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

April 2018

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Marikus Suyat (Rhino Keeper – RIF)
4. Samat Gubin (Rhino Keeper – RIF)
5. Ronald Jummy (Rhino Keeper - RQF)
6. Rasaman Jaya (Rhino Keeper - RQF)

* 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 rain in April falls more frequently in the late afternoon with blazing heat from late morning until about 1500H. This alters the behavior of the rhinos, especially Kretam who would come quite late into the night stall for his second meal (dinner) due to the intense heat. He would remain in the wallow until late afternoon. The total rainfall in April 2018 was 476 mm (21 total rain days) as compared to 453 mm in March 2018 (11 rain days) and 321 mm in February 2018 (10 rain days).

The frequent rainfall ensures good supply of rhino food plants and young saplings. The heat also affected the storage of foliage in the food stall and many, including some ficus species and Ludai (*Balakata baccatum*) wilted quite badly despite being watered frequently. Such poor quality was rejected by the rhinos, especially Kretam.

The heavy rainfall does affect Iman's wallow, situated at the bottom of the slope. The wallow was used by Iman for almost four months and had expanded to almost twice the original size, towards the fence. Sand bags had to be used to prevent the wallow from collapsing the fence (Plate 1).

Plate 1. The sand bags were placed next to the fence to prevent Iman from expanding further

Iman and Kretam has problem with cracked hoof on the hind legs. Iman still has infrequent discharge from her vagina but are usually pale white – yellow color and of mucoid consistency. These were sometimes observed in her wallow or after defecation inside the night stall. She was scanned 1 – 2 times a week to monitor her estrus and status of her reproductive pathology. Her feces were placed inside Puntung's paddock to provoke Kretam's breeding response.

1.2 Body Weight

Both the rhinos were weighed routinely using the TruTest® electronic weighing scale. Kretam was weighed, once in the middle of the month and once at the end of the month. Iman was routinely weighed once a week. This allows monitoring of her body condition to avoid potential bleeding if she becomes overweight. Iman's weight is maintained at between 520 – 530 kg. Kretam is maintained at around 670 kg to reduce the impact on his healing hoof cracks. In April, the average weight of Iman and Kretam is 523 kg and 670 kg respectively (Figure 1).

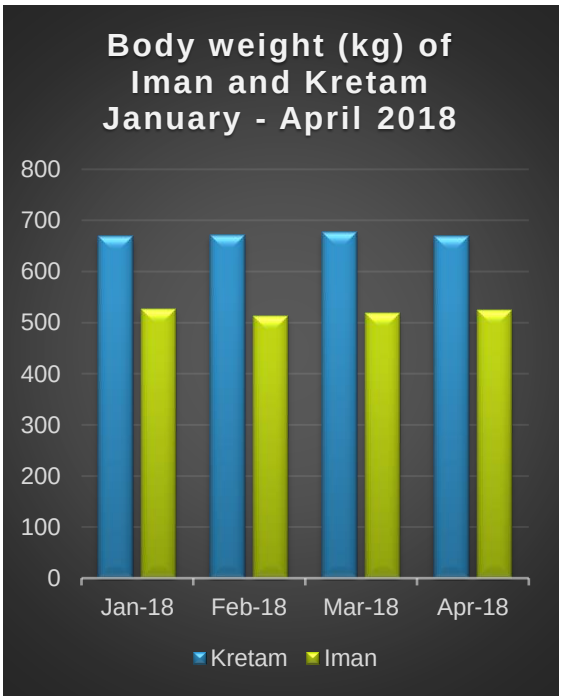

Figure 1. The bodyweights of rhinos In Tabin Wildlife Reserve (January – April 2018)

It was observed that Iman would bleed when the amount of forage was increased to 15 kilograms per feeding session. It was also noticed that when her body weight was above 540 kilograms, she would also bleed more frequently. Iman's body weight fluctuated in February 2018 (506 – 516 kg) gradually increased in March 2018 (508 – 522 kg) and maintained at around 523 kg in April 2018 (Figure 2).

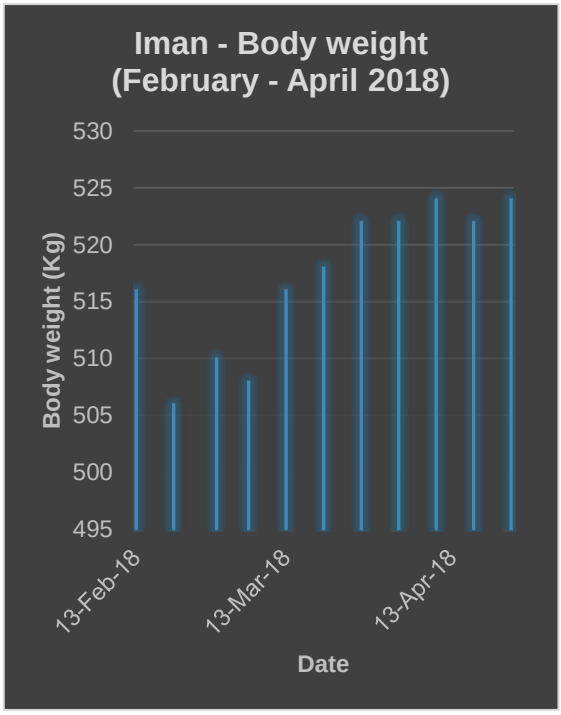

Figure 2. Iman's bodyweight showing the gradual increase in March 2018 and stabilizing in April 2018

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). Kretam's bodyweight was reduced to offset his hooves problem, comprising of cracks and chippings. In April 2018, due to the hot afternoon, Kretam would come back quite late for his second hand – feeding. Most of his time is spent inside the wallow. Iman came back on time for all her feedings. Her body weight is maintained at under 530 kg to avoid undue stress on the leiomyomata and other associated uterine pathologies. We observed that too much bulk from the forage could result in bleeding. Iman is currently being treated for hoof cracks.

In early April 2018, Kretam was observed to be excitable and mounted the log or mud – mount in his paddock on several occasions. This is in response to the daily placement of fecal materials from Iman inside his Puntung's paddock adjacent to his.

All hoof cracks healed with new dermal lamellae. The more recent crack observed in March is still being treated and will heal soon.

The routine monthly sampling for health checks were carried out for both rhinos on the 16th April 2018 (Monday) and submitted to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepayan, Kota Kinabalu on the 17th April 2018, before noon.

The soil sampling were carried out around 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. Floor swabs were taken at random locations inside the night stalls, focusing in areas where water accumulates after washing or heavy rain. Blood, urine and fecal samples were also collected from the rhinos for complete blood count, bacteriology and parasitic counts. Water from all the water tanks were sampled for coliform counts, particularly *E.coli*. Water sample from the Lipad River was also examined from time to time for contamination with pathogenic bacteria.

2.1 *Kretam*

a. Deformity of posterior horn

The posterior horn was worn off due to is constant rubbing on the door handle. It is still being treated. In general, the horn matrix has increased in height but the growth is uneven as he frequently rubs the horns on objects around the exercise yard and night stall. Treatment consisted of Povidone (Septidine®), applied on the inner part of the horn. The oral supplementation with Hoofmaker TRM® (20 grams) powder, reconstituted to become a paste. The horn matrix has grown vertically and showed good progress. However, a depression can be seen in the middle of the horn. (Plate 2).

Plate 2. The posterior horn with the middle depression (arrow)

The plan is to seal the depression with a dental acrylic or similar compound (eg. Demotec 95 ®) so that water and mud do not stay in and soften the keratin matrix.

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 3 – a).

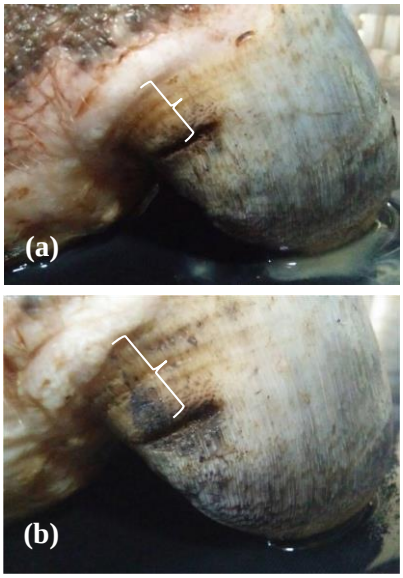

Plate 3 – a. The crack observed in March 2018 and (b) in April 2018. Note the growth lamella

Similarly, a chip or hole was seen on the same hoof in March 2018 but had been pushed to the distal tip in April 2018 (Plate 4).

Plate 4. The chipped parietal dermis slowly being pushed to the distal end of the hoof.

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

Similarly, the problem with hoof is also seen in Iman. Currently, the problem is seen on digit 1, left hind feet. A 1 cm irregular chipping was observed on the parietal dermis. It had chippings at the base, likely a traumatic injury sustained coming into the night stall (Plate 5).

Plate 5. The lesion on the first digit, left 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.

b. Reproductive tract pathologies

The vaginal discharge (from the uterus) is seldom seen as it is sometimes voided out inside the wallow and blended with the mud. Occasionally, a small amount of watery – mucoid discharge was observed inside the night stall, more often after defecation or urination. The color ranged from clear to whitish or yellowish (Plate 6).

Plate 6. The mucous discharge mixed with mud, observed inside the night stall

The last Improvac® (Gonadotrophin Releasing Factor) was administered on the 9th November 2017. This was followed by the 'near – death' bleeding from the leiomyomata in December 2017 – January 2018. She was subsequently treated for anemia, dehydration, infection and hemorrhage.

Ultrasonography in April 2018 showed a more severe uterine pathology as compared to 2017. This was performed on twice weekly to assess ovarian activities and status of her uterine pathologies. Most of the ultrasound were carried out in the morning. (Plate 7).

Plate 7. BORA Veterinarian performing ultrasonography on Iman as she is being fed in front

The uterine pathologies were similar to previous year but had increased in intensity, size and number. The leiomyomas also displaced the ovaries when compared to the images before December 2017.

There were some calcific changes (bright spots) 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 (Plate 8).

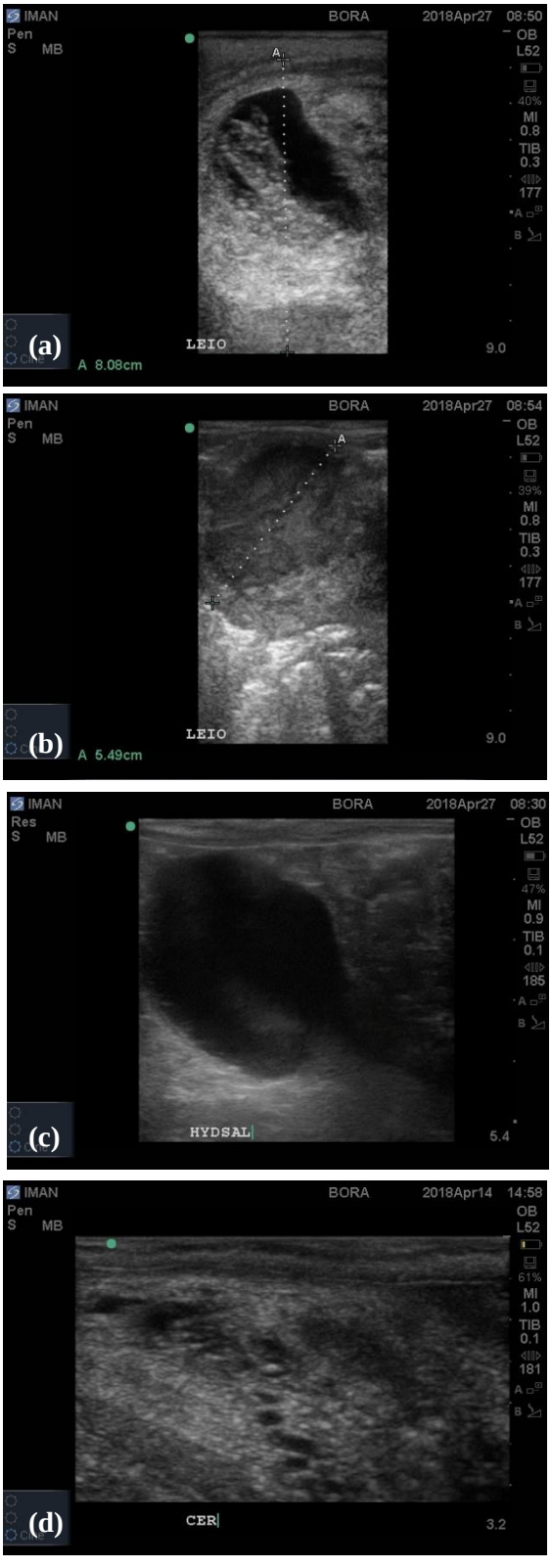

Plate 8. (a) a large leiomyoma with a thick capsule and large amount of fluids (b) a leiomyoma with solid inner mass (c) hydrosalpinx inside the right oviduct and (d) several cysts inside the cervix

3. Feed and feeding

The amount and variety of food gathered from the reserve is adequate to meet the daily demands of the two rhinoceros. A few new food plants, particularly the creeping fig trees (Ara Lipan) are being added to the lists of edible rhino food plants.

All food plants were collected, separated between species, washed and stacked in a store. Prior to hand – feeding, the foliage will be weighed before and after feeding (Plate 9).

Plate 9. The foliage is weighed before being fed to the rhinos.

3.1 Forages

In April 2018, the total amount collected for the two rhinos 3352 kilograms, 64% of this was allocated for Kretam and the rest for Iman. The total amount consumed (hand fed and hung out for night feeding) was 2069 kg or about 62%.

The most common foliage fed daily is Nangka (*Artocarpus heterophylus*), Putih Sebelah (*Leucosyke capitellata*), Maitap (*Neonauclea spp*), 3 – 4 Ficus species and Kelawit (*Uncaria spp*).

3.2 Voluntary Feed Intake (VFI)

The feed intake of Iman and Kretam were maintained to a daily maximum of about 20 and 36 kg respectively. Iman came back for both her morning and evening feedings (2x 30 days). She gets between 9 – 10 kilograms for each feeding, comprising of about 16 species. Her appetite remains excellent. Iman consumed about 30% (4.5 kg daily) of the foliage hung out for her each evening. She consumed between 18 – 22 kg of foliage per hand – feeding. Her average daily feed intake in April 2018 is 25 kg.

Kretam came back for 29 mornings and 28 evenings. In total he consumed 1318.5 kg for April 2018. His average daily feed intake is 35.5 kg (hand – feeding) and 8.5 kg (foliage hung out). Kretam consumed about 42% of the foliage hung out as compared to 29% for Iman (Figure 3).

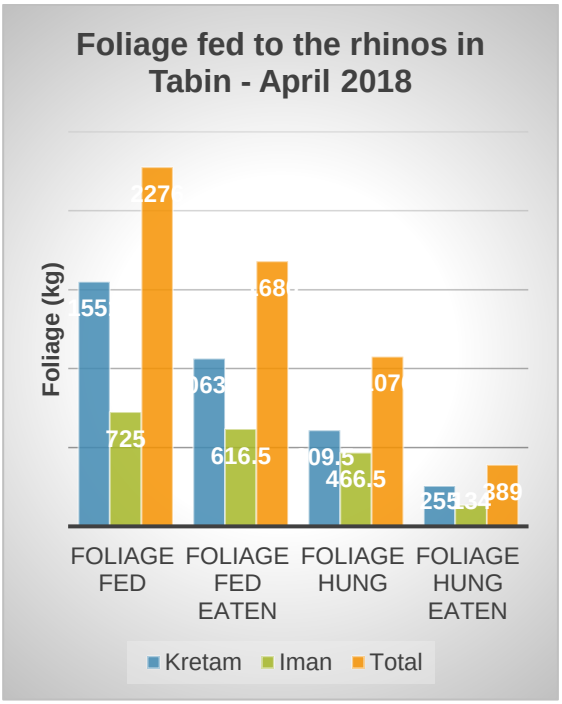

Figure 3. Foliage consumed by the two rhinos in Tabin

The consumption of foliage hung out for Kretam varies from 3.5 - 13.5 kg from a total of 20 kg. The factors ranged from his mood, time he is released back, amount of food he consumed via hand – feeding and species of forage. On some days, he would finish a whole bundle of *Merremia spp* and *Leucosyke capitellata* but on other days, only a few twigs were eaten (Plate 10).

Plate 10. Justine hanging out food in Kretam's paddock

Iman and Kretam gets various fruits daily, consisting of banana, papaya, pumpkin, mango and *cempedak*. The latter would depend on season. Half of these were fed in the morning and the remaining in the afternoon or evening. The most common fruits fed include banana (300 kg/month) and papaya (56 kg/month).

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.

4. Biosecurity/health monitoring

The biosecurity measures were in place to prevent any disease introduction from outside sources. These also 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. ensuring the rhinos gets adequate nutrition and are not stressed. Apart from good hygiene, regular checks are necessary to ensure pathogens are absent in and around the rhinos. Tyre and foot bath are provided and maintained (disinfectant) at crucial locations to prevent this.

After collection, the foliage was rinse down with water and segregated into species. They were washed once more and stacked under shade inside the store. Fruits were also washed before feeding the rhinos.

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 bacterial contamination, 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 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 dailyscrubbing of is a compulsory daily routine.

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 2018.

Parameters	Animal (Kretam)	
	14 Feb	18 April
Hemoparasites	Nil	Nil
RBC (X10^12/L)	6.66	5.8
WBC (1000/UL)	6.05	7.04
Hb (G/DL)	14.1	14.2
PCV (%)	40	40
Seg. Neutrophils (%)	76	67
Eosinophils (%)	17	23
Lymphocytes (%)	5	9
Monocytes (%)	2	1
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

Results for the floor swabs showed *Bacillus spp* in swabs 1, 2, 5 – 13, 15, 16 and 20. Floor swabs 3, 4, 14 and 18 were positive for *Acinetobacter sp*. Floor swab 17 was positive for *Bacillus sp* and *E.coli*. Floor swab 19 was positive for *Alcaligenes faecalis*.

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*.

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 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	*E.coli*
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.

The horse pellets had high total bacteria count, low *E.coli* counts and negative for Salmonella

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.

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.

5. Reproductive assessments

The routine placement of Iman's feces in Puntung's paddock was done each morning. The positive response is seen when Kretam shows increased in libido. He would climb dead logs or soil mounts inside his paddock and not come back for his food. He would often have erections while inside the chute.

On the 1st, 2nd and 4th April, Kretam was observed to mount a dead log in the middle section of his paddock. On the 4th April he did not return for his evening food (Plate 11).

Plate 11. Kretam mounting a small soil outcrop