Appendix I

Isolated Amphibian Rooms at Omaha's Henry Doorly Zoo

An Example of Complying with the Quarantine and Husbandry Standards for Amphibians Designated for Reintroduction into the Wild

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INTRODUCTION

In February 2006, the IUCN Conservation Breeding Specialist Group (CBSG) and the World Association of Zoos and Aquariums (WAZA) hosted an Amphibian *Ex Situ* Conservation Planning Workshop in El Valle Panama. One of the many purposes of the meeting was to make recommendations for husbandry standards for amphibians that are part of reintroduction programs or captive collections that may be returned to the wild at some point in the future (Zippel et al., 2006). Many of the recommendations made involve upgrading current housing and quarantine standards practiced by many zoological, private, and academic institutions, and have been seen by some as impractical and extreme for zoos and aquariums. Armed with the lessons learned from the global spread of *Batrachochytrium dendrobatidis* (*Bd*; the amphibian chytrid fungus) and the potential for new pathogens to emerge, it would be prudent for institutions that are housing amphibian species designated for repatriation to review their basic husbandry practices and quarantine standards, attempting to comply with the new recommendations.

Omaha's Henry Doorly Zoo responded to this call-to-action and immediately established dedicated amphibian rooms within existing buildings on zoo grounds. The *Isolated Amphibian Rooms* (IARs) have become a working model for the application of the recommended standards in a zoo or aquarium setting. Each of the IARs holds one species or an assemblage of species from the same geographical area. The following list of images, prices, materials, and sources are provided to serve as an early example to others who might consider constructing their own IAR facilities for amphibians.[1]

1 Materials and sources cited are presented based on fabrication at Omaha's Henry Doorly Zoo, not as an endorsement. Contact the author for additional information about any of the products presented.

Figure 1. A typical non-compliant amphibian room.

AMPHIBIAN ROOMS

Not Biosecure Compliant

Most amphibian-holding rooms at zoos and aquariums are not in compliance with new bio-security recommendations. One example of a non-bio-secure amphibian room is one that houses animals from all over the world (Figure 1). Other problems may be that steps were not taken to prevent wastewater from spilling from tanks placed on higher shelves into tanks below, or a wastewater treatment process was not employed to prevent pathogens from exiting the facility and endangering local amphibian populations. Keeper error can never be completely ruled out, and unsecured lids may further increase pathogen spread between animals from different areas of the world.

Figure 2. An example of the Isolated Amphibian Room – size 8 x 8 x 8 ft (2.4 x 2.4 x 2.4 m)

Biosecure Compliant

Each IAR at Omaha's Henry Doorly Zoo holds just one species or one species assemblage from the same area. The IARs are versatile rooms constructed out of commercially available greenhouse materials with all construction completed by zookeepers (Figure 2). IARs at the zoo range from 8 x 4 x 8 ft (2.4 x 1.5 x 2.4 m) in size to 10 x 16 x 8 ft (3 x 4.9 x 2.4 m). The walls are made of 1.5 x 1.5 inch (3.8 x 3.8 cm) hollow-aluminum tubing overlaid with two-ply Lexan® sheeting. Individual walls are joined together with 1inch (2 cm) aluminum angle pieces (Figure 3). Commercially purchased stormdoors are used to access each room. All joints and cracks are sealed with 100% silicone to prevent water from leaking into common areas or into other isolation rooms. Seals are pressure-tested before installation of equipment and animals and visual inspections are ongoing to maintain biosecure levels. The stormdoor is placed at the lowest point and the one-inch threshold allows each room to hold at least 175 gallons (796 L) before overflowing into a common hallway with a drain.

List of items used for the construction of the room in Figure 1 above:

Cap[2]	18 @ 8 ft (2.4 m)
Splice[2]	3 @ 8 ft (2.4 m)
Lexan®[2]	6 @ 6 x 8 ft sheets (1.8 x 2.4 m)
Aluminum Tubing[3]	18 @ 8 ft [1.5 x 1.5 inch (3.8 x 3.8 cm); 1/8 inch (0.3 cm) thick]
Storm door	
Hardware	
Screws	
Washers	

Figure 3. Close-up of the 1inch (2 cm) aluminum angle pieces holding the 1.5 x 1.5 inch (3.8 x 3.8 cm) aluminum tubing and storm door.

2 www.stuppy.com
3 www.statesteel.com/omaha.htm

Figure 4. The portable heating/air condition unit and dedicated footwear placed in each room.

Portable heating/air condition units are used to control the ambient temperature in each room (Figure 4). Units can be purchased with different BTU ratings for different size rooms: 8 x 8 x 8 ft (2.4 x 2.4 x 2.4 m) rooms use 10,000 BTU units; the 10 x 16 x 8 ft (3 x 4.9 x 2.4 m) use 12,000 BTU units. Also visible in Figure 4 is the designated footwear for within this room. Footwear that is easy to disinfect is changed as the keeper crosses the room threshold.

List of items used in the room shown in Figure 4 above:

Heater/AC[4]	10,000 BTU units
Footwear	

Figure 5. Shelving with amphibian enclosures.

4 www.sunpentown.com/wa12poacwihe.html

Tubs used for amphibian enclosures are made from food-grade polycarbonate material to prevent the leaching of toxins sometimes found in plastic materials (Figure 5). Though glass fish-tanks may be a less expensive, the polycarbonate tubs are far more durable and versatile, making them suitable for housing terrestrial or aquatic species. Drilling each tub does not require a specialized drill bit nor do they crack or break as easily as glass. The volume of the tanks used ranges from 5 gallons to 16 gallons.

List of items used for the shelving within the room shown in Figure 5:

Shelving units[5]
Frog tanks[6]
Lids[7]

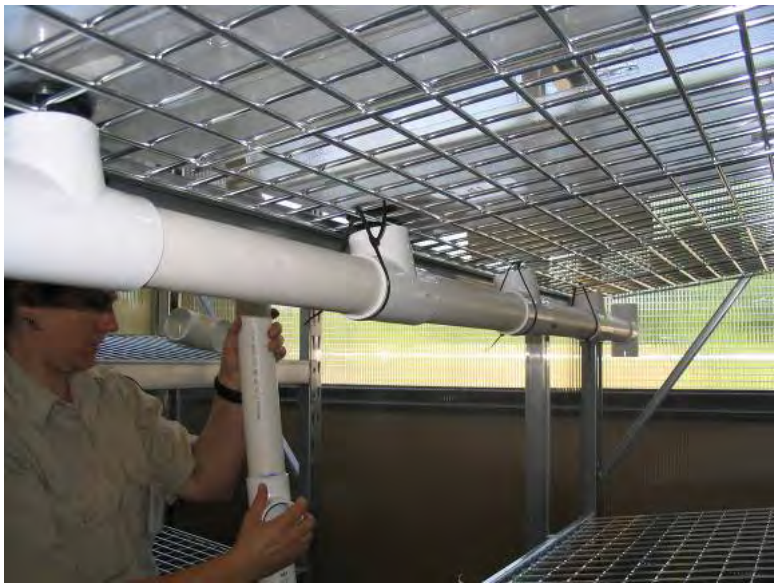

Figure 6. The over-sized drain system under each shelf being installed in the IAR.

The drain for each enclosure runs into a common drain system located under every shelf. Drain system lines are 2-inch (3 cm) diameter to allow for large volumes of water to pass through them without backing up into adjacent enclosures (Figure 6). The drain systems pipes all run into the wastewater collection tub (Figure 7).

5 www.samsclub.com/shopping/navigate.do?dest=5&item=203424&pCatg=7085 or from materials acquired at local hardware stores
6 www.rcpworksmarter.com/rcp/products/detail.jsp?rcpNum=3328
7 www.habitatsystemsltd.com, custom fabricated

Figure 7. IAR wastewater collection tub with sump pump below.

A sink combination is used to collect all wastewater from each isolation room and is created by stacking two inexpensive utility sinks together (Figure 7). The bottom tub (without legs) is set directly on the floor un-drilled. The second sink (with legs) is set within the tub below, and plumbed to drain into the lower tub without splashing. A sump pump with an automatic on/off switch is set within the lower tub to pump wastewater to the Central Treatment Station (Figure 8). The upper tub can be plumbed for use as a working sink if desired, or else dedicated hose-lines can be run into each room and provide filtered source-water.

List of items used for the wastewater collection tub in Figures 6 and 7 above:

- Two utility sinks
- Sump pump[8]
- PVC pipes, T's, and elbows
- Plumbing

8 www.flotecpump.com/pdf/Page_06_2004.pdf

Figure 8. The building's water storage and central treatment station.

All water is treated coming into and out of the IAR facility at the Central Treatment Station. A large water container is used to hold reconstituted reverse-osmosis (RO) water that can be pumped to each room as needed (right side of Figure 8; See Chapter 1 for additional information on reconstituted RO water). Two barrels are used to collect all wastewater (center of Figure 8), which is then treated with household bleach for 12 hours before being released into the city sewer system. See Chapter 3 for more information on wastewater treatment.

List of items used for influent and effluent water treatment within the room shown in Figure 8 above:

RO water storage vessel	300 gallons (1135 L)
RO filter system	
RO reconstitution feeder	
Wastewater treatment barrel	2 @ 55 gallon (208 L)
Bleach feeder system	
PVC piping	
Plumbing	
Water quality test kits	

Figure 9. Lighting accommodated into the racks.

Lighting on every rack system is provided in two forms: compact florescent lights above each shelf to provide ultraviolet light and small heat lamps on each enclosure to provide basking sites for species requiring higher temperatures (Figure 9).

List of items used for lighting in the room shown in Figure 9 above:

Lighting fixtures[9]
Bulbs[10]

Summary Budget for an 8 x 8 x 8 ft (2.4 x 2.4 x 2.4 m) IAR:

Room materials	1,100 USD
Shelving	270 USD
Heater/AC	700 USD
Frog tanks	145 USD each x 18 = 2,610 USD
Lighting	210 USD each x 9 = 1,890 USD
Plumbing	450 USD
Electrical/duct work	200 USD
TOTAL for one room	7,220 USD

CONCLUSION

The Johannesburg Zoo of South Africa has used similar technologies and practices to develop isolated amphibian rooms in their efforts to meet international biosecurity standards at their Amphibian Conservation Center. At the Johannesburg Zoo, an existing building on zoo grounds was modified to house several endangered species intended for a release program. The methods described above appear to be working very well for them, demonstrating the transferability of Omaha's Henry Doorly Zoo's techniques not only to other AZA-accredited zoos and aquariums, but to international facilities as well.

This chapter demonstrates that with a little imagination, institutions are able to follow the biosecurity recommendations handed down from the CBSG/WAZA Amphibian *Ex Situ* Conservation Planning Workshop with a relatively low investment of space and financial

9 www.drsfostersmith.com/Product/Prod_Display.cfm?pcatid=3773&N=2004+113345
10 www.esuweb.com/cardfile.asp?ItemNumber=55112&IDProductRelationship=281

resources. Hopefully, this will motivate others to consider constructing their own IAR and attempt to save at least one species or one assemblage of amphibians.

REFERENCE

Zippel, K., R. Lacey, O. Byers (eds.) 2006. CBSG/WAZA Amphibian *Ex Situ* Conservation Planning Workshop Final Report. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN 55124, USA. Pp. 65.