

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

May 2018

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Maslin Mohiddin (Rhino Keeper – RQF)
4. Samat Gubin (Rhino Keeper – RIF)
5. Ronald Jummy (Rhino Keeper - RQF)
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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 May 2018, is much warmer with less rainfall and most of the smaller streams were drying out. The intense morning – afternoon heat caused the rhinos to spend more time in the wallow and late for hand – feeding. This is apparent in Kretam as compared to Iman. Kretam was seen to re – use several wallows and on 17th May 2018 made a new one.

The total rainfall in May 2018 was 134 mm (14 total rain days) as compared to 476 mm in April 2018 (21 rain days) and 453 mm in March 2018 (11 rain days).

The rhino food plants are still available in good supply with young shoots from Ara belimbing (*Ficus spp*), which is readily consumed by both the rhinos. The heat does cause some of the foliage to wilt and dry before it reaches the food store. The more

sensitive species including Nangka air (*Ficus lepicarpa*), Putih sebelah (*Leucosyke capitellata*), Jackfruit (*Artocarpus heterophylus*) and Ludai (*Homalanthus populneus*) will wilt quite rapidly in the strong heat (Plate 1).



Plate 1. Nangka air leaves wilting in the sun

Washing and watering the forage after collection does help keep them fresh until the next day. After weighing and segregating the forage for the two rhinos, they were stacked inside the food store and watered (Plate 2).



Plate 2. Justine and Maslin stacking and hosing the forage, completing their task of collecting rhino food

The rhinos, especially Kretam will not eat leaves that are dry or wilted, especially those that are hung out in the paddock for the evening – night feeding. In total about 64% of the forage hung out were not eaten

by the rhinos. These comprised of branches and unpalatable leaves.

Iman's old wallow was unsuitable and almost a meter deep and dangerous for her. A new wallow was identified and partially dug out and soften with water. Iman located it almost immediately and started to reshaped the sides and eventually used it daily (Plate 3).



Plate 3. The newly constructed wallow being used by Iman (above) and the old wallow used in February – May 2018 showing the original section being covered by dried leaves as she expands closer to the fence. Note the depth of the old wallow (below)

The chronic problem with cracked hooves still persist in Iman and Kretam. Although in Kretam, all hooves had healed, the one on the left hind (digit 1) is still not resolved completely. The healing process is slow. Similarly, Iman is also being treated for cracked hooves.

The discharge from her vagina, coming through from the uterus is occasionally observed but none indicated bleeding. It is usually pale white, clear or yellowish mucous. It is usually seen in her wallow or sometimes in the night stall. She was scanned 1 – 2 times a week to monitor her estrus and status of her reproductive pathology.

The feces from both rhinos were used to instigate positive behavioral response by placing them outside the respective paddocks (Iman's feces outside Kretam,s paddock and vice versa).

1.2 Body Weight

The body weights do indicate obesity or emaciation in the rhinos. Both have negative implication of health and well-being of the animal. A heavier Kretam would certainly be bad for the hoof cracks. Similarly, a heavier Iman would increase the chance of hemorrhage inside the uterus as observed in previous bleedings.

Apart from physical examinations and monthly clinical evaluation, the body weight acts as an indicator of health in the rhinos. Weighing was done using the TruTest® electronic weighing scale. Assembling the scale and the load bar must be done correctly and securely to avoid false reading. Kretam was weighed twice a month while Iman, four times or weekly. This higher weighing frequency for Iman is to ascertain that her body weight does not exceed 530 kg. This is directly related to her uterine pathology, particularly the leiomyoma and subsequent bleeding. Iman's weight is maintained at between 520 – 530 kg. Kretam's body weight averaged

670 kg, similar to previous the month. The average weight for Iman in May, is 523 kg (Figure 1).

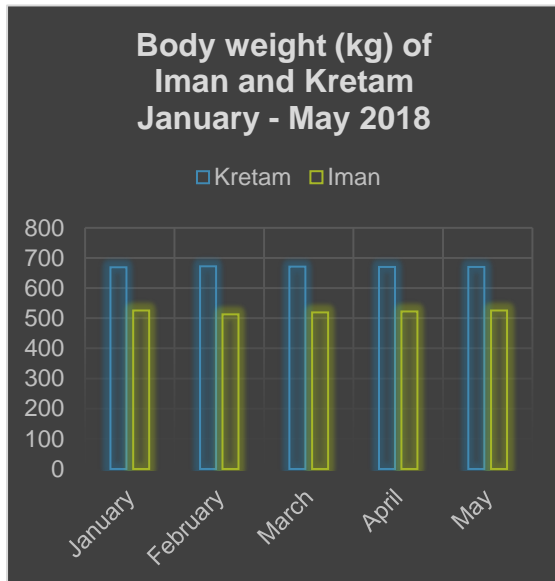


Figure 1. The bodyweights of rhinos In Tabin Wildlife Reserve (January – May 2018)

Iman's body weight gradually increased from January to April 2018 and subsequently maintained at under 530 kilograms. Her feed intake is maintained at around 25 kilograms of foliage daily. In May 2018, her body weight ranged from 522 to 530 kg (Figure 2).

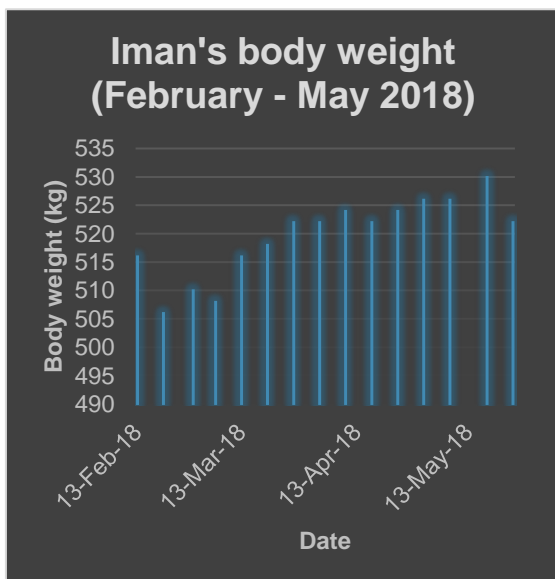


Figure 2. Iman's bodyweight showing the gradual increase in March 2018 and maintained in April – May 2018

2. Animal Health

The body score for Kretam was maintained at around 3.0 and Iman maintained hers at 2.5 (modified from Body Condition Scoring for Horses, Henneke et., al 1981). The rhinos' bodyweight was monitored and maintained within limits, to reduce the pressure on hoof cracks (both rhinos) and the uterus (Iman).

Apparently, hoof cracks are becoming a chronic recurring problem with the rhinos in Tabin. The main reason is possibly, the overused paddocks with deep trenches, holes and waterlogged areas. Although all previous hooves' cracks healed, the recent ones occurring in April had not resolved.

On the 10th May, a new wallow was constructed for Iman, about 20 meters from the old one. This is to replace one that is too deep and too close to the electric fence. The hot weather, small size of the paddocks and limited suitable soil type, creates desperations for Kretam to thermoregulate. After reusing several old wallows, Kretam finally dug a new mud wallow inside the paddock on the 18th May 2018.

Iman's average body weight was 422 kg, within the limits planned for her (520 – 530 kg) to reduce the stress placed on her uterine pathologies. She is also being treated for hoof cracks.

Iman was ultrasound twice each week to determine her ovarian activities and status of her pathologies. Iman's follicles did not grow at a normal rate and remained small (2 – 5 mm) in both ovaries. This phenomenon is related to the uterine pathologies which could have disrupted the hormonal functions of Gonadotropin – releasing hormone (GnRH), possibly by antibodies or binding substance against them. Subsequently FSH and LH production is suppressed.

The routine monthly sampling for health checks were carried out for both rhinos on the 13th May 2018 (Sunday) and submitted

to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepayan, Kota Kinabalu on the 14th May 2018, before noon.

The soil sampling was carried out around the perimeter of the night stalls at RIF and RQF. These included areas inside the exercise yard (RIF) and paddock (RQF). Soil samples were also taken from the active wallows.

The floor swabs were taken at random locations inside the night stalls, focusing in areas where water stagnates after washing or heavy rain. These are usually around the vertical wooden walls. Blood, urine and fecal samples were also collected from the rhinos for complete blood count, bacteriology and parasitic counts. Currently, blood was only drawn from Kretam as Iman is highly excitable and would struggle inside the chute. Water from all the water tanks were sampled for coliform counts, particularly *E.coli*. The main source of water is from Lipad river and harvested rain water from the gutters.

2.1 *Kretam*

a. Deformity of posterior horn

Although the horn matrix has increased in height but the growth is mainly observed at the periphery with two depressions in the middle. Water and mud would pool inside this depression and subsequently soften the keratin matrix. The treatment consisted of Povidone (Septidine®), applied on the inner part of the horn.

Previously, the depression was sealed with an epoxy compound similar to dental acrylic. However, it was observed that the hard compound does not allow the new growth of horn matrix. Currently, the deep depression in the middle was thoroughly clean and swabbed with alcohol and let to dry. The depression was later filled with silicon sealant and let to dry before he was released into his paddock and monitored (Plate 4).



Plate 4. (a) The posterior horn with the middle depression (arrow) and (b) depression filled with silicon

b. Hoof cracks

Currently, only digit 1 of the left hind leg is affected. A 1.5 cm lateral crack could be seen on the parietal dermis, 5.0 cm distal to the coronary band (Plate 5).



Plate 5. The lateral crack observed on the first digit

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. On the 16th May 2017, he was started on an additional supplement (Pro – Dosa Boost®) containing electrolytes & trace elements, vitamins and amino acids.

2.2 Iman

a. Hoof chipping

Currently, the problem is seen on digit 3, right hind feet. A 1 cm irregular chipping was observed on the parietal dermis at the base of the hoof, also likely a traumatic injury sustained inside the paddock (Plate 6).



Plate 6. The lesion on the third digit, right hind feet after being washed prior to treatment

The routine daily treatment regime consisted of topicals (antiseptics, 2.5% formaldehyde and coal tar) administered in the morning and evening. The oral Hoofmaker TRM® powder was mixed into a thick paste, placed inside banana and fed to Iman. Sometimes, Iman would take the whole bolus of Hoofmaker TRM® from the keeper.

b. Reproductive tract pathology

At the moment, Iman does not show any signs of discomfort, anemia or colic. The apparent signs if any, would be cessation of vocalization and inappetence.

Occasionally, a small amount of watery – mucoid discharge was observed on the floor of the night stall. This is seen after defecation or urination. The vaginal discharge (originating from the uterus) is seldom seen as it is sometimes voided out inside the wallow and blended with the mud. The mucoid discharge ranged in color from clear to whitish or yellowish (Plate 7).

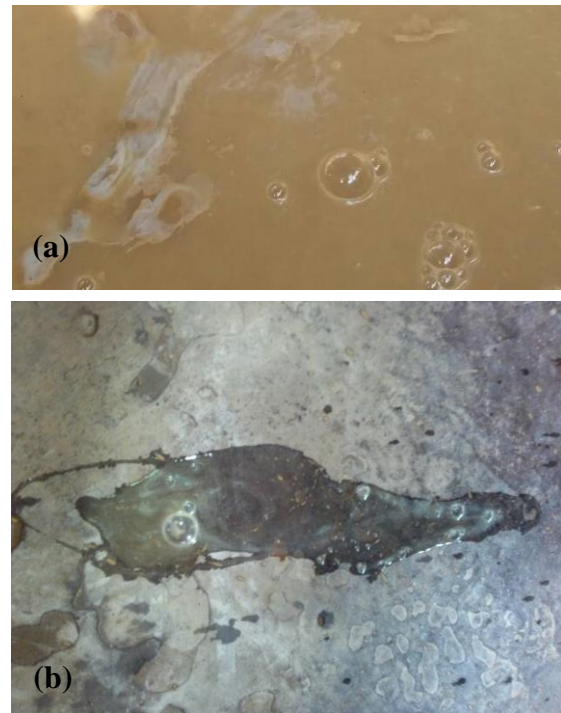


Plate 7. The whitish mucous discharge mixed with mud, inside the wallow (a) and in the night stall (b)

Ultrasonography was performed at least twice weekly to monitor the follicular development and uterine pathology. The uterine pathologies were similar to those described in April 2018.

“There were some calcific changes inside and at the periphery of the leiomyomas. Other degenerative changes include hyalinization and cystic formation with the increase in edematous fluids. The hydrosalpinx in the right oviduct is still visible and persisted since her capture from the wild. The cervix is edematous. Several cysts of varying sizes were also observed inside the cervix, more than in the previous years”

In addition, the hydrosalpinx is 3 cm in diameter. The right ovary is more vascular, more likely as a result of the previous ovum pick – up procedures. The large leiomyoma could be easily palpated rectally. The various pathology was visible via ultrasound (Plate 8)

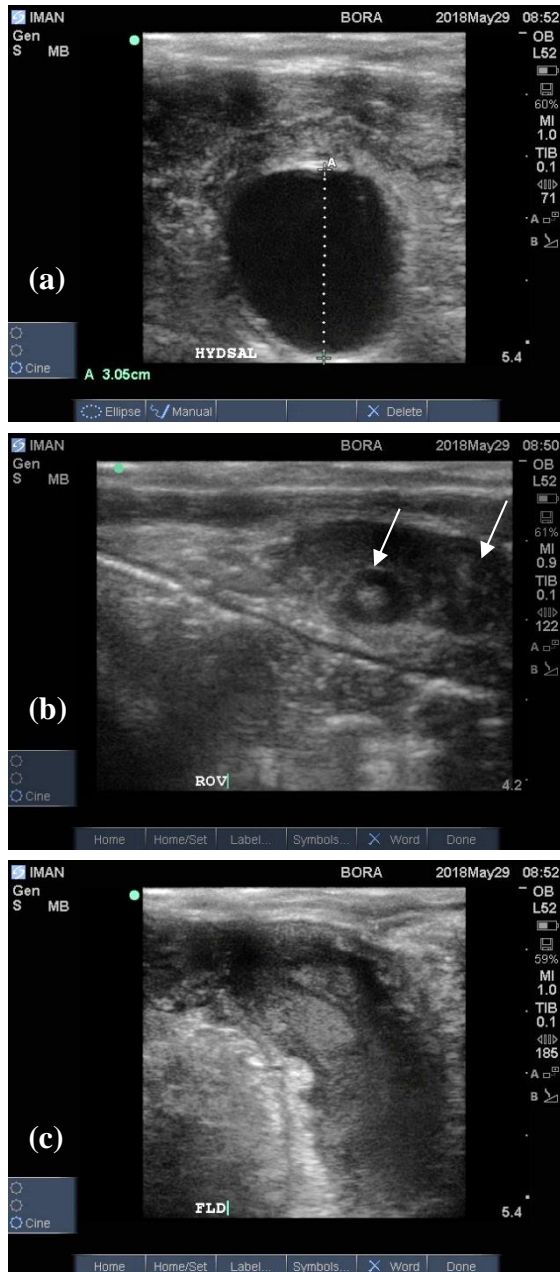


Plate 8. (a) A hydrosalpinx seen in the right oviduct was aspirated in 2016 but recurred. (b) The right ovary with several blood vessel (arrow). (c) Hypoechoic fluid with shadows seen inside the uterus. The fluid is homogenous

Several fluid filled cavities within the leiomyoma (cavernous) could be seen during the ultrasound examinations. The shape varies from oval, round and irregular. They vary from a few millimeters to 2.5 centimeters (Plate 9).

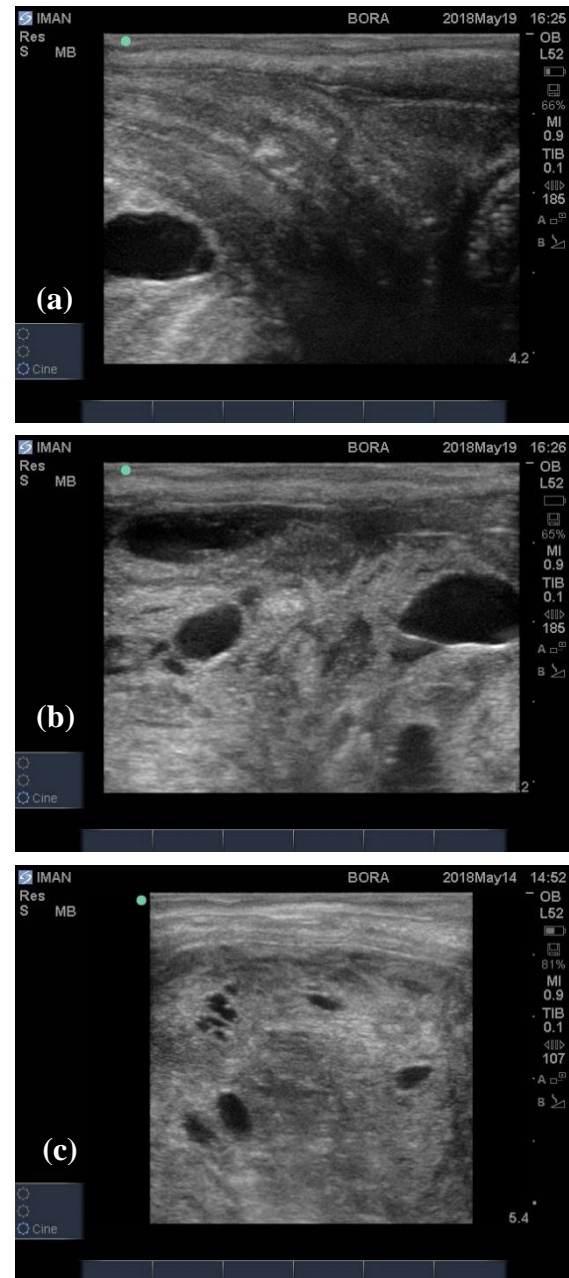


Plate 9 (a – c). Cavernous leiomyoma (anechoic structures) in the uterus

3. Feed and feeding

As more acreage of the oil palm plantation were cleared for replanting, the quantum and variety of rhino food plants was significantly reduced (Plate 10).



Plate 10. The felling of old oil palm trees for in KL – Kepong Plantation

However, the current supply from the remaining oil palm plantation, forest fringes and the Rhino Food Plantation is still adequate. The keepers would spend between 3 – 5 hours daily to gather the forage depending on the distance travelled (up to 30 kilometers).

3.1 Forages

The total amount collected for the two rhinos in May 2018, is 3643.5 kilograms, 63% of this was allocated for Kretam and 37% for Iman. The total amount consumed (hand fed and hung out for night feeding) was 2143 kg or about 59%.

The most common foliage fed daily is Nangka (*Artocarpus heterophyllus*), Putih sebelah (*Leucosyke capitellata*), Maitap (*Neonauclea spp*), Earth fig (*Ficus uncinata*), Kelawit (*Uncaria spp*), Ara mangga (*Ficus spp*), Nangka air paya (*Ficus spp*) and Nangka air pasir (*Ficus spp*) and Gatal berbulu (*F. francisci*). However, the other species of food plants are also provided, to make up the 16 species consumed each day.

3.2 Voluntary Feed Intake (VFI)

The feed intake of Iman was maintained to a daily maximum of about 20 kg while Kretam’s daily minimum stands at 36 kg. Iman came back for both her morning and evening feedings (2 x 31 days). She gets between 18 – 20.5 kilograms for each hand feeding, comprising of about 16 species. Her appetite remains excellent. Iman

consumed about 32% (6 kg daily) of the foliage hung out for her each evening. Her average daily feed intake in May 2018 is 24.5 kg.

Kretam came back for 30 mornings and 31 evenings. In total he consumed 1639 kg for May 2018. His average daily feed intake is 36.4 kg (hand – feeding) and 8.2 kg (foliage hung out). Kretam consumed about 40.1% of the foliage hung out as compared to 31.5% for Iman (Figure 3).

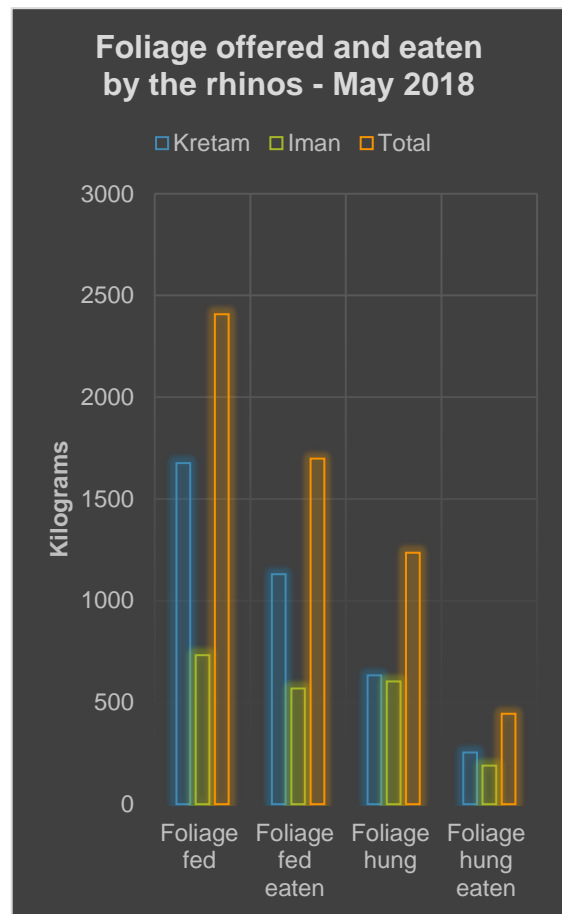


Figure 3. Foliage consumed by the two rhinos in Tabin

The consumption of foliage hung out for the rhinos varies each day. Kretam varies from 5.5 - 14.5 kg from a total of 20 kg. Similarly, Iman prefers mostly Nangka and Ara Ajinomoto but does consumed other species in smaller quantity. The factors ranged from their mood, time released back to the paddock, amount of food consumed via hand – feeding and species of forage (Plate 11).



Plate 11. The amount of uneaten foliage from those that was hung out for Iman is sometimes substantial

Fruits consisting mainly of banana, papaya and mangoes were provided daily to both rhinos. Occasionally, they get the Cempedak (*Artocarpus integer*) when in season. Half of these were fed in the morning and the remaining in the afternoon or evening. Pumpkins were also given at a rate of 500 grams daily.

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.

4. Biosecurity/health monitoring

The biosecurity plan for the Sumatran rhinos has always focused on preventing any incidence of a disease. The many reasons apart from these being the last two captive individuals in Malaysia. The equally important reasons being, the indwelling problems within the individuals (Kretam is getting old and Iman has massive uterine pathology) and, most of the food source are acquired from outside the center (forest, forest edges and oil palm plantations).

The two important aspects emphasized are maintaining the optimum health of the

rhinos (adequate well – balanced diet, reduce stress and treatment of disease) and adopting best farm or veterinary practices. Wallow is an essential part of the rhino’s life and keeps stress level down (Plate 12).



Plate 12. Kretam just coming out of his wallow and heading towards the night stall

Biosecurity zones were established and tyre bath maintained for vehicles coming through carrying rhino food. Once delivered, the vehicle will be thoroughly washed. The forage will only be collected from “safe areas” and areas with signs of herbicidal use will be avoided. Staff are always reminded of this. All forage collected will be segregated between rhinos and washed prior to stacking them on racks in the food store.

Apart from good nutrition and hygiene, regular checks are necessary to ensure pathogens are absent in and around the rhinos

The drinking water, soil samples, floor swabs were checked once a month for bacterial contamination., The water from 13 tanks were tested for total coliform counts and *E.coli* as half of these tanks were for human consumption.

Staff were also reminded to adhere to good hygiene and best animal husbandry practices. Routine cleaning of night stalls and surrounding areas is done twice daily after the rhinos were fed.

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 April and May 2018.

Parameters	Animal (Kretam)	
	18 April	14 May
Hemoparasites	Nil	Nil
RBC (X10 ¹² /L)	5.8	5.73
WBC (1000/UL)	7.04	10.4
Hb (G/DL)	14.2	14.3
PCV (%)	40	55
Seg. Neutrophils (%)	67	58
Eosinophils (%)	23	25
Lymphocytes (%)	9	17
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 values but are within normal limits.

4.2 Bacteriology

To date, the results for the floor swabs has yet to come from the Veterinary Diagnostic Laboratory, JPHPT Kepayan.

The 17 soil samples were negative for *Bukholderia pseudomallei*. The samples from the wallows were also negative for *Bukholderia pseudomallei*. No pathogens were observed inside the two tyre baths.

The water samples taken from 13 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 100 – 920 cfu/ml. Total coliform count only ranged from 0 – 380 cfu/ml. The *E.coli* count was low ranging from 0 – 60 cfu/ml. Only tank number 2 (RIF – staff water tank) had a

count of 60 cfu/ml and were immediately treated (Table 2).

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

Tank	Total bacteria	Total coliform	<i>E.coli</i>
1	100	0	0
2	470	380	60
3	468	0	0
4	600	0	0
5	370	30	10
6	920	80	0
7	380	10	0
8	374	0	0
9	250	0	0
10	240	0	0
11	375	0	0
12	622	50	10
13	380	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. Occasionally, rain water collected from the gutters at the quarters had high counts, probably due to contamination by rodents or macaques.

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 outside the enclosure, wet and soggy ground and sumps. Liming was also carried out when required around the staff quarters and paddocks.

Deworming was done using an oral paste, three times every year and the

anthelmintic, changed every 2 years to avoid parasitic resistance.

Disinfectant were added to the tyre bath at least once weekly, depending on the weather condition. During heavy rainfall, the addition of disinfectants was more regular (Plate 13).



Plate 13. The two tyre bath (RIF and RQF) are constantly checked to ensure adequate disinfectant concentration is maintained at all times

5. Reproductive assessments

The routine placement of Iman's feces in Puntung's paddock (vice versa) was done each morning. The positive response is seen when Kretam shows increased in libido, which would normally coincide with increasing size of the follicles. Kretam was observed to display erections on the 5th and 29th May 2018. These incidences occurred inside his chute, during feeding. In addition, on 29th May 2018, Kretam mounted a soil outcrop inside his paddock, late in the evening (Plate 14).



Plate 14. Kretam climbing a mount inside the paddock

Iman's ovarian activities was almost static at the beginning of the month extending to almost the end of May 2018. During the routine ultrasound on 14th May 2018, there were very small follicles (<2mm) observed on the left and right ovaries (Plate 15).

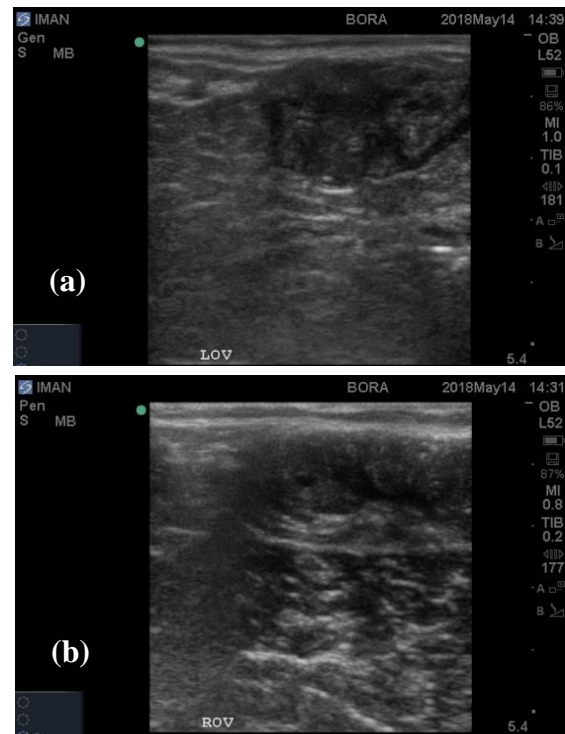


Plate 15. The left ovary (a) with a tiny follicle (< 2 mm diameter) and none on the right ovary (b)

On the 19th May 2018, the scan showed an increase in size of the follicle on the left ovary (3.5 mm diameter) and one 5 mm follicle was also observed on the right ovary (Plate 16).





Plate 16. The two left ovary (a) and the right ovary (b) showing the anechoic follicles

The rate of growth of the follicles is about 1 mm per day, starting from 14th May 2018, which is about the normal rate for the Sumatran rhinoceros. With Iman, the folliculogenesis is not normal due to the presence of pathology, particularly leiomyomata.

Subsequently, the ultrasound carried out on the 29th May 2018, showed an increase in size of the follicles on the left ovary. Two round follicles were observed – a 7.7 mm and 5.6 mm diameter.

However, there were no follicles observed on the right ovary but it seem to have more blood vessels (anechoic circular or elongated structures) which was observed in previous images since 2017 (Plate 17).

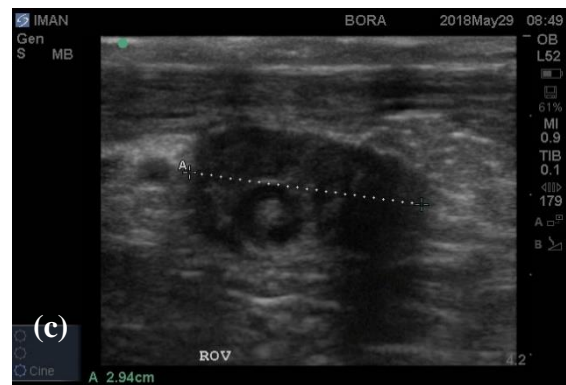


Plate 17. The two follicles on the left ovary (a and b). The right ovary (c) is void of follicle but presented with anechoic structures of the blood vessels

