

## Compliance Criteria Evaluation

Each criterion is listed in bold followed by the compiled summary of the team's findings relative to that item. The team found that the CRC had substantially met all the criteria. This report was drafted by B. Douglas, S. Hoskin, J. Siegel, and C. Stihler.

### **1. Project Plan is coordinated and approved by WVFO and relevant state wildlife agency (WVDNR).**

The project plan/proposal was submitted to the USFWS in response to the request for White-nose Syndrome Research posted on grants.gov on June 19, 2009 (Funding Opportunity FWS-R5-ES-09-011). The plan was reviewed and evaluated by a team of USFWS biologists prior to receiving approval for funding. The CRC coordinated with the USFWS West Virginia Field Office and the WVDNR prior to submitting the official proposal. These offices gave final approval of the plan prior to proceeding. The Virginia Department of Game and Inland Fisheries (VDGIF) was also involved to a lesser extent.

### **2. Project Plan is developed that includes the following required items (p 10):**

- **Qualification of team members**
- **Project specific goals/objectives Description of facility to be used/proposed methodology**
- **Explanation of how source populations will be obtained**
- **Description of quarantine measures that will be used**
- **Budget**
- **Description of required permits and how/when they will be obtained**

The Project Plan contains all the required elements. The qualifications of key team members are provided in on page 24-36 of the proposal and all appear to be well qualified. Their objectives are provided on page 3 and the goals are provided on page 14 -15 of the proposal. Source populations and permits are described on page 6. Quarantine procedures are described on pages 4-6. A budget is provided on page 9.

### **3. State and federal permits are secured.**

The CRC obtained all required state and federal permits including those from the USFWS, the VDGIF, and the U.S. Department of Agriculture. They also obtained approval from the National Zoological Park's Institutional Animal Care and Use Committee. WVDNR also obtained a USFWS permit to capture the bats and transport them across the state line into Virginia.

**4. Routine communication and open sharing of information with partners occurs. (Partners are defined to include the USFWS, State wildlife agencies, and others engaged in WNS research.)**

The CRC sent project updates to the WVFO and WVDNR on an almost daily basis. Staff from WVFO and WVDNR attended two prior site visits and meet with CRC staff at those times. VDGIF was invited to these site visits but was not able to attend. Representatives from Bat Conservation International and Bat World NOVA were present during the initial site visit. At least 3 conference calls were held with WVDNR and USFWS staff (WVFO and Regional Office) from November 2009 – March 2010. CRC staff also attended a Symposium on Conservation and Management of Big-eared Bats in the Eastern United States that was hosted by the Southeastern Bat Diversity Network and openly discussed the status of the project with attendees.

**5. Annual report and/or quarterly reports are prepared and submitted.**

The first quarterly report was submitted to the USFWS and WVDNR on schedule (December, 2009). The second quarterly report is due the end of March 2010. Annual reports are not yet due.

**6. Individual bats are marked so they can be identified.**

Immediately after capture and prior to transporting the bats to the CRC, the bats were weighed, measured, and non-toxic acrylic paint of different colors was used to mark either the left or right ear of the bats. This technique was based on the recommendation of Bat World Sanctuary and Singleton Consultants. Additional paint was applied as it wore off every few days. CRC staff did notice that some bats appeared bothered by the paint and in at least one case a bat was found with its ear folded in on itself due to the stickiness of the paint. This bat had trouble flying and was disoriented. Bats were later marked with very small (8.5mm x 2.01mm; 0.067 gram) passive integrated transponder (PIT) tags inserted dorsally between the shoulder blades. This was only done if the health of the individual bat appeared stable and tagging was not considered a risk. The bats did not exhibit any problems associated with their PIT tags, and site wounds generally healed nicely. However, a few tags have fallen out of the bats.

**7. Site-specific quarantine procedures are established.**

Site-specific quarantine procedures are outlined in the Department of Animal Health Standard Operating Procedures for Veterinary Management of Virginia Big Eared Bats (*Corynorhinus townsendii virginianus*) in captivity at the Smithsonian National Zoo's Conservation and Research Center. Bats are within a double-walled mesh enclosure in a building. The area where the bats are held is separated from other areas of the building by a door. Before going into and out of the area people were required to dip their shoe soles into an antibiotic footbath. Individuals entering the actual bat enclosure must also first pass through a double-doored and latched vestibule. Everyone working inside the bat enclosure was required to suit up in coveralls, disposable latex gloves, rubber boots

and disposable surgical masks. These items are available upon entering the vestibule and do not leave the facility. Bats are treated for medical conditions within the facility and not transported to other buildings.

- 8. Bats are held at a facility where they are not in contact with other wild bats or other species being held at the facility that could be vectors of disease.**

The bats are housed in an indoor double-walled mesh enclosure and do not come in contact with other wild bats. No other species (with the exception of the meal worms and other insects raised as food for the bats) are held within the same area as the bats. See additional description provided under item 7

- 9. Quarantine and decontamination procedures are established for people entering facility.**

See description provided under items 7 and 8.

- 10. Bats are only handled by individuals that have appropriate rabies vaccines.**

Everyone who handles the bats not only has had rabies vaccine, but also has had their titers checked to ensure they were at acceptable levels for handling potentially rabid animals. This procedure is further outlined in the Department of Animal Health Standard Operating Procedures for Veterinary Management of Virginia Big Eared Bats (*Corynorhinus townsendii virginianus*) in captivity at the Smithsonian National Zoo's Conservation and Research Center. Records of staff's vaccinations and titers are held at the CRC.

- 11. Bats are held at temperatures that minimize growth of *G. destructans* and/or are screened for the presence of the fungus.**

Bats were maintained at room temperatures consistent with an active colony (as opposed to hibernation temperatures which favor the growth of *G. destructans*). Since the bats have been in the enclosure the ambient temperature has been relatively consistent and averages 74°F. The minimum and maximum recorded temperatures are 67.1 and 81.0°F. These temperatures are not conducive to the growth of *G. destructans*. In addition, all bats that died were tested for the fungus and none were positive. Records of the temperature of the enclosure are maintained on their daily logs and at their centralized maintenance facility in Washington D.C. However, the temperature and humidity inside the bat enclosure, while minimizing the growth of *G. destructans*, appears to encourage the growth of black mold on the facility walls which may pose a potential concern for the health of humans working in the enclosure or contribute to the development of yeast infections/health effects on the bats themselves.

- 12. Preliminary husbandry guidelines are initially followed with adaptations made as needed (see Appendix B page 21 of the Plan).**

- **Temperature maintained at 68-90<sup>0</sup> F; gradient of temps provided.**
- **Humidity minimum of 60%.**
- **Netting with mesh size of ¼” or less used.**
- **Flight cages are provided with adequate space (see examples).**
- **Hard or metal surfaces that bats may come in contact with are covered.**
- **Multiple sizes of mealworms and types of food are available/presented to the bats.**
- **Food and water are available at all times.**
- **Aggressive interactions are tracked.**

The bats are being held under conditions that appear to be suitable for their general well-being. Modifications to protocols were made, as allowed in the Captive Propagation Plan, based on the response of the bats to techniques used. Examples are provided below.

The enclosure was kept warm and humid. Temperatures are maintained within the proper limits (see item 18 above). Temperatures between the floor and ceiling of the enclosure vary up to 5<sup>0</sup>, providing a gradient of temperatures for the bats. Humidifiers are used to increase humidity. Current humidity setting is 53%. This adjustment to a slightly lower level was made after higher humidity levels in the building resulted in the growth of black mold on the ceiling. Netting size was initially ¼” which was within the range recommended for bat flight cages in the original husbandry guidelines. However, some problems with the digits and carpals may have been caused or aggravated by the mesh, and CRC has replaced much of the netting with a finer 1/6” mesh. While this has appeared to reduce the occurrence of injury, some abrasions are still occurring, potentially due to the bats crawling to feed rather than flying. Attempts have been made to provide food in a manner that would reduce this occurrence, such as providing small suspended feed cups.

Flight cages are 35’ x 30’ which is larger than the examples provided in the draft husbandry guidelines. The enclosure size appeared adequate for bats to feed and drink on the wing and the space had a variety of roosting, feeding and watering options available to the animals. Enrichment objects were provided in the cages (artificial trees, roost structures, etc.) that provided structure and objects for bats to fly around. On a previous visit, bats were observed flying and drinking from the water trough while on the wing. Hard surfaces around doorways, etc. are covered and padding has been placed under the enclosed roosting structures. Bats were initially separated by sex in two flight enclosures, as recommended in the Plan. However, the two enclosures were later used to separate bats based on ability to self-feed, thus reducing the amount of disturbance and handling that self-feeding bats received. This also allowed for easier identification and care of bats needing more individual attention. Currently the divider between the two areas has been removed allowing all bats to mix in a larger area.

Food and water are available at multiple locations in the enclosure at all times, but the bats feed primarily during the night period. A variety of insect foods were presented to the bats, including live mealworms, crickets and moths. The bats are provided meal worms of various sizes (including giant and regular) and were given the ability to select

the size mealworm that they preferred. Mealworms are raised on site and are gut-loaded to ensure they meet the bats' nutritional requirements. The label of the food used to gut-load the mealworms and crickets was provided to the review team. Mealworms are placed in a rotational system so that they have been gut-loaded for multiple days before they are fed to the bats and should thus be nutritionally complete. Fresh mealworms are provided on a daily basis and live, uneaten worms are returned to the rotational gut-loading stations. Other foods have also been offered, including silk moths, silk moth caterpillars, crickets, and wax worms. Meal worms were the food preferred by most bats (one individual preferred wax worms). Animals that did not initially accept adequate amounts of live food were presented with prepared mealworm viscera, insectivore chow softened in water or a semi-liquid diet of blended mealworms. The recipe for making the blended mealworms and the label from the insectivore chow was provided to the review team. All bats are currently self-feeding on live mealworms.

Aggressive interactions have been tracked, but have not been numerous while in the larger enclosure, CRC staff did note some aggressive behavior when groups of bats were placed in the soft sided crates. One bat was noted to be a little more aggressive than others, so this bat was never placed in a small cage with other bats and was isolated from other bats during handling to try to avoid bat-to-bat bite injuries, which were occasionally observed.

Additional site-specific details and guidance on husbandry protocols used are contained in the Virginia Big-eared Bat Mammal Unit Protocol for Animal Building 1 (South Wing) 254 Conservation Drive Original Dated October 11, 2009.

**13. Stress to bats is reduced by only allowing a small group of primary caretakers to handle the bats. All individuals handling the bats are instructed/trained on proper procedures.**

Proper methods to handle the bats are outlined in the Mammal Unit Protocol. In general, a small group of caretakers tended the bats. Initially there were three primary caretakers (in addition to the consultant) and later a fourth was added. Nucharin Songsasen also assisted when needed. The initial caretakers trained the newer caretakers. All caretakers have multiple years of experience handling small animals such as birds and mammals and/or have a background as a veterinary technician. Two of the initial caretakers attended a training workshop at Bat World Sanctuary where they learned the proper ways to care for bats, and each handled numerous bats while there. The third caretaker volunteered with Bat World NOVA where she learned to care for bats. For the first two weeks after the bats arrived, a consultant recommended by Bat World Sanctuary was hired to assist with the care of the bats and to advise the "bat team." She was also there a week before the bats arrived to help prepare for their arrival.

A small number of people usually took care of the bats (initially the three primary caretakers, the consultant and a veterinarian). Because there were 40 bats to feed and few bats learned to feed themselves within the first few weeks, feeding took a fair amount of time. If fewer people had tended the bats, the time people were in the cage tending them

would have been greater, which potentially would have caused the bats greater stress. Although initially the bats were gathered and placed in a holding cage then fed and then released one at a time, the feeding process was later modified so that only a few bats were captured at a time, fed, and released. This reduced the number and amount of times each bat was handled.

Currently, since the bat population has reduced, three people are in the enclosure at one time, two people to feed the bats and clean the enclosure, and one veterinarian. During the site visit, animals were gently handled for feeding and medical procedures in an attempt to minimize stress. However, the bats' general difficulty in learning to free-feed, their frequent crawling on substrates, and subsequent generally poor health condition meant the bats needed to be handled twice a day to receive rehydration fluid injections and other medical care. While these procedures are necessary for their continued survival, they may also be inherently stressful to the animals.

**14. Bats are provided with secure roosting structure(s) that mimic natural situations.**

The bats were provided a number of different roosting structures including "artificial caves" that attempted to mimic natural roosts, although it was not possible to simulate a roost as large as an actual cave and the roosts were not as completely dark as a cave would be. The roosts were enclosed structures topped with a half plastic barrel. The inside (convex) surface of the barrel was covered with various substrates that strived to mimic different textures found in a cave environment (e.g. coated with sand, gravel, etc.). Other roosts of mesh and cloth were also provided. Although the bats were provided structures that simulated small caves, most bats did not use these roosts. For reasons unknown, they preferred to roost using the mesh ceiling netting often in locations that were quite exposed.

**15. Roosting areas are separated from flight areas (people entering flight areas do not disturb roosting bats).**

Each flight cage was provided with several separate potential roost areas within the enclosure. The artificial cave roosts provided the greatest isolation of the bats from the flight area. However, these were not used to any great extent. During the site visit approximately half of the bats were using segregated areas and the rest were roosting in the open (flight) section of the enclosure. People entering the enclosure did not appear to disturb the roosting bats.

**16. Procedures are developed and implemented to minimize disturbance while cleaning, feeding, etc.**

Efforts were made to minimize disturbance while cleaning the facility and feeding the bats. Because the bats chose not to use the "cave" roosts, most were not completely isolated from activities in the flight cage. Cleaning was conducted during the feeding visits so that the bats were not disturbed by two separate visits – one to feed and one to clean. Lights and noise were kept low. The enclosures appeared clean and there were no

offensive odors from feces, urine or food. The enclosures were cleaned with water and mild soap with little disturbance to the animals. Strong cleaners that might create noxious fumes were not used.

**17. A feeding regime is developed that provides opportunity to retain some natural feeding behaviors/prey items.**

Several techniques were used to try to introduce some naturalistic feeding scenarios into the feeding routine. Although the bats did not seem to take advantage of these opportunities, the staff made attempts to provide these feeding options. Crickets were allowed to crawl about on artificial plants where the bats had an opportunity to glean them. Efforts were made to get meal worms, crickets, etc. to crawl up suspended strings where, again, they could be gleaned. Feeding trays were located at several places in the flight cages and at various heights. The feeding of moths and crickets as well as meal worms and wax worms was attempted. Initial attempts to provide moths were delayed because the permitting process was cumbersome and live moths are generally not available through vendors. The CRC staff raised some moths and provided them to the bats, but the bats did not appear to prefer the moths to the other available food items. The moths were also difficult to contain in the enclosure. During the site visit, crickets were seen in the foliage inside the enclosure. The bats that are at the facility are currently all self-feeding on mealworms. All required some hand-feeding prior to developing the ability to free-feed. Animals were encouraged to eat by placing them inside a dish of live mealworms, or confining them in a smaller enclosure that contained dishes of mealworms. This approach worked for a majority of the animals.

**18. The bats' health is monitored and they are provided with necessary veterinary care.**

The bats' health was monitored closely and any required veterinary care administered up to twice daily. Care was provided when needed, and the care was based on the results of bat health inspections, the experience of the staff veterinarian, reviews of the literature, and consultation with others. Treatments seem to have been well thought out and included grooming, cleaning wounds, applying an anti-fungal/anti-bacterial/anti-inflammatory ointment, sub-dermal and oral antibiotics, and surgical procedures when necessary. Detailed records are at CRC, and during the site visit the compliance team was able to review the records. A separate review is being conducted between the Service and CRC veterinarians.

**19. Procedures for cleaning/disinfecting feeding and watering materials are developed and implemented.**

Procedures for cleaning/disinfecting feeding and watering materials are outlined in the project plan and in the Mammal Unit Protocol. Cleaning of the enclosure occurred daily. Feeding and watering apparatus were frequently changed and washed. The procedure for cleaning feeding and watering materials was adequate and minimized disturbance to the bats. Harsh chemicals that could have been irritating to the bats were avoided or used minimally. On this visit and previous visits to the facility, the cages were clean, feeding

trays were clean and full of fresh food, and water troughs appeared clean. Caretakers wore gloves when feeding the bats, and gloves were changed between bats, or even during the feeding of a particular bat if they became dirty.

**20. Detailed records on bats and activities conducted are maintained.**

A file for each individual bat has been established. Very detailed daily records are maintained for each bat noting feeding behaviors (number and size of each type of food taken, name of care taker, observations of self-feeding), weights, medical conditions, interactions with other bats, general condition, and treatments provided. These activity logs appeared to be detailed and complete. Body temperatures of individual roosting bats were routinely measured using a temperature gun. Information on environmental conditions was also compiled. Two examples of individual bat records, a table of compiled bat weights over time, and a table and graph of roosting bat temperatures were provided to the review team.

**21. Procedures for the disposition of animals are established.**

A necropsy and complete pathology analysis was conducted on all bats that perished. The necropsy generally utilized the entire carcass. Any remains were preserved in formalin and are held at CRC labs. Detailed records and reports are at the CRC and during the site visit the compliance team was able to review the records and discussed the findings in detail. The MOU between USFWS and WVDNR establishes procedures for necropsy and the disposition of any tissue specimens or remaining parts of dead bats that were not needed for postmortem diagnostics. The MOU also outlines disposition procedures for any live captive-held or raised bats.

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Note: The following items were also identified as requirements of the Plan. However, for this project, these items were not the responsibility of the CRC because the USFWS and WVDNR were responsible for coordinating the collection and transfer of the bats. As a result, it was not pertinent to review compliance with these criteria in the context of the status of CRC's permit.

**1. Collection plan is approved by WVFO/WVDNR prior to proceeding.**

**2. Collection plans addressed the following items:**

- Genetic diversity of founders
- Rationale for collection site
- # of bats of each sex to be collected
- plans to minimized disturbance to bats
- appropriately trained personnel
- decontamination procedures

**3. Initial collection did not exceed 40 to 50 bats.**



4. When possible, bats are collected from sites with no signs of WNS.
5. Collectors used up-to-date decontamination guidelines.
6. Bats are transported in a manner that minimizes stress (e.g. in soft-sided cages, kept in dark environment, moved to facility in timely manner).
7. Basic information is collected at time of capture (body mass, forearm length, etc).

## Reviewer Notes on the VBEB Project

### Summary:

All reviewers left with a favorable impression of the efforts that CRC staff expended to care for the bats and found nothing to indicate that they had acted in an unprofessional or inhumane manner. The project was, and continues to be, very challenging. Previously unconsidered stressors such as ambient noise within the audible range of VBEB were identified and CRC staff have initiated efforts to evaluate these factors.

### Reviewer #1:

My overall impression of the care that the bats' received at the Smithsonian facility was very favorable. Their enclosure was well built and roomy, appearing to be adequate for the task of supporting 40 bats or more. Food, water and roosting substrates also appeared adequate for the bats' survival. My only concern about their enclosure was the presence of a variety of ambient noises from generators, ventilators, fluorescent lights and other electric apparatus. The ambient noise was considerable, and may be matched or exceeded by noise and vibration perceptible only to bats that might interfere with their ability to navigate their environment by echolocation.

The project staff, including supervisors, veterinarians, and animal technicians appeared to be conscientious about trying to provide for the health and welfare of the animals. Care and feeding of the bats took a great deal of time and effort, with the feeding alone taking up to 6 hours per day. The daily bat caretakers appeared to have gone beyond the call of duty to try to insure the well-being of their charges, often working long hours.

My chief concern about the husbandry of the bats is the apparently high level of stress they are experiencing both due to being handled twice daily to be weighed, fed, hydrated and medicated, and the substrate conditions of their captivity. These animals rarely self-feed or drink enough to maintain adequate weight and hydration. They are not flying to feed and water on the wing, instead are being placed in bowls of live food to eat. Instead of flying about, they are crawling on substrates they would not experience in the wild, including plastic mesh and cement flooring, abrading the skin on their limbs. The result is skin and limb infections, some requiring amputation of the thumb.

Subsequently, because they need to be handled twice per day for a variety of nutrition maintenance and medical reasons they are under a great deal of stress, which I believe has set up a declining health spiral where their overall poor physical condition is further undermined by lowered immunity to various types of infection caused by stress, resulting in further deterioration of their health and ultimately to their death.

Caretakers quickly recognize when individual bats are not thriving and attempt to remedy the situation in a variety of reasonable and logical ways ranging from changing substrates and feeding approaches to the way animals are medicated. Bat-care personnel appear open to suggestions to solve bat husbandry problems and to improve the prospects for the overall success of the project, despite frequent setbacks and unfavorable publicity. I am fairly convinced that no

other zoological facility could have done a better job under the unusual circumstances of trying to quickly establish a colony of endangered, insectivorous bats of a species new to captivity.

**Reviewer #2:**

The site visit lasted approximately six hours; the majority of the time was spent reviewing the medical files and having a detailed conversation regarding their course of action. Approximately 1-2 hours were spent at the enclosure, inspecting the conditions, the food sources, and observing the veterinarian and two handlers during their daily health inspection.

An underlying theme of my questions was determining if CRC consulted the outside rehabilitation/American Zoological Association (AZA) community. I found they made many attempts to consult with the bat rehabilitation community, staff members of Bat Conservation International, and members of the AZA. It seems CRC staff were sometimes given conflicting advice, advice that changed over time, opinions that did not come with supporting evidence why one particular option was better than the other, or a general lack of knowledge on husbandry for the Virginia big-eared bat.

I left the CRC with a favorable impression of the facility and the staff. I found the staff were open and anxious to discuss the history of the Virginia big-eared bat captive propagation effort, their handling and care of the bats, and their efforts to overcome issues as they arose. I did not sense any reluctance to discuss any of the topics that were brought up. They were professional when discussing particular allegations against their facility and their actions. They genuinely seemed to care about the health and well being of the bats at their facility and were distressed that the mortality rate is so high and the remaining bats continue to have health issues.

**Reviewer #3:**

CRC staff have clearly spent a great deal of time and effort in an attempt to adequately care for the bats. They entered the project knowing there were significant risks and had little time to prepare. It was obvious from their responses to our questions that they had done a significant amount of background research, had reviewed available literature that was potentially pertinent to the effort, and discussed the project with various other institutions and individuals that might provide insights. The CRC staff committed extensive hours trying to respond to issues that came up. The "bat team" held daily meetings and had detailed discussions on the status of the bats, and project problems/successes. They engaged in considerable brainstorming and tried various approaches to address issues. Methods described in various publications or recommended by others were often tried. Different sources often provided conflicting recommendations. As a result, there were times when there was no clear way to proceed and/or novel approaches had to be devised. Their explanations of their thought processes and decisions seemed rational and gave every impression that they acted in a professional manner with due diligence and were concerned about the health and welfare of the bats. They were open in their responses and did not seem to be afraid to admit lessons learned and problems encountered. They came to the meeting prepared to share information.

The bats proved more difficult to train to self-feed than the CRC was lead to believe based on feedback from members of the bat rehabilitation community that had dealt with other species of

bats. Given the relatively large number of bats, the effort required to feed each individual bat and care for the colony was extensive. This may have increased the level of stress the bats were under and created a situation that exacerbated the development of other medical issues. Many of the remaining bats still require medical treatments or monitoring. Currently these bats are handled twice a day. This may increase the level of stress the bats experience. However the need to reduce stress must be weighed against the need to provide adequate care, particularly since results from other bats have demonstrated that their condition can degrade quite quickly. Given that VBEB are an endangered species and are known to be more sensitive to disturbance and handling than other more common species, I suspect that there are significant differences between this sub-species and other species that have been more commonly held in captivity or rehabbed. Caution should be used when extrapolating methods or results used on other species when making determinations as to the appropriate care for VBEB.

Of note, is the CRC's attempt to move the bats into another building after problems with the original enclosure were noted (black mold growing on the ceiling, netting size, etc.). A nearby building was identified that had a separate cinderblock and netted enclosure. CRC installed multiple roosting areas similar to those that the bats were already preferentially using, outfitted the area with smaller sized netting to address the potential digit and carpal lesions, provided feeding and watering stations similar to those being used by the bats, and included enrichment items such as plants and trees. They then tested the new facility by moving four of their "best" bats, who were all apparently healthy, over to the new area. Within the first 24 hours, two of the four bats were found dead. The remaining bats were taken back to the original enclosure and attempts to use the new facility were abandoned. This provides a strong indication that the bats are highly sensitive to change and that attempts to move the bats or alter their existing routine should be undertaken with the utmost caution. The review team all responded favorably to the layout of the new facility, which in many ways appeared to be an improvement over the original enclosure. We did note that both areas had a lot of background noise (e.g. from heating and ventilation systems), and considered the possibility that the bats may be sensitive to some of the noises that were not audible to humans. Arrangements have been made to provide the CRC with an acoustic monitor that can detect sounds within the range audible to the VBEB and to test both facilities and the incubator that they had used to determine what types of noises the bats are exposed to.

**Reviewer #4:**

The CRC and the "bat team" made all efforts to provide the bats with the facilities and care they anticipated they would require. It must be understood that there was not a lot of time to prepare for this effort. White-nose Syndrome (WNS) was identified in VBEB natural roosts in early 2009, and at that time there was no plan in place to address such an issue. Amazingly, a plan was compiled, funding found, permits obtained, and a facility prepared in time to take bats into captivity in early Nov 2009. Because the impact of WNS on VBEB was not known, and because mortality rate of over 90% had been seen in other bat species, it was decided to take bats into captivity before WNS could impact them while in hibernation during winter 2009-2010. There was no time to test facilities or procedures using a surrogate species.

The CRC staff had a great deal of experience dealing with various mammal and bird species in captive settings, but realized they had no experience dealing with bats. They addressed this lack

of experience by sending two caretakers to Texas for training at Bat World Sanctuary, suggested another employee volunteer with a local bat rehabber at Bar World NOVA, and hired a consultant recommend by Bat World Sanctuary to assist them for one week before the bats arrived and two weeks after their arrival.

Many of the problems encountered with the colony may be related to the first days the colony was housed at the facility. The first major setback seems to be related to dermatitis associated with feeding meal worms with an increased moisture content (as suggested by the consultant). The excess juices exuded by the worms during feeding resulted in matting of the fur, infections, and eventually dermatitis and hair loss. Because of these conditions, the bats required additional handling which may have resulted in additional stress.

It was also found that placing bats in smaller cages with food facilitated their learning to eat on their own. This is an example of another factor that could have reduced handling, but this was not learned until later. In general, based on what has been learned, the early handling of the bats could probably be improved with a resultant increase in the condition of the bats and a reduction in handling and stress. However, when the bats first arrived, this information was not available and handling proceeded based on the training the caretakers received at Bat World Sanctuary and the experiences of the consultant and CRC staff.

Later declines in health issues associated with problems with the digits appeared to be caused or aggravated by the netting used for the cages. This was also exacerbated by the fact that the bats were not feeding on the wing and spend more time crawling than they normally would in the wild. CRC staff is attempting to correct this situation by switching to a finer mesh. However, the mesh size originally used was within the recommended range, and the CRC was not negligent in using the larger mesh.

Another unforeseen problem was the development of black mold in the holding area due to the increased humidity. The resulted in a human health problem and potentially a problem for the bats as well. CRC staff, in consultation with USFWS and WVDNR, decided the best option may be to construct a second facility where the bats could be housed while the original facility was treated. When the new facility was completed, the four healthiest bats were moved there. Within 24 hr, two of the bats died. The remaining bats were moved back to the original facility and that is where the bats are currently housed. This effort required unanticipated time and effort, but CRC staff always seemed willing to do whatever needed to be done even if it was not in their original plan.

The bats were provided good medical care with a veterinarian on site. Treatments were well thought out and based on experience with other animals, literature pertaining to the care of bats, and consultation with others. Detailed records were kept. Overall, the CRC staff seemed very dedicated to providing the bats with the best care and facilities.

## SUPPORTING DOCUMENTS

1. Project Plan: Establishing a Security Population of the Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*) at the Smithsonian's National Zoological Park
2. Permits including: USFWS Permit to WVDNR and CRC to transport and hold VBEB, VDGIF Threatened & Endangered Species Permit, USDA Record of Acquisition and Transport, and NZP-IACUC Approval.
3. Compiled email updates from CRC to USFWS since November 11, 2009 to March 01, 2010.
4. First Quarterly Progress Report submitted 12/31/2009.
5. Department of Animal Health Standard Operating Procedures for Veterinary Management of Virginia Big Eared Bats (*Corynorhinus townsendii virginianus*) in captivity at the Smithsonian National Zoo's Conservation and Research Center.
6. Nutritional Information: The label of the food used to gut-load the mealworms and crickets. The recipe used for making the blended mealworms. The label from the insectivore chow.
7. Virginia Big-eared Bat Mammal Unit Protocol for Animal Building 1 (South Wing) 254 Conservation Drive Original Dated October 11, 2009
8. Two examples of individual bat records, a table of compiled bat weights over time, and a table and graph of roosting bat temperatures.
9. Memorandum of Understanding among the United States Fish and Wildlife Service, the West Virginia Division of Natural Resources' Wildlife Resources Section and the Smithsonian's National Zoological Park.
10. NZP Response to PEER Report, Virginia Big-Eared Bat Project, March 17, 2010