

**Captive Management of Sumatran rhinoceros (*Dicerorhinus sumatrensis*)
Tabin Wildlife Reserve**

June 2018

Paddock Staff

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* RQF: Rhino Quarantine Facility
RIF : Rhino Interim Facility
RFP : Rhino Food Plantation

Sumatran Rhinoceros

| No. | Animal ID | Sex | Accession No |
|-----|-----------|--------|--------------|
| 1. | Kretam | Male | SWD 002 |
| 2. | Iman | Female | SWD 004 |

1. Husbandry

1.1 Animal Management

The weather in June 2018 started with a spate of long three weeks dry spell, followed by constant rainfall in the evening during the last week. The total rainfall in June 2018 was only 72 mm (5 total rain days) as compared to more than 400 mm in the last two months.

However, the rhino food supplies (foliage) were still in abundance and of good quality.

The issues with frequent heavy rainfall is the tendency to flood the wallows and if the water is not drained out, then it becomes a problem. It might not use the particular wallow if the rhinos have several to choose from. Alternatively, without any choice, the rhino would have to add more mud from the walls of the wallow to make it thicker and usable. This would involve tremendous effort to scrape the wall with the horns and

churned them using its feet. In Iman, this strenuous effort would lead to bleeding from the leiomyoma.

Scanning of the female was carried out with caution as it could lead to bleeding from the leiomyoma. Iman did not show much ovarian activity and follicular growth was very slow in June 2018. This disrupted the plan for ovum pick – up by IZW.

Preparations are being made to start conditioning the rhinos to enter the transport crate. This would reduce the stress to move them to the new enclosures at the Borneo Rhino Sanctuary at the end of July 2018 (Plate 1).

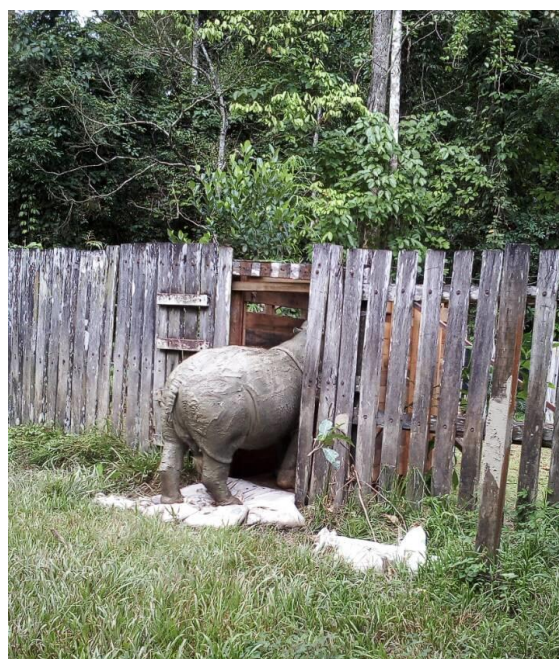


Plate 1. Kretam is seen entering the transport crate, placed outside the yard

The common problems for the two rhinos were hoof cracks, abrasions and minor lacerations. Iman had vaginal discharge (from her uterus) almost each day. However, they ranged in color from pale white – yellow color, pink and reddish. They were sometimes thin and watery or thick and mucoid. These were frequently seen in her wallow or occasionally after defecation inside the night stall. She was scanned 1 – 2 times a week to monitor her estrus cycle and status of her reproductive

pathology. This was carried out with caution. Her feces were placed inside Puntung's paddock that is adjacent to Kretam, to provoke his breeding response.

1.2 Body Weight

The weighing was done using TruTest® electronic weighing scale. Kretam was weighed, once in the middle of the month and once at the end of the month. Iman was weighed once a week to allow close monitoring of her body condition to avoid potential bleeding whenever she becomes overweight. Iman's weight is currently maintained at 520 – 530 kg. Kretam is currently overweighted at 675 kg, and effort is being made to reduce his feed intake, particularly of selected fruits. In June, the average weight of Iman and Kretam is 523 kg and 675 kg respectively (Figure 1).

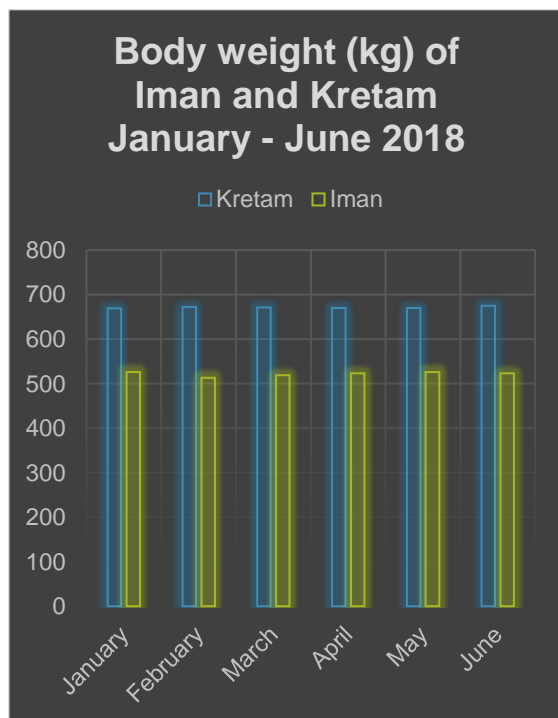


Figure 1. The bodyweights of Kretam and Iman in 2018

In general, the bodyweight of both rhinos was maintained throughout 2018, although, an increase was observed in Kretam in June.

It was observed, the tendency to get bloody discharge is correlated to the increase in her body weight. It is important to maintain an average of 520 kg reduce the incidence of bleeding. However, other factors including strenuous physical activities and straining could also contribute to the bleeding.

Iman's body weight was maintained during the last three months (Figure 2).

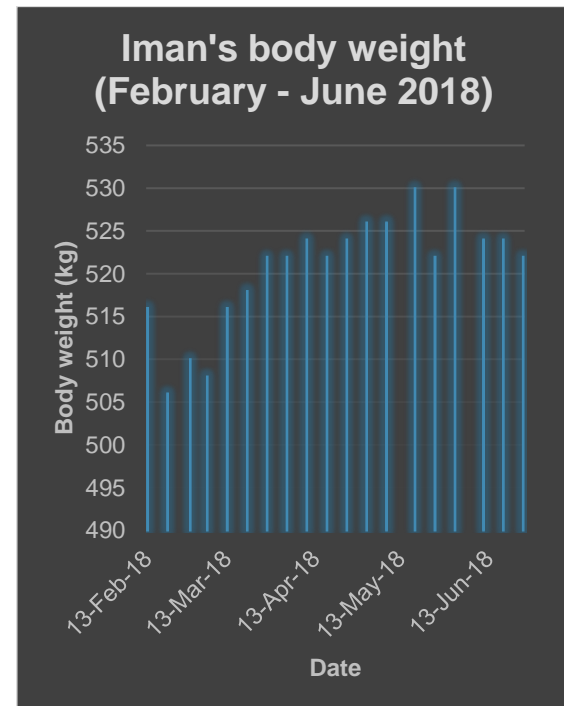


Figure 2. Iman's bodyweight showing the gradual increase in March 2018 and stabilizing in April and June 2018

2. Animal Health

The body scores of Kretam was maintained at around 3.0 and Iman at 2.5 (modified from Body Condition Scoring for Horses, Henneke et al., 1981). In general, the main chronic issues with Kretam were his hooves (mostly chippings) and the posterior horn (erosions). Iman had a few cracks on the hooves and a watery left eye. However, the more serious condition remained the leiomyomata and the mucous discharge with a tendency to have blood (likely an open pyometra).

Iman's diet is maintained at about 9 – 11 kg of browse, limited to softer browse. Those with hard stems such as Ara Kapal (*Ficus montana*), Ara Epal (*F. tricocarpa*) and Kelawit (*Uncaria spp*) were limited to a kilogram per day.

As a prophylactic measure, deworming was carried out three times annually. In June 2018, both rhinos were dewormed on the 20th, using Ivermectin and Praziquantel oral paste (Ashiver Plus®). The 6.42 grams paste was inserted into bananas and fed to the rhinos (Plate 2).



Plate 2. The dewormer was given to the rhinos every three month

Abrasions and minor lacerations are frequently present but many do not require treatment but were monitored daily until it is resolved.

Kretam was observed to mount a small earth outcrop inside the paddock on the 1st June 2018.

The routine monthly sampling for health and environmental checks were carried out for both rhinos and their surroundings on the 17th June 2018 (Sunday) and submitted to the Veterinary Diagnostic Laboratory, JPHPT and Public Health Laboratory in Kepayan, Kota Kinabalu on the 18th June 2018, before noon.

The samples included soil, mud from wallows, water, floor swabs, horse pellets (Gold Coin®), feces, urine and blood. All these samples except blood, were analyzed for bacterial contamination, particularly *E.coli*, *Salmonella sp* and *Bukholderia psedomalleie*.

2.1 *Kretam*

a. Deformity of posterior horn

The central depression that was filled up with black silicon in early May 2018 is still intact. It will be slowly removed in August 2018 and examined for growth of the horn matrix. A second depression will also be filled up with silicon. The treatment, if necessary would consist of povidone swab on areas of the horn, that is soft or wet. This is done twice daily (Plate 3).



Plate 3. The silicon (arrow) in the middle of the posterior horn

b. Hoof cracks

Kretam's hooves have a high tendency to get chipped or cracked. It is also very likely the overused and reused wallows contained more rocks, as the mud is washed off with time. Currently, three hooves are affected, including one that was there in April 2018 (digit 1 of the left hind leg). The healing process is good but it is very slow. (Plate 4).



Plate 4. The lesion can be seen being pushed ventrally (arrow)

The other hooves affected with chippings, were the right hind feet (digit 2) and the digit 1 of the right front feet. The chippings involved the parietal dermis and were located at the distal end (Plate 5).



Plate 5. The chippings as seen on the hind feet (above) and fore feet (below) of Kretam

The daily treatment consisted of topicals (antiseptics, 2.5% formaldehyde and Stockholm coal tar) twice daily and supplementation of biotin and methionine (20 grams Hoofmaker TRM®), once daily in the afternoon.

2.2 *Iman*

a. Hoof chippings

As with Kretam, Iman has several hoof cracks, but only one was regarded as more serious than the others. Similarly, the causes were more likely traumatic and involve the ventral aspect of the hoof (Plate 6).



Plate 6. The digit 2 of the hind feet that shows a deep crack

The daily treatment includes thorough cleaning of the hooves affected, followed by 2.5% formaldehyde swabs and Stockholm coal tar. This was done in the morning and evening. Biotin supplement (20 grams Hoofmaker TRM® powder) was reconstituted with water to form a bolus and fed to the rhino (Plate 7).



Plate 7. The Hoofmaker TRM bolus that will be fed to the rhino

b. Corneal opacity

On the 11th June 2018, her left eye was reported to be watery and inflamed. She was tearing from the eye and frequently shutting it. On close observation, the cornea had a 1 cm diameter whitish coat at the center (Plate 8).



Plate 8. The opacity (arrow) probably caused by trauma

b. Reproductive tract pathologies

In June 2018, Iman had a varied form of discharge ranging from white to red, watery to mucous. The normal discharge from her are clear, whitish and white. This do not require treatment but were monitored daily. Most of the discharge would be voided while she is wallowing (Plate 9).



Plate 9. The milky discharge as seen inside the wallow

Occasionally, Iman does void her discharge after defecation, which she does inside the night stall. Iman has marked her “toilet” inside night stall “1” and would frequently defecate inside it. The discharge is voided soon after. Similarly, the color ranged from clear to white to pink to red (Plate 10).

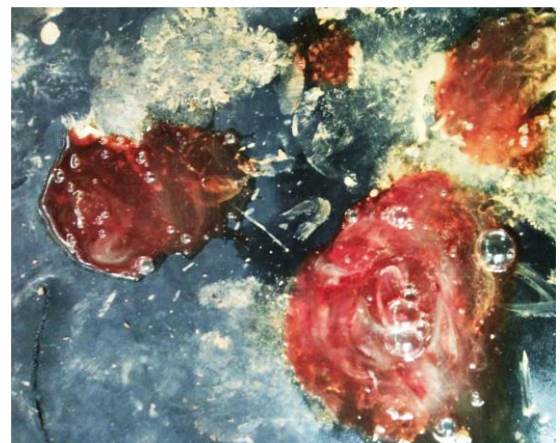


Plate 10. The varied color of the discharge indicating the severity of the polyps

Her last Improvac® (Gonadotrophin Releasing Factor) vaccination was on the 9th November 2017. She almost died from profuse bleeding, anaemia, dehydration,

infection and shock in December 2017 – January 2018. She was subsequently treated for anemia, dehydration, infection and hemorrhage. Improvac® was stopped and she was monitored.

Ultrasonography in June 2018 showed severe uterine pathology. The leiomyomas ranged from 4 – 9 cm diameter with some calcific changes inside and at the periphery. Hyalinization and cyst could be observed inside some of the leiomyoma. Some of the leiomyoma has fluid filled cavities ranging from a few millimeters to 4 centimeters (Plate 11).



Plate 11. The small fluid filled cavities in a leiomyoma (above) and a large cavernous leiomyoma (below)

The cervix is edematous and cysts could be seen at the cranial region. The 3 cm diameter anechoic hydrosalpinx is still visible in the right oviduct.

The 3.4 cm long right ovary does not show any follicle when examined. However, this

anestrous ovary presents several large blood vessels (rounded and elongated) during ultrasonography (Plate 12).



Plate 12. The anechoic blood vessel (arrow) in the parenchyma of the right ovary

3. Feed and feeding

In June 2018, despite the long dry season, the food source for the two rhinos is sufficient to meet their daily needs. However, due to the replanting of oil palm seedlings, many hectares of old palm trees were cleared. Many of the *Ficus spp* including strangling figs, were also removed as a result of this. This also include the popular Ara manga (*F. annulata*). Similarly, as the palm were removed, shade loving plants including Nangka air (*F. lepicarpa*) and Bendera halus (*F. uncinata*) also perished. Once the food plants were collected, they were segregated and washed before stacking in the shaded store (Plate 13).



Plate 13. The various food plants gathered from the surroundings were stacked according to species in a store

The rhinos were fed fruits (banana, papaya, jack fruit, mango and pumpkins) prior to the foliage. This is to avoid pieces of the soft fruits to lodge in between the teeth and cause decay and other related problems (Plate 14).

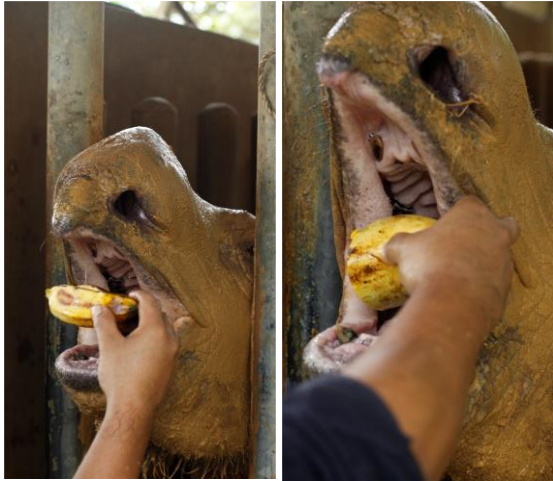


Plate 14. Iman being fed banana (left) and mango (right) before her main meal of forage

The feeding varies each day for Kretam but more consistent for Iman. The more important reason being the size of their paddock (smaller for Iman) and distance of the night stall from the wallow (s). Iman's wallow is very close to the night stall.

Kretam spends at least two hours eating inside the chute as compared to 1.5 hours for Iman. He is very selective and would require more number of species each day. Similarly, Kretam was more careful when taking any medication.

3.1 Forages

In June 2018, the total amount collected for the two rhinos is 3339 kilograms. Of this 63% (2107 kg), was allocated for Kretam and the balance was fed to Iman. However, the total percentage consumed by both rhinos is similar (59%). About one third of the foliage were hung for the rhinos inside the paddock or night stall and two thirds were hand fed to them (Figure 2).

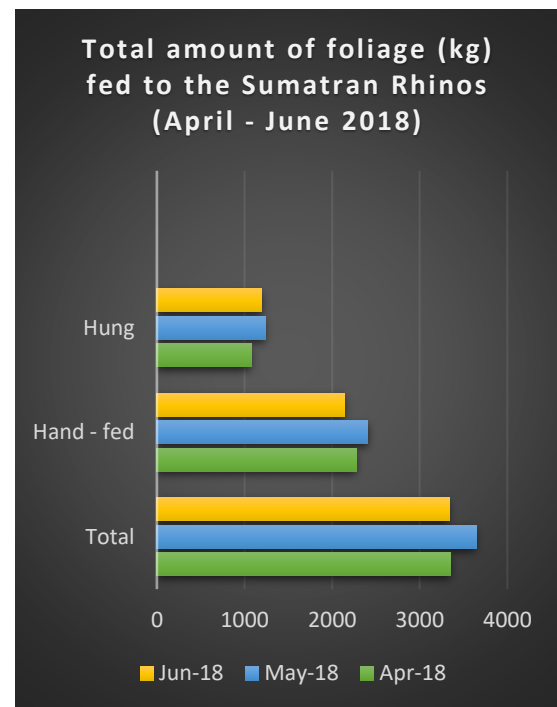


Figure 2. The foliage fed to Kretam and Iman for April – June 2018

3.2 Voluntary Feed Intake (VFI)

The feed intake of Iman and Kretam were maintained to a daily minimum of about 20 and 36 kg respectively. In June 2018, Iman came back for all her feedings, while Kretam only came back for 29 morning and 29 evening feed.

Iman was fed 9 – 10 kilograms of foliage per feeding (18 – 20 kg per day), consisting of 16 species of plants, mostly figs. Her appetite remains excellent and feed intake, consistent. Iman consumed about 34% (198.5 kg) of the foliage hung out for her in June 2018. Her total feed intake is 723 kg, 35 kg less than in May 2018. This is due to the number of days for that month and consistency of her returning back for feeding.

Kretam consumed 1256 kg of forage in June 2018, as compared to 1385 kg in May 2018. His average daily feed intake consists of 33.2 kg from hand – feeding and 9.0 kg from the foliage hung out inside the paddock. Although, the amount of foliage hung out for Kretam and Iman is similar in

quantity, the amount consumed by him is significantly more (Figure 3).

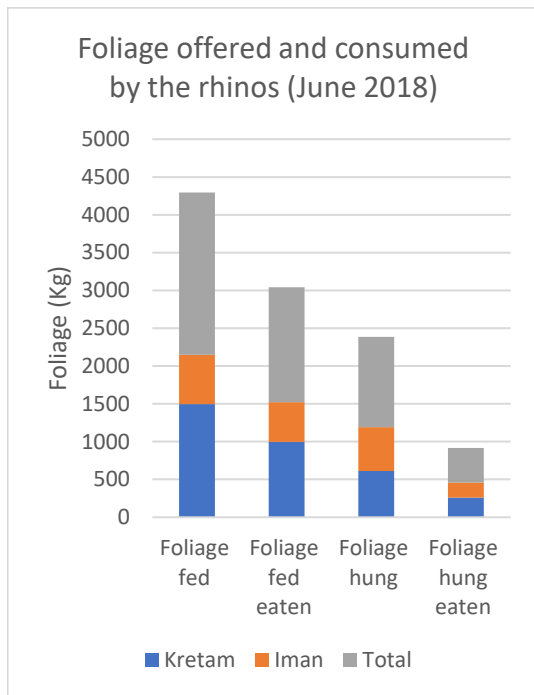


Figure 3. Foliage consumed by the two rhinos in Tabin

Fruits constitute 28 – 49 % of the total diet of the two rhinos. Most fruits are available throughout the year (*Musa acuminata*, *Carica papaya*, *Mangifera indica* and *Artocarpus heterophyllus*) and a few are seasonal (*Artocarpus integer*, *Mangifera foetida*). About 500 grams of pumpkin were also fed to each rhino, daily. Half of the fruits were fed in the morning and the remaining in the afternoon or evening.

Horse pellets (Gold Coin ®) were given as supplements. Kretam receives 300 grams each day and Iman gets 500 grams. These were mixed with water and soften before feeding the rhinos. In addition, the mineral and vitamin supplements (Stressvitam®) were added to the drinking water and the water to rinse some foliage prior to feeding the rhinos.

Clean drinking water was offered inside a tub, intermittently during hand feeding. About 8 to 10 gallons of water were

consumed by the rhinos while inside the chute (Plate 15).



Plate 15. Iman drinking water from the pail

4. Biosecurity/health monitoring

The biosecurity for the rhinos in Tabin relates to preventive measures to reduce risk of disease transmission from outside sources. However, ensuring optimum health is also fundamental to prevent a disease. All of these were translated into management protocols. These includes ensuring the rhinos gets adequate high-quality food, without contaminations from pathogens or toxic materials. The reduction of stress is also an important tool in preventive medicine. Apart from good hygiene, regular checks and monitoring are necessary to ensure good health of the rhinos. Tyre and foot bath are provided at crucial locations and maintained (disinfectant) to prevent disease introduction.

The drinking water were checked constantly and analyzed once a month for bacterial contamination. Soil samples, floor swabs, water samples from water tanks, urine and feces from the rhinos were also analyzed for pathogens. The water from 13

tanks were tested for total coliform counts and presence of *E.coli* as half of these tanks were for human consumption.

Staff were also reminded to adhere to good hygiene and best husbandry practice. Samples were collected for isolation of pathogenic bacteria (particularly *E.coli*, *Bukholderia pseudomonas* and *Salmonella*) and general health checks were carried out on the rhinoceros routinely.

In addition, the floor inside the night stall is thoroughly scrubbed twice a day.

4.1 Hematology

Blood was collected into EDTA tube from the digital plexus, for a complete blood count (CBC). Kretam's CBC was compared with his previous results (Table 1).

Table 1. The complete blood count for Kretam in June 2018.

| Parameters | Animal (Kretam) | |
|----------------------------|-----------------|---------|
| | 18 April | 18 June |
| Hemoparasites | Nil | Nil |
| RBC (X10 ¹² /L) | 5.8 | 5.46 |
| WBC (1000/UL) | 7.04 | 8.65 |
| Hb (G/DL) | 14.2 | 15.6 |
| PCV (%) | 40 | 55 |
| Seg. Neutrophils (%) | 67 | 52 |
| Eosinophils (%) | 23 | 14 |
| Lymphocytes (%) | 9 | 34 |
| Monocytes (%) | 1 | 0 |
| Basophils (%) | 0 | 0 |
| MCV (FL) | NA | NA |
| Platelets (G/L) | NA | NA |
| MPV (FL) | NA | NA |
| MCH (PG) | NA | NA |
| MCHC (G/L) | NA | NA |

The complete blood count showed variables are within normal limits. There is a slight elevation in WBC.

4.2 Bacteriology

All the floor swabs were positive for *Bacillus spp.*

The 17 soil samples taken from various locations surrounding and inside the rhino enclosures were negative for *Bukholderia pseudomallei*. The four samples from the wallows were also negative for *Bukholderia pseudomallei*.

Kocuria rhizophila were isolated from the two tyre baths. Water from the sumps were positive for *Kocuria rosea*.

The water samples taken from 13 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 80 – 1590 cfu/ml. Total coliform count only ranged from 0 – 830 cfu/ml. The *E.coli* count was low ranging from 0 – 30 cfu/ml. Only tank number 9 (RQF – staff water tank) had a count of 30 cfu/ml and were treated (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for the month of April 2018.

| Tank | Total bacteria | Total coliform | <i>E.coli</i> |
|------|----------------|----------------|---------------|
| 1 | 250 | 10 | 0 |
| 2 | 120 | 0 | 0 |
| 3 | 1590 | 0 | 0 |
| 4 | 180 | 0 | 0 |
| 5 | 80 | 0 | 0 |
| 6 | 110 | 10 | 0 |
| 7 | 1210 | 380 | 0 |
| 8 | 90 | 0 | 0 |
| 9 | 370 | 130 | 30 |
| 10 | 380 | 180 | 0 |
| 11 | 1010 | 830 | 0 |
| 12 | 300 | 120 | 0 |
| 13 | 340 | 0 | 0 |

There were no *Salmonella sp* isolated from the water samples.

The monthly fluctuations in bacterial and *E.coli* counts is related to the natural water source from the Lipad River and its tributaries. The high bacterial counts are

related to the heavy rainfall and wash down from the soil.

4.3 Parasitology

The fecal samples from both rhinos were negative for endoparasites and parasitic egg count.

4.4 Routine prophylaxis

Routine liming (application of calcium/magnesium – rich materials) was carried out mostly around the rhino dung piles (composting area) located outside the enclosure. Liming were also carried out around the wet ground and sumps. The tyre baths were monitored and maintained with proper disinfectants and concentration (Plate 16).



Plate 16. Tyre bath at the Rhino Quarantine Facility

5. Reproductive assessments

Iman was scanned about 2 – 3 times a week but towards the end of June 2018, due to her slight bleeding from the uterine pathology, the procedure was halted momentarily.

The ovarian activity was slow with the right ovary showing absence of follicles. The left ovary has a 6 mm diameter follicle in early June 2018, maturing to 8mm after seven days. A second follicle was also observed with a diameter of 4mm. On the 17th June the two follicles had increased to 8 and 9 mm diameter (Plate 17 a - c).



Plate 17a. The right ovary showing blood vessels but void of follicles (above) while a 6mm follicle could be seen on the left ovary (below)



Plate 17b. The left ovary showing two follicles on the 12 June 2018.

The right ovary remained anestrus, with ultrasound images showing several blood vessels within the ovary.



Plate 17c. The active left ovary showing the 8 mm diameter follicle

The routine placement of Iman's feces in Puntung's paddock was done each morning. Kretam was seen to mount a small earth outcrop once on 1st June 2018.