Environmental enrichment for various nocturnal animals

Currently, environmental enrichment is an important part of any zoo which cares for animals. For the successful use of enrichment, it is important to discuss several criteria:

1) The biological needs of an animal and the need to constantly evaluate the success of the enrichment.

2) It is very important to observe the animals and to take into account their individual characteristics and preferences.

3) It is also necessary to take into account the convenient handling of various enrichments. This allows enrichments to be used by any staff member.

In the "Nocturnal Primates" section of our primate department, we house the following species: Senegal bushbaby (Galago senegalensis) (fig.1), pigmy loris (*Nycticebus pygmaeus)* (fig.2), Bengal slow loris (*Nycticebus bengalensis)*(fig.3), lowland paca (*Cuniculus paca)* (fig.4), aardvark (*Orycteropus afer)* (fig.5), greater galago (*Otolemur crassicaudatus)* (fig.6), and mouse deer (*Tragulus napu)* (fig.7). As part of their well-being, we try to create conditions that are similar to natural conditions to stimulate natural behaviour.

Our enclosures have the following design. Fig. 8-15. Each enclosure has an individual design for the species living there. We tried to select a convenient substrate for animals and its arrangement in the enclosure. Since nocturnal primates are arboreal, we cut parts of fruit trees (apple, pear, plum). One of the main ways to display nocturnal animals is an inverted day. Since the animals are kept on the underground floor of the primate house, which unfortunately do not have outside enclosures, and which almost 90% of the time is viewed by visitors - we created natural shelters away from the view of the public.

Now for the environmental enrichment used for each of the species.

Slow loris. (Fig. 2) It is one of the most stress-sensitive animals in the world. When there is constant stress, they can develop various diseases, such as stereotypic behaviors, diabetes, and deterioration in the quality of their fur. Before the enclosures were rebuilt they looked like this (fig.16, 17), after we changed the design, they looked like this (fig.8,13).To reduce the stress of constant visual contact with visitors, as well as for having different areas in the enclosure, we installed "bamboo groves" - made from live sections of green bamboo 2 meters high and we drilled holes in the stems then inserted dried green bamboo twigs, which increases the visual area of the enclosure and reduces the risk of unwanted aggressive interactions that may come from keeping animals in groups,. (fig.18, 19)

Bamboo is attached to the ceiling mesh from the top and the bottom is covered with some bark. Since bamboo is naturally one of the preferred places where loris are quite common, we recreated the conditions close to their natural habitat. Also, ropes are connected to trees, which the loris can use to move through without having to go down to the ground. Since we have built the shelters, animals have been calmer and our pair of pigmy loris even successfully breed in the enclosure. (fig.20)

In addition to different shaped nest boxes in the enclosure, which are used as shelter and places to sleep, we use baskets in which we interweave fresh branches of trees, (fig. 21a, and b) and we sew hammocks from canvas material. (fig.22).

To stimulate feeding behaviors, we place fruits on tree branches (this enrichment is also used for galagos) and make movable feeding platforms to make food availability more of a challenge. (fig.23)

Paca. (Fig. 4) Representing rodents of South America, the second largest after the capybara. As a result of his nocturnal lifestyle, less is known about them. Like capybara, the paca spends part of his time in ponds where, in the wild, he hides from predators and finds food. We created an artificial pool (fig.24) with steps to a deeper part and the edges of the pool have a barrier preventing bark from falling into the water.

Since pacas spend most of their time is search of food in the wild, we try to scatter and hide food around the enclosure (it includes small nuts and pumpkin seeds) – this makes them take a longer time finding it and increases the time visitors have to see the animal on exhibit.

According to sources, we learned that in the wild pacas live in burrows (usually a few) and very often burrows are made with several entrances. To do this, we designed houses (two for each enclosure), each with two entrances (fig. 25). We had houses with one entrance before (fig. 26) and noticed that our animals gnawed an additional entrance. At the moment, this does not happen anymore.

As a result of our observations, we were able to discover some of the paca's behavioral patterns. By chance, we learned that the paca prefers to cover one of the burrow entrances with natural material, such as branches. In the autumn, when the leaves fall, we collect oak leaves from the park. After drying and processing them with UV light, we scatter them in the enclosures. In the enclosure, the paca collects them with its mouth and carries them to its burrow (fig.27). Next, he uses his nose to plug one of the entrances to his house. It's very interesting to watch for both keepers and visitors; this procedure takes quite a long time. This behavior also allows the animal to show its biological needs. In addition to leaves, pacas use branches with foliage. This is how the house looks after improvements by the paca (fig.28).

We try to make the movement around the enclosure more difficult for our paca (fig. 29), placing logs and tree trunks in the enclosure - to make an undergrowth similar to his natural habitat. It also allows to have different areas in the enclosure, and gives the animal an opportunity to use different types of locomotion.

Senegal bushbabies (fig 1.) This is small nocturnal animal inhabits Africa, from the South to the Sahara. They are very interesting to exhibit. At the Moscow Zoo we have had them since the 1980s. At the moment, our population has 100 animals. Last year we were the first zoo in the world to hand-rear a baby galago (fig.30, 31).

Enclosures are decorated in the form of shrouded bush with a branchy crown of low trees. Senegal bushbabies can jump up to 7 meters. We attach swinging branches to the ceiling mesh, along with horizontal branches (fig. 32) or several branches connected to each other with the help of carbineers, since the galago often jump onto these types of limbs and swing on them.

We hang food enrichment using feeders with holes (fig.33a, b, c, d, and e) into which either mealworms or crickets are placed. These feeders are suspended on chains and also swing freely.

Because of the enrichment, we noticed that Senegal bushbabies use dry leaves and parts of branches to line their nest (fig. 34).

Since greater galagos (fig. 6) have a greater body mass than bushbabies, we use more solid swinging branches and mobile objects (fig.35, 36). Because they are not agile jumpers, they need more continuous paths in the upper part of their enclosure.

Aardvark. (Fig. 5) Aardvarks spend 90% of their time in the wild eating and searching for food. Since it is difficult to recreate conditions such an extensive food search in captivity, particularly feeding on termites, we must take into account an aardvark's features, which rely mainly on olfactory receptors in their search for food, and observing how our aardvark actively studies and sniffs everything, we offer olfactory based enrichment (fig. 37). For example, we put a piece of soaked fabric that has been boiled in water with different herbs in a rubber ball with holes. We recommend changing the herbs constantly. Enrichment with new smells can occupy our aardvark for a very long time.

In addition, we designed a termite mound to help slow the pace of eating mealworms, taking into account the physiological characteristics of aardvarks (fig. 38, 39, 40). The termite mound is made of cement; in it, there are four holes that were made to place smooth plastic tubes, which are closed at one end. Plastic tubes with mealworms in them are inserted inside the termite mound. So, while there are mealworms in the tubes, the aardvark will try to get them out through the different holes. Since the tubes can be pulled out, they can easily be cleaned.

It is best to have several such termite mounds so as to increase searching and feeding time. In addition, we have bamboo enrichment with mealworms which we use to feed our aardvark (fig. 41).

We also offer a porridge to the aardvark in the mornings, which is fed in special slow-feeders for dogs (fig. 42, 43). As the aardvark eats porridge from these feeders, you can see how the tongue works (fig. 44, 45), which is interesting to both keepers and visitors.

Greater mouse deer. (Fig. 7) Our mouse deer is the only representative of its species in European zoos. It is housed with the family of Bengal slow loris in the Asian enclosure. Since this is a shy creature, in addition to bamboo thickets, we use hollow stumps of tree trunks as shelters (fig. 46) and housing.

Zoos often have problems with these animals wearing down their hooves. The Artis Zoo Manual recommends using sandstone for this purpose, but we haven't done so yet.

After installing the bamboo groves in the enclosure, we noticed that our mouse deer began to spend more time there, using it as a shelter.

In the summer, we use different fresh green twigs for all of our animals, and we try to refresh them at least once a week. These twigs are used as food, nest building material, olfactory marking areas, and more. In the winter, we use frozen green twigs. During winter, our zoo receives pine and Christmas trees. Our animals readily use them (fig. 47, 48). These new substrates provide enrichment for them to climb, to mark, and to play in.

For all our gum eaters, such as the greater galago, lorises, and Senegal bushbabies, it is necessary to constantly stimulate and massage gums and brush teeth, which naturally occurs during the extraction of gum from trees. In captivity, animals have problems with their teeth frequently. Feeders are made from cut fruit trees (fig. 49, 50, 51), we drill holes where we pour the gum which is in the form of a gel. We also add solid gum pieces into the feeders, which our animals gnaw (fig. 52, 53). We also noticed that some animals gnaw the fruit trees, perhaps in search of gum.

We are currently researching which fruit trees loris prefer to gnaw on in captivity.