to feed slower, while warm weather causes them to feed faster. Larger specimens such as turtles and large skulls will need more time to be cleaned. Progress on a large skull can be checked by examining the amount of brain matter left. If specimens are not available, vacation food can be used to sustain the colonies until more specimens have been prepared. Vacation food usually consists of limbs, or other parts, of larger specimens. Only the skull and skin of larger specimens is kept due to space, and so the limbs will be frozen for future use.

It basically depends on the beetles, sometimes they just won't eat and sometimes they will eat a whole specimen in a night. You must keep an eye out and you can tell when the specimen is done. As for flies, those can be a handful. If you see maggots, take out as many of them as you can and trash them. Freeze the maggot-infested specimen if possible and put it back in the bugs after the first round of flies is dead. There are sticky traps for the flies, but not all of them stick so make good use of the fly swatters and channel your Jackie Chan energy. Very large specimens can be left alone for a few days. After four days make sure check on them. If you are going to be gone for a longer length of time, notify Heather to set up a plan.

Figure 3. A specimen, tagged with its metal tag, placed individually in a box in the colony.

When placing specimens into the bins, they need to be in a box and away from the substrate. This will keep all the bones together and much cleaner. Specimens that have been promptly cleaned should be removed as soon as they are finished. Bones can be lost in the substrate if forgotten about or not removed. This can lead to error and confusion with other specimens present in the bin. Once the specimens are removed from their boxes, dump out the left-over shed skins and dead adults from the box. Worst case scenario, if you do find spare bones in the colony, it's better to throw them away than add them in with another skeletal specimen.

The cardboard boxes that are used tend to wear down and degrade as specimens rest on them and the beetles eat it away. The beetles and the larva will create small tunnels through the boxes that allow for easier access to their food source. Over time, you will notice boxes beginning to fall apart, become weak, or are caked with beetle mud. Boxes that are falling apart can cause bones to be lost and dirty boxes can make the cleaned skeletons very dirty. Beetle mud, a mix of beetle feces and substrate, is easier to prevent than it is getting off a skull or small bones. Regularly remove decaying boxes. It's a good idea to have a large stockpile of various-size boxes in the bug room so you don't have to waste time going back to get another box.

There will be times, especially during the warmer months, when flies will be breeding inside the bins. It is common for flies to enter the building through various small holes in the infrastructure or from someone going in or out the door. These flies are generally more annoying than problematic, until they are seen inside the bins. When flies are noticed in a bin, remove or kill all the flies from inside the bin. Fly larva, maggots, are white and worm-like. It is easy to confuse them with a freshly molted dermestid larva. Dermestid larva, and most other insects, are white directly after molting. Dermestid larvae are much hairier than fly larva and not to mention, more important for cleaning skeletons! A few flies here and there is fine, but if an increase and persistence in flies is observed, a substrate change will be needed.

The temperature of the bug room should be between 70°F and 80° F. Anything out of these ranges can either be detrimental to the health of the colonies or greatly slow the rate at which the beetles clean. The beetles can tolerate higher temperatures, but they are able to fly above 80°F. This can cause issues if a deer skull with antlers, or something else too large for a

lid to be closed, is being cleaned. If you can't fully close a bin, cover it with a trash back with holes in it to prevent excess escape of beetles and reduce the possibility of flies. In the summer months, utilize the cooling unit to lower the temperature of the bug room. In the winter, the space heater in the bug room can be placed near the colonies on the floor to keep them warm. Even when it is cold, never turn off the fans blowing directly on the colonies as they are needed for air flow.

Substrate Changes

Each colony has a two-inch layer of Carefresh small animal bedding for the beetles to use as substrate. Carefresh is made using paper fibers, from trees such as spruce, fir, pine and hemlock. The bedding gives them a place to hide, reproduce, and grow. As the larva and beetles bury and break down the bedding, it will expand and thicken. This broken-down layer of substrate has been shown to help keep the colonies healthy and keep the temperatures warm to promote larval growth. The thicker the layer (up to 5 inches), the healthier the colony. When the bins start to produce flies, or it has been 6 to 7 months since the last substrate change, it is time for the bedding to be replaced. The previous date of substrate change should be labeled on the box but use your best judgement on when to change the substrate.

The first step of a substrate change is removing as many beetles as possible. Any time a substrate change is done, a generation of beetles will be lost. All the beetles and larvae can't be removed, especially the newly hatched and the first and second instar larva, as they are too small. This will shrink the colony, but it is a part of the process. To remove the insects, place a specimen into a jar and lay the jar on its side in the bin. This can be done with any specimen that can fit in the jar, but something large, like a skull, may start to decompose before the beetles can eat it. Let it sit for enough time for beetles find the specimen. Beetles and larva can be transferred to a deep metal tray while you are changing the substrate. Using a hunk of meat that is vacation food is preferrable, that way loss of bones is not an issue.

Next, remove all boxes from the bin and place them in the tray with the beetles. Most of the boxes will have beetles all over and in between the cardboard. Moving the boxes into the bin with the new substrate allows for pupating larva to emerge and not be trashed.

Remove the substrate, wash the box with a mild bleach solution, and replacing it with

Figure 4. All boxes and specimens have been removed for a substrate change. It has been placed so that the bin is resting inside the bag and the contents can be easily scooped into the bag.

fresh hamster bedding. This should be done outside. Stirring up the substrate throws large amount of dust and fine hair from the larvae into the air. Not only would you be breathing this in, but it will cover every possible surface in the room. Once outside, dump the old substrate into a trash bag and put it in the dumpster behind the BRTC. Only about two inches of hamster bedding is enough for the beetles. Over time, the bedding will expand as they molt and break down the bedding into frass. Replace any boxes and specimens still being cleaned. A mask is recommended. Don't forget to create a label detailing the date of the substrate change you just did.

Building Maintenance

The bug room should be kept clean and tidy. Weekly, the room should be swept, surfaces should be wiped down, and the shelf and table should be organized to keep a tidy workspace. Any cleaned specimens should be taken off the holding shelf and into the freezer. Trash should be taken out to the dumpster behind the BRTC when it is full, smelly, or when flies begin to accumulate on the trash.

Flies commonly enter the bug room through holes in the infrastructure or by reproducing in the colonies. It is a good idea to have any visible holes (example: around the AC unit) plugged. As temperatures rise, flies will be more active and therefore the numbers getting into the room will increase. If flies are reproducing in the colonies, it may be time for a substrate change. Kill and remove any flies or maggots in the colonies. Sticky traps can be used to help manage the indoor population of flies. Make use of the fly swatters.

Skeletonizing Procedure – The Beetle Colony

- Specimens should be skinned and gutted, with eyes and tongue removed. Larger specimens, such as a bobcat, should have as much muscle removed as possible if keeping the entire skeleton for the collections.
- Prepared specimens that are ready to be skeletonized should be in the freezer, put in its own individual baggie, and placed in the "Ready for Bugs" box. It should be labeled with its proper prep number consisting of the preparer's initials and specimen number (BBD 214). If a specimen is a part of a project, all specimens in the project should be stored in their own box and taken through the entire cleaning and cataloging process together.

Figure 5. Specimen BBD 214 has been tagged with metal tag 203 before being placed in a bin.

- Before placing a specimen in the beetle colony, use metal wire to attach a metal tag (Figure 5) to the specimen and catalog all the specimen's information (prep number, bin placement etc) onto the specimen log sheet. The specimen should be placed in its own individual box to prevent bone loss and mixing with other specimens.
    - Giving a specimen a metal tag is backup procedure and is very important. It is possible for a specimen's prep number to be lost in the colony or eaten by the beetles. As soon as we lose that information, the specimen lost all data attached to it and cannot be put into the collections. The metal tag will continue to serve this purpose all the way through the soaking process.

- Remove any horns (not antlers) from the specimens as soon as possible. The beetles will begin to chew on the outer layer as seen in Figure 6.

Figure 6. Beetles have eaten the outer layer of these Nilgai horns.

- Once a specimen is as clean as the bugs can manage, remove all the bones from the box and place it, and its metal tag, back into a baggie. Put the cleaned specimen into the freezer until the soaking process is started.

Skeletonizing Procedure – Soaking and Cleaning

- Pull all the specimens that need to be soaked out of the freezer. Use a cart to grab the jars and metal trays you will need.
- When preparing the bones for soaking: empty one bag of bones at a time onto a metal tray and try to remove as much bug mud and dead bugs from the bones as possible using forceps and a long pin. Place these cleaned bones into a glass jar that has a piece of painter's tape on the outside. On this tape write the prep number and metal tag number. Repeat until each specimen is in individual, labeled, jars.
- Take jars to sink, fill one of the pitchers with hot water and then add enough dawn until it is a medium blue color. Pour this into the jars until each is about half full. Then fill the pitcher with more hot water (no soap this time) and fill the jars until the specimen is covered in water and the water-color is a light blue. This mitigates the amount of bubbles you will have to deal with. You may have to poke some of the bones until they stop floating. Place all jars on the cart and take back to your station, come back in 4-10 hours. I tend to let the bones soak overnight. Large skulls can be soaked in the bins stored underneath the table in the soak area. The bigger bones tend to smell strongly, it is a good idea to turn on the fan.

- After soaking, use the metal wire mesh strainer and place it over a pitcher in the big sink. Pour out the water through the strainer and into the pitcher. The strainer is there to catch any extra beetles in the solution or bones that may have fallen out while pouring. Put bones back into jar, empty pitcher and rinse mesh, fill jar with clean water, stir gently

Figure 12. A method for rinsing specimens after a soak.

with long forceps until sufficiently agitated, then pour out water through mesh again. Repeat as necessary until no more dirt or bugs comes out.
- For drying, place folded paper towels on metal trays. Then empty the bones onto paper towels and put the specimen's label tape next to each pile of bones. One paper towel per specimen generally helps distinguish each specimen sufficiently. Keep the fan blowing on them. Big skulls will take longer to dry, they might need flipping as well.
- The specimens should be dry before moving on to the next stage. If they are still wet, they can crack while in the freezer for the last time or mold.

Freezer Fumigation

- Each dry specimen should be examined, and any remaining insect parts be removed. Rewrite the prep number with a pigma pen if it is faded, using the metal tag and specimen logs as reference if the number is lost. Remake the tag if the bugs have eaten it. Remove metal tag once the specimen tag is readable.
- Place the specimens in an appropriately sized glass vial or box, refer to the curator of the division for their preference on storage.
- For vials, make sure that the anatomical tag and prep number are visible from the outside of the vial (eg. Not buried in the bones.
- For boxed specimens, neatly write the prep number in the top right corner with pencil on the outside of the box.
- Insert specimens into the freezer on a large freezer tray. Label each drawer with date into the freezer.

- All specimens should be put into the Freeze-Thaw-Freeze box in the walk-in freezer. They will remain in the freezer for 14 days and on the 7th day they should be removed for thirty minutes then returned to the freezer.
    - Some pests can survive a freeze, but only a single freeze. This method ensures that the pests (if any) thaw out and then are frozen again, killing them.
- After the second freezing, deliver the specimens to their respective curators and they will be processed into the collection.

APPENDIX F – STUDENT WORKER TASKS

Collection of Fishes

General Tasks
Students working in the Collection of Fishes at the Biodiversity Research and Teaching Collections are expected to contribute to the general upkeep, organization and restocking of supplies in the wet lab area. This area is utilized by faculty, staff, students and visiting researchers and should be always kept neat and tidy. These tasks include, but are not limited to:

- Restock jars and lids – new stock can be found behind the green curtains under the mezzanine at the back of the Collection of Reptiles and Amphibians. Only stock standard size jars. Empty boxes should be broken down and placed by trash can or taken to dumpster. Alert Ms. Prestridge if stock of a particular size is running low.

- Police sink area – return dry, clean jars to shelving to the left of the sink. Jars that will not fit in that area can be stored at the back of the Collection of Amphibians and Reptiles. Return clean and dry specimen trays to the filing cabinets to the right of the sink. Non-standard jars can be disposed of.

- Monitor 70% EtOH level – the carboy near the Fishes worktable should be refilled as necessary. 95% EtOH is located in the tank room, to dilute, fill the carboy to the demarcated line with 95% and top off with R.O. water located to the right of the sink. Use the appropriately labeled pumps to move EtOH and Water.

- Monitor R.O. water level – the R.O. water is located to the right of the sink. To turn the unit on, adjust the green lever until the pressure on the R.O. unit dial reads 40 PSI. The unit will discharge wastewater into the sink via the small yellow tube. The unit should be turned off when the reservoir is full, or you leave for the day.

- Monitor light use over the collection – light switches for the research range are located to the right of the front door. The two right most switches will illuminate the research range of Reptiles, Amphibians and Fishes. Over time, light exposure can cause damage to specimens. If no one is working in the range, the lights should be turned off.

- Return all materials - the worktable is utilized by many students and staff throughout the week. At the end of your shift, return all the materials you've used and wipe your area down. If you've used a cart, it should be wiped down and returned to the back to the collection. If you've emptied jars, they should be washed and left on either side of the sink to dry.

Shelving specimens
Specimens stored in jars are arranged on the open shelving in the collection in the following order:

1. Families are arranged systematically within orders according to Nelson (1994). This number appears on the top left of the label inside the jar.
2. Species are arranged alphabetically within families.

3. Undetermined species within a family (no genus or species appears on the label) are shelves at the beginning of the family.
4. Undetermined species within a genus (sp.) are arranged at the beginning of the appropriate genus.
5. Multiple jars of the species in the same size are placed in rows close together at the back of the shelf to reduce the effect of ambient light.
6. Jars are positioned so that labels face outward.
7. Cleared and stained specimens and skeletal material are arranged and shelved in an identical manner, but they are stored in a separate area.

Students are also asked to identify problems amongst the shelved specimens in the research collection and work to remedy problematic lots as appropriate. The more eyes we have on the collection, the better. It is expected that as you shelve specimens you look for and correct the following:

Problem	How to identify	Solution
Jars in need of more ethanol.	Air space is visible between jar lid and top of ethanol.	Refresh with appropriate concentration EtOH.
Jars in need of new lids.	Jar lid is cracked.	Replace with appropriate size lid.
Jars of a non-standard size.	Bail top jars, jars with metal lids, and short squatty jars are now not standard.	Replace with appropriate size jar and return to shelf.
Jar in need of a new label.	Label is damaged, smeared, or un-readable.	Move jar to a cart and request a new label from Ms. Prestridge. Wait till the end of your shift to alert her of the need for labels.
Labels that are incorrectly installed.	Specimens are trapped in between label and jar.	Using forceps, carefully adjust the label to be flush at the bottom of the jar with specimens neatly behind.
Specimens in an inappropriately sized jar.	More that 80% of the jar is occupied by specimens.	Move specimens, nose down, to a new jar of an appropriate size. Request a new label if necessary. Reshelve.

Collection of Birds

General Tasks
Students working in the Collection of Birds at the Biodiversity Research and Teaching Collections are expected to contribute to general upkeep, organization and restocking of supplies for the preparation area and research range. Our preparation area is used by various groups, students, visiting researchers and curators throughout the week and should always be kept neat and tidy. The same is true of the work table that is situated in the research range amongst the specimen cabinets.

- Unpin dry specimens and move them to the freezer for fumigation.
- Move specimens through freezer fumigation to chemical fumigation.
- Restock boxes and vials used for skeletons located in the storage cabinet near prep area.
- Police prep area, sweep and wipe down surfaces as needed. Organize prep cabinets and prep kits to make sure they are fully stocked and alert Ms. Prestridge via email when supplies are running low.
- Tie anatomical tags.
- Monitor and replace mothballs in cases.
- Return all materials - the worktable is utilized by many students and staff throughout the week. At the end of your shift, return all the materials you've used and wipe your area down.