Using Photographic Guides & Charts to Integrate 'Non-invertebrate' Keepers into an Invertebrate House

Amber Zelmer

Senior Keeper, Children's Zoo, Houston Zoo

1513 Cambridge Dr

Houston TX, 77030

Introduction

When The Houston Zoo opened the doors to our new 'Bug House' in May of 2014 the keepers were vastly outnumbered by the new additions. Many keepers in our area, myself included, had limited experience caring for invertebrates on this scale. User-friendly labeling systems, photographic identification guides and detailed 'How To' exhibit protocols are just some of the tools that we developed for our Bug House. This paper will share some of the organizational techniques that we employed to help get all of our Bug Team Members on the same page and provide tips for others to do the same.

Challenges

One of the biggest challenges faced by keepers new to invertebrate care was the sheer volume of specimens in the Bug House. With over 80 different species and over 650 individuals, not including the ant colony, it nearly doubled the number of species in the Children's Zoo collection as a whole. Keepers that previously relied on common names to reference their animals were now faced with the task of recognizing many individuals from a scientific name alone. Often, the common names of the invertebrates varied depending on their source and occasionally multiple species could have the same common name, further muddying the water for keepers that were still learning 'who was who.'

Aside from learning how to recognize, and care for, each species, keepers were also concerned with keeping track of each individual. With an ant colony in addition to the main Bug House population a daily 'head count' was not feasible. Caring for colonies required a different mindset than caring for individuals and ensuring that each individual received the appropriate diet at the correct frequency was also something that needed to be organized. Keepers quickly realized that their general routine, which could be easily modified to fit all other sections of the Children's Zoo, was not as applicable to the Bug House. After identifying the needs of the keepers, a structure was developed that would help ensure everyone was on the same track. This structure

relied heavily on visual aids, such as easy to reference charts and labels as well as photographic 'How To' guides, each of which are detailed in the following sections.

Bug Exhibit Cards

In all other sections of our Children's Zoo, making sure each and every animal is accounted for is the first thing that's done each day. For keepers used to laying eyes on all their charges, it took some restraint not to go digging through the mulch for a buried beetle or trying to count every single stick insect on a cup full of browse. One of the first priorities in organizing our collection was developing a way to inform keepers of how many invertebrates and of what type, were contained in each enclosure.

After gathering information from multiple keepers, I developed a format for a 'Bug Exhibit Card' that could be laminated and placed on each enclosure. The purpose of the card was to both display the most important information about the species within and provide an easily changeable format to keep track of the ever changing populations. The template for these exhibit cards, the venomous exhibit warning card and an example of a completed card are shown in the following figure:

Figure 1

Common name (Common name in TRACKS if different from above) ***(Scientific name)***	
Group #	
Current Population:	blank to write in population
Caution:	Warnings (venomous, can fly, can bite, can pinch etc)
Misting:	Necessary misting amount for this species (Daily, As needed or Never)
Feeding Schedule: OR Browse last changed date: (depending on diet)	blank to write in feeding days (EOD, M/W/F, Group A, B or C etc)
Diet:	Classification- (Browse Eater, Carnivore or Herbivore)
Breeding notes (ON or OFF exhibit):	Whether they breed ON or OFF exhibit; special care of juveniles (remove from exhibit, leave on exhibit etc)
Substrate OR Water change done:	Blank to write in date of change

CAUTION!!

VENOMOUS!!

DO NOT open this enclosure unless properly trained!

New Guinea stick insect ***(Eurycantha calcarata)***	
G29587	
Current Population:	
Caution:	Males in particular have sharp spines, can poke you!
Misting:	
Diet:	Browse eater; Feed out: Red-tip, viburnum
Breeding notes (ON or OFF exhibit):	ON; move juveniles to nursery tank when found
Browse changed on:	*Check for adults & juveniles before discarding!

Our institution uses the 'TRACKS' database for recordkeeping and each individual animal is assigned a number. For invertebrates, most species were assigned a group number and all individuals of that species would share this number. Some exceptions to this rule were long-lived species, such as tarantulas, which warranted individual identification numbers. The individual number, or group number, was prominently displayed on the exhibit card, along with both the common and scientific names for keepers to easily reference.

The cards were laminated and affixed with Velcro tape to the different enclosures to facilitate easy removal and ensure that they could be swapped to reflect the current occupant of the enclosure. Static information was typed onto each individual card and included: frequency of misting required for that species, anything to be cautious of when caring for the species and their feeding classification (herbivore, carnivore or browse eater). The preferred diets for the browse eaters were also typed onto the card.

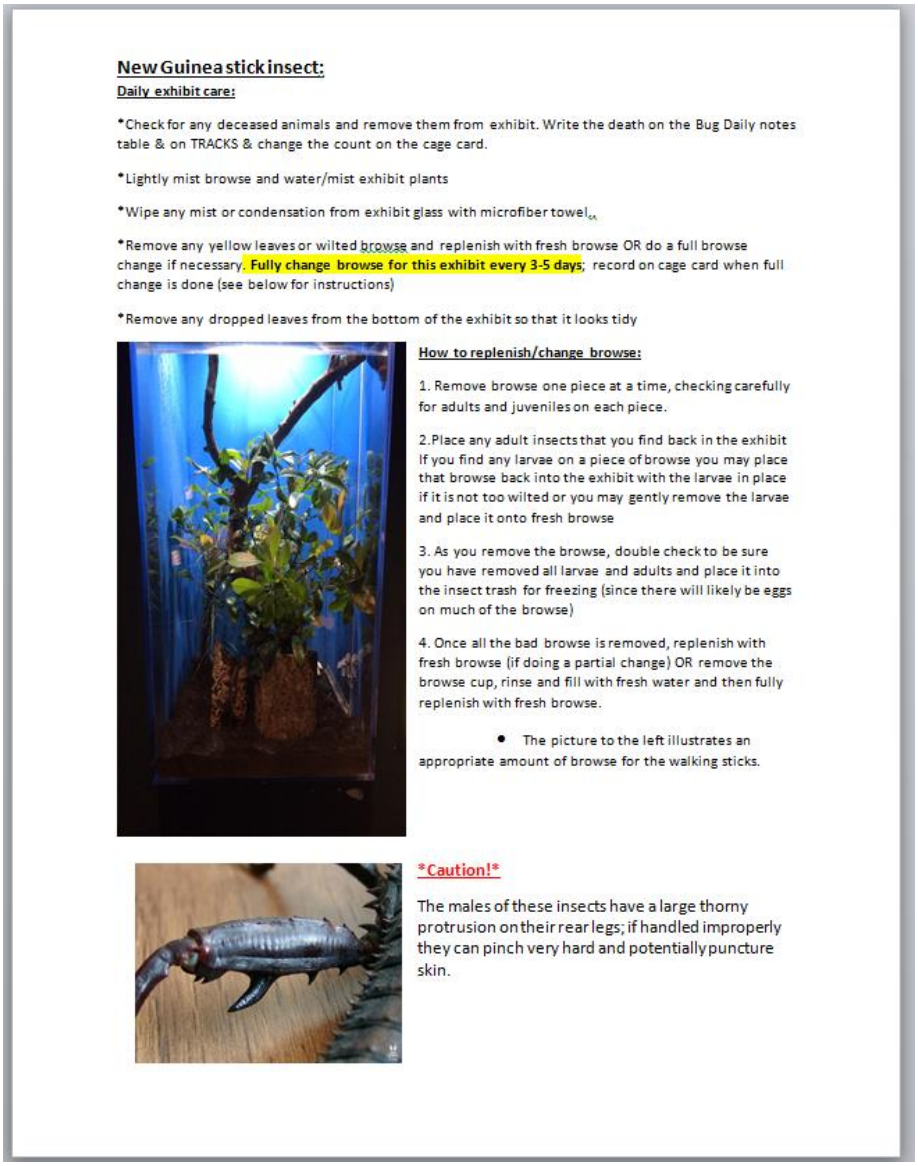
Wet erase markers were used for the keepers to write in values that frequently changed, such as, population, enclosure number, feeding day and feeding group. Keepers also recorded the date of the last substrate and/or browse change using the wet erase markers. An additional laminated warning card was printed and placed onto any enclosure housing venomous invertebrates clearly stating that the enclosure should only be serviced by keepers trained in their care.

By utilizing these cards, keepers knew what to expect when checking each enclosure and had a rough idea of what was required for the inhabitants' care. Time constraints still did not allow for a full count of each enclosure daily, so guidelines were made that balanced the zoo's desire for accuracy and the keepers' work load. In enclosures containing ten or less invertebrates, an effort was made to count them during servicing of the enclosure. If an exhibit contained less than five invertebrates, it was required to count each invertebrate when servicing the enclosure. For exhibits with multiple browse eating insects, a general census count was performed and recorded at each browse change. Finally, for exhibits with self-sustaining colonies, such as hissing cockroaches or assassin bugs, a census count was performed whenever a deep clean of the exhibit was done.

Photographic 'How To' Guide & 'Diets at a Glance' chart

While the exhibit cards fulfilled the need for an easy to understand overview of each enclosure, it was helpful for new keepers to have more detailed information available. I created a 'How To' guide that listed each individual enclosure, detailing exactly what steps needed to be taken to service the exhibit each day. I tried to make sure any information that had seemed confusing to me when learning the area was clarified in the guide and used photographs whenever possible to make it less tedious to read.

Figure 2- Screenshot from 'How To' guide



New Guinea stick insect:

Daily exhibit care:

*Check for any deceased animals and remove them from exhibit. Write the death on the Bug Daily notes table & on TRACKS & change the count on the cage card.

*Lightly mist browse and water/mist exhibit plants

*Wipe any mist or condensation from exhibit glass with microfiber towel.

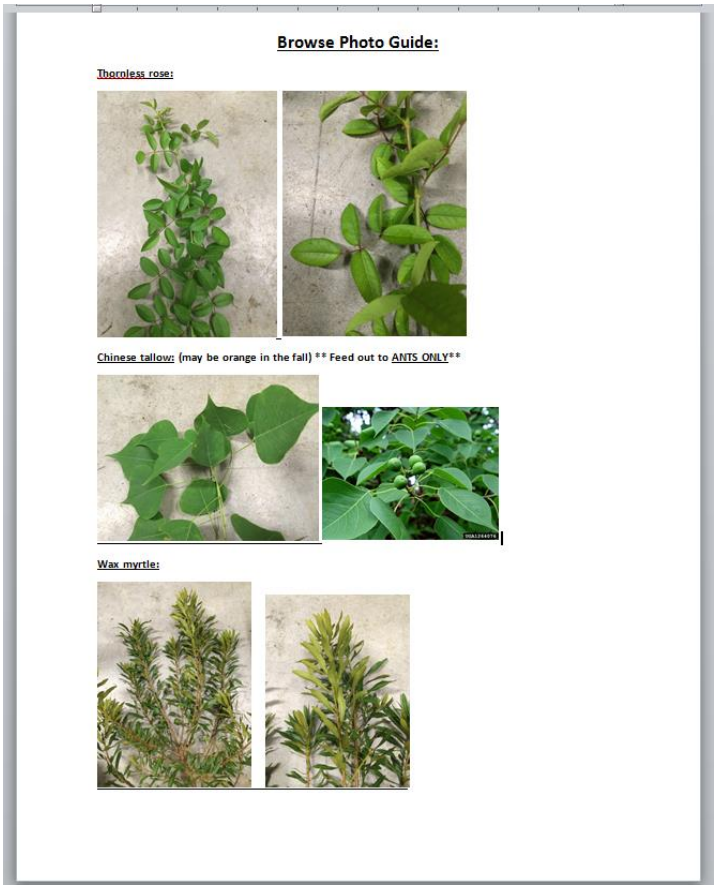
*Remove any yellow leaves or wilted browse and replenish with fresh browse OR do a full browse change if necessary. **Fully change browse for this exhibit every 3-5 days**; record on cage card when full change is done (see below for instructions)

*Remove any dropped leaves from the bottom of the exhibit so that it looks tidy

Although it was easy to reference the guide for each individual enclosure, it was difficult to keep up with the constantly changing occupancy of each enclosure. I was frequently updating and reprinting pages and as the other keepers became more confident in their routines, the guide was utilized less and less. Certain sections of the photo guide, such as the browse photo guide, were used more than others. For browse eating insects a full browse change was done a certain number of times per week depending on the species and number of individuals in the enclosure. The 'How To' Guide provided information on how many times per week, each enclosure should be changed. However, keepers generally selected which browse changes needed to be done by looking at the 'last done' date on the exhibit cards rather than sorting through the notes to see how many times per week the changes had been done. Each keeper was held to the standard of performing two browse changes per day and would perform up to four on days with lighter

workloads. The exhibit cards were utilized for communicating when a browse change was last done.

Figure 3- Screenshot of browse photos from the 'How To' guide



Overall, even though I took great care to make sure the guide was well put together it turned out to be a less practical application than the exhibit cards and proved more useful for new keepers to read than for communicating changing information to current keepers. A simple Excel chart labeled 'Diets at a glance' was created which summarized the diets of all the invertebrates in the Bug House. When used in conjunction with the exhibit cards, this seemed to be the preferred method for keepers to answer any questions they had during their daily routines.

Figure 4- 'Diets at a glance' chart

Off Exhibit:

Aquatics:

Arizona giant water bugs (ADULT): 1 med/lg cricket (frozen) each

Arizona giant water bugs (JUVENILE): 1 sm/med cricket (frozen) each

Sunburst diving beetles (LARVAE): fruit flies or mosquito larvae

Carnivores:

Asian Forest scorpions (Group B): 1-2 med/lg crickets each

Assassin bug JUVENILES: 10-15 sm/med crickets for whole tank

Black and yellow garden spider: 1-2 sm crickets each

Common burying beetle: 2 mealworms or waxworms each

Desert blonde tarantula: 1-2 sm crickets each

Giant desert centipede (Group C): 1-2 med/lg OR 1-2 sm/med crickets each

Green lynx spiders (Group B): 1 sm/med cricket each

JUVENILE Green lynx spiders (Group B): 1 -2 fruit flies each

JUVENILE mantids: 1-2 sm/med crickets or 1-3 fruit flies each

Mombassa golden starburst tarantula (Group A): 1-2 sm/med crickets

Salmon pink birdeater tarantula (Group C): 1-2 small crickets

Trinidad chevron tarantula (Group A): 1-2 med/lg crickets

Venezuelan suntiger tarantula (Group C): 1-2 sm/med crickets

Vinegaroons (Group B): 1-2 sm/med crickets each

Browse eaters:

Australian prickly stick JUVENILES: Rose, red-tip (very young, tender shoots)

Leaf insects JUVENILES: Red-tip; rose and/or blackberry

Jumping sticks JUVENILES: Red-tip, rose and/or blackberry

Jungle nymph JUVENILES: Red-tip, rose and/or blackberry

Malay stick insects: Red-tip

New Guinea stick insects: Red-tip; rose and/or blackberry

Peruvian fire walkingstick JUVENILES: Sword fern only

Phasmid JUVENILES: Red-tip; rose and/or blackberry

Two-striped walkingsticks: Red-tip; rose and/or blackberry

Herbivores:

African millipedes: greens, cucumber, fruit mix, oyster shell

Atlas beetles: banana slices, beetle jelly

Black stag beetles: banana slices, beetle jelly

Domino roaches (JUVENILES): greens, fruit mix, fish flakes

Eastern lubbers JUVENILES: greens, fruit mix, grapes, corn

Elephant beetles: banana slices, beetle jelly

Giant flower beetles: banana slices, beetle jelly

Grant's hercules beetles: banana slices, beetle jelly

Harlequin flower beetles: 1/3 banana, halved

Hissing cockroaches: greens, fruit mix, fish flakes, some produce chunks

Siamese rhinoceros beetles: banana slices, beetle jelly

Unicorn beetles: banana slices, beetle jelly

Western hercules beetles: banana slices, beetle jelly

LARVAE BUCKETS & EGG CONTAINERS:

Atlas larvae: no feeding necessary; mist if no condensation present

Australian prickly stick eggs: no feeding necessary; mist if no condensation present

Darkling beetle larvae : 2 small, THIN slices of apple

Elephant larvae: no feeding necessary; mist if no condensation present

Eudicella sp larvae : 1/4 apple, sliced

Harlequin flower beetle larvae: 1/4 apple sliced

Goliath larvae: no feeding necessary; mist if no condensation present

Hercules larvae: no feeding necessary; mist if no condensation present

Jungle nymph eggs: no feeding necessary; mist i

Rainbow stag larvae: no feeding necessary; mist if no condensation present

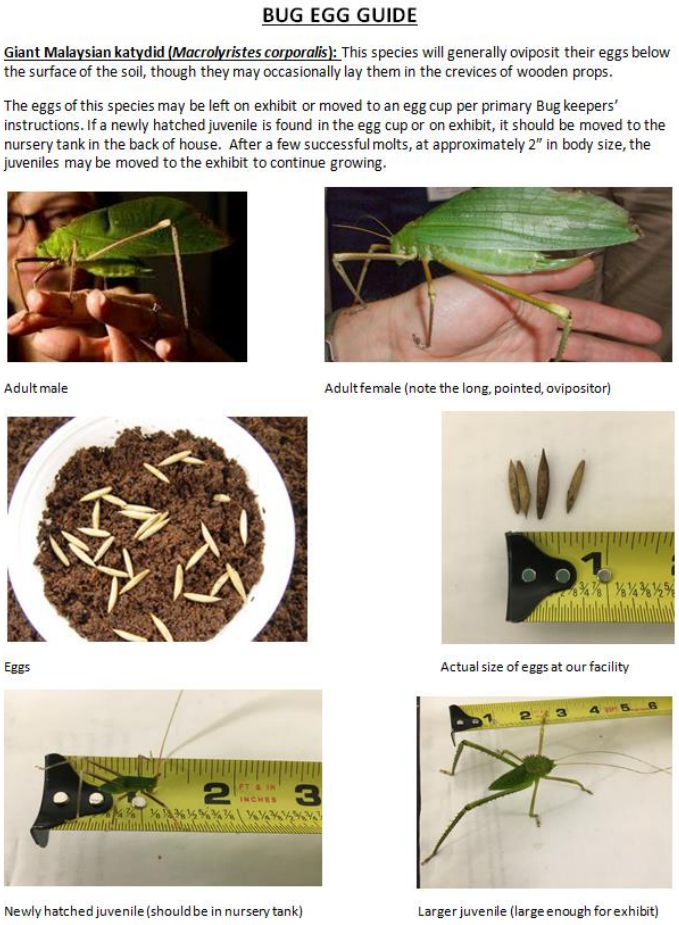
Key
Carnivore
Herbivore
Browse Eater
Nectar Eater

Bug Egg Guide

Another visual aid that seemed to be utilized more than the exhibit guide was the 'Bug Egg Guide.' While keepers with lots of invertebrate experience had no trouble distinguishing eggs from frass, keepers new to invertebrates did not find it so simple. In order to ensure that valuable eggs were not getting tossed during daily exhibit husbandry, I photographed the eggs of the majority of our browse eating species. Any species that were successfully hatched at our facility were also photographed alongside a ruler, so that keepers could easily differentiate a newly hatched juvenile from a pest that had come in with our browse delivery. Additional photographs were taken of larger juveniles alongside a ruler and guidelines were given as to what size juveniles needed to be kept in the nursery and when they could be placed onto exhibit. In addition, photographs of the adults were also included in the guide, along with information about whether the species deposited its eggs on the surface or oviposited in the ground or props.

This chart was particularly useful when tasking a volunteer or intern with sorting through substrate for eggs. Searching through pounds of substrate for objects mere millimeters wide can be very tedious. It was helpful to have a set of extra hands and most of the 'helpers' agreed that the photos were useful in definitively identifying the eggs they sought.

Figure 5- Excerpt from 'Bug Egg Guide'



BUG EGG GUIDE

Giant Malaysian katydid (*Macrolyristes corporalis*): This species will generally oviposit their eggs below the surface of the soil, though they may occasionally lay them in the crevices of wooden props.

The eggs of this species may be left on exhibit or moved to an egg cup per primary Bug keepers' instructions. If a newly hatched juvenile is found in the egg cup or on exhibit, it should be moved to the nursery tank in the back of house. After a few successful molts, at approximately 2" in body size, the juveniles may be moved to the exhibit to continue growing.

Adult male

Adult female (note the long, pointed, ovipositor)

Eggs

Actual size of eggs at our facility

Newly hatched juvenile (should be in nursery tank)

Larger juvenile (large enough for exhibit)

Conclusion

The biggest lesson I learned while organizing things in the Bug House was to limit textual information. The majority of keepers seemed to gain more from a short explanation paired with a photograph than they would from reading a paragraph of text. Compromise and flexibility played a huge role in organizing the area as well. Many of my first drafts, specifically of the exhibit cards, made more sense to me than to other keepers; asking for input and modifying documents accordingly proved to be very useful. While many of these guides are very specific to our collection, I hope that some of the ideas contained in this paper can be tailored by other institutions to fit their needs. If desired, a copy of any of the aforementioned guides may be requested by contacting azelmer@houstonzoo.org.