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

February 2017

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. Joseph Stimon (Rhino Keeper - RIF)
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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.	Puntung	Female	SWD 003
3.	Iman	Female	SWD 004

1. Introduction

It rained almost every day during the last two weeks of February, mostly in the afternoon. Roads and path were constantly wet and many places muddy. Although rainfall was less, the total rainfall during the last two weeks was much higher than the previous months. The total rainfall days was 17 compared to 23 in January 2017.

The total rainfall for February 2017 is 479 mm and ranged from 1 – 98 mm per day (Ladang Tungku, KL – Kepong, Rainfall Data).

The first two weeks had low rainfall as compared to Week 3 and 4 (Figure 1).

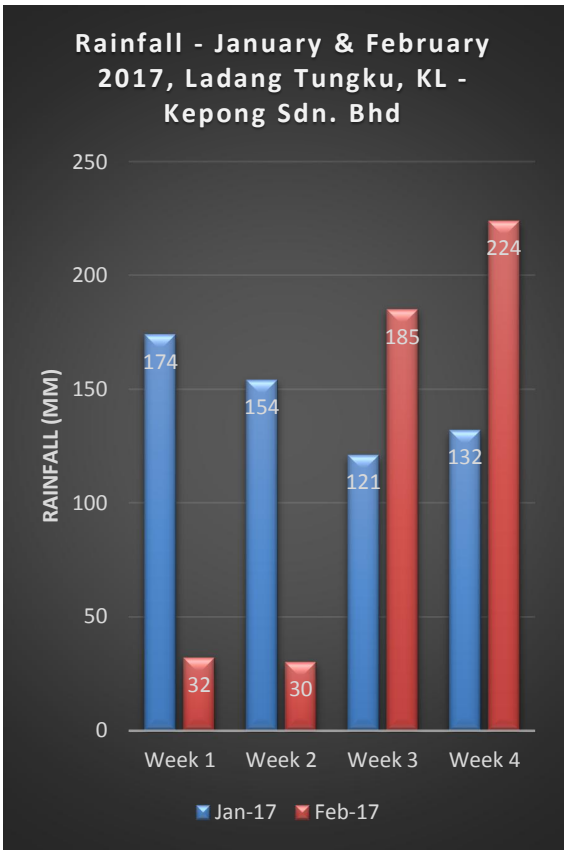

Figure 1. Weekly rainfall total (mm) for January – February 2017.

During the heavy rain, the water level at Lipad River rose about a meter but never reached the bridge as seen in 2014 and 2015. Many water run offs were also seen along and across the main Tabin road and those towards the core area. The Lipad – Urit road was also badly damaged and impassable to vehicles.

Many roads damaged due to the rain, required repairs to patch up holes and create more drainage. Apart from river rocks, old hardened cement blocks were also used for the repairs (Plate 1a and b).

Plate 1. Collecting the cement blocks (a) and (b) filling up the damaged road

Fortunately, there were no water disruptions in February 2017, despite the heavy rainfall.

Apart from Puntung, Kretam and Iman are in good condition. Puntung has a swelling on her left cheek and is being treated. The cause is probably traumatic. The Voluntary Feed Intake for Iman and Kretam are within the normal range. The vaginal discharge was only observed once on 7th February 2017 and without any signs of bleeding from her uterus.

Staff meeting with the section heads was held at least once a week. The main objective is to get the most current updates and to resolve problems associated with management of rhinos and maintenance of the facilities.

Filming of the rhinos by Happy Camper Production was carried out on the 4th - 5th February 2017.

2. Husbandry

2.1 Animal Management

Based on the feed intake, age, fitness and general health, the body score of all three rhinos is around 3.0. However, Kretam and Iman has a body score of slightly over 3.0.

Puntung had several issues ranging from abrasions to leech bites. In November – December 2016, she had a problem of not being able to cut the coarse part or stem of her food. However, the problem was not considered serious and did not affect her mastication and feed intake.

On the 23rd February 2017, Puntung was observed to have asymmetrical left cheek, a swelling anterior and ventral to the eye. The swelling was irregularly rounded. She was unable to open her left eye fully due to the lesion. A tentative diagnosis include external trauma, insect or centipede sting, ulcer or injuries to her buccal pouch. She is currently being treated with anti-inflammatory and antibiotics.

Iman had only one incidence of mucous discharge from her uterus. However, no treatment was administered.

Kretam was observed to interact on many occasions with Puntung even when she was not in estrus. The interactions occurred mostly in the forest on either side of the fence.

In February 2017, Puntung did not come back to the night stall for several times, especially with the current swelling on her left cheek. She only comes back for the evening feedings. The medication comprising of anti-inflammatory and antibiotics were given to her either in the night stall or inside her paddock. These were placed inside banana or papaya and hand fed to her.

She spends most of her time inside the wallow, coming out to defecate or occasionally return to the night stall. The mud from the wallow does sooth the swelling on her cheek. In addition, Tabanids or biting flies were many and does contribute to one of the reason for her not coming out of the wallow.

The old wallow was reactivated again by Puntung after the keepers drained the two pools of urine (Plate 3 and 4). It is now larger and with excellent quality mud. She frequently scraped mud from the wall of th wallow and churned it.

Plate 3. Two urine pools observed in Puntung's wallow in January 2017. They were subsequently drained off.

Plate 4. Puntung reuse the abandoned wallow after clean-up operation

The only time Kretam did not come back was when he was mounting a small soil outcrop in his paddock. This occurred on the 21st February 2017, at 1700H (Plate 5).

Plate 5. Kretam is seen mounting the lump of soil near a stream, 20 meters from his night stall.

This behavior is occasionally seen with Kretam. Sometimes it does correlate with Puntung coming in estrus.

Iman came back on all 28 days, once in the morning and once in the afternoon. She seemed very happy and vocalized constantly, even while being fed in her chute. In January – February 2017, she created a few more shallow wallows. For some reason, she loves to construct wallows, even in the past, when she was at the Rhino Interim Facility, in 2014.

She treated the night stall as her permanent toilet and never fails to defecate every time she is in. It is always important for the keepers to ensure the sliding door is open for her in the morning.

2.2 Body Weight

The three rhinos (and keepers), were weighed using a TruTest® electronic weighing scale, at least twice a month. Puntung was weighed three times in February 2017 as she did not come back for "hand – feeding" on six occasions. Iman was weighed every week due to her inconsistent body weight. It is a routine that each rhino is cleaned to remove the mud cakes before weighing. Alternatively, the mud were gently scraped off the rhino using a rubber scrapper or a piece of wood. The amount of mud on the rhino sometimes weigh as much as 5 kilograms. In case of Iman, a small amount of mud was left on her, otherwise she gets annoyed and would refuse to re – enter the chute afterwards. Prior to weighing, the TruTest® the keeper(s) would weigh themselves to ensure that the weighing scale is accurate. All rhinos were weighed at least twice before taking the average reading.

The two load bars and a wooden platform were placed horizontally inside the chute or along the passageway in the night stall. The rhinos were coaxed or baited using fruits.

The bodyweights of all rhinos increased as compared to January 2017. Kretam's body weight increased by 13.5 kg while Iman increased by 12 kilograms. The body weight of Puntung remained the same (Figure 2).

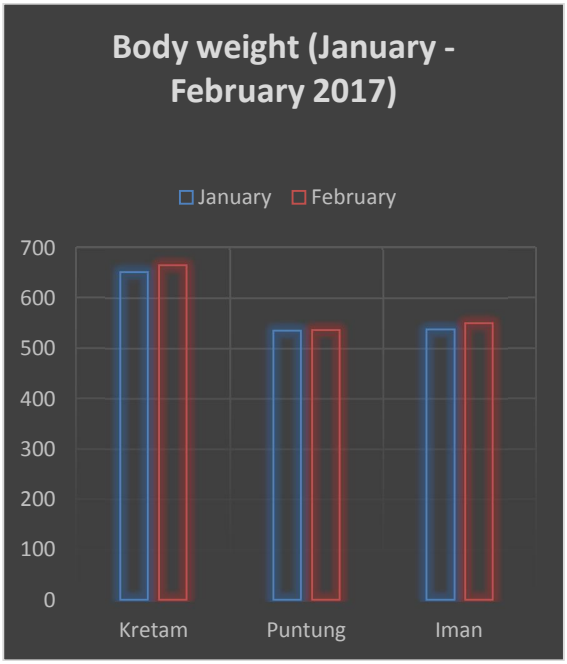

Figure 2. The body weights of all the rhinos (January - February 2017)

Despite Puntung not returning back on six occasions, she was observed to consume various foliage inside her 2.5 acre paddock. This include a creeper, locally referred to as *Pisang – pisang* (Plate 6).

Plate 6. *Pisang – pisang* eaten by Puntung

Iman's body weight in February 2017, averaged 551.5 kg, as compared to 539.5 kg in January 2017. Although the weight fluctuated, but it needed to be reduced to around 530 – 540 kg (Figure 3).

Figure 3. Iman's body weight (kg) fluctuations for the month of January and February 2017

2.3 Animal Health

Generally, all the rhinos are in excellent body condition and two are slightly overweight. The wet weather did provide abundant, lush food for the rhinos, both from the surrounding Tabin forest and BORA's food plantation.

The common problems includes abrasions, bites from *Tabanids* and leeches. The hoof chippings has not resolved and being treated. Iman had one occasion of mucous discharge but it was not serious and untreated. Puntung had a swelling on her left cheek and was treated with antibiotics and anti – inflammatory. She is currently under observation. Her other parameters are normal except coming back for both morning and evening feedings. She would come back once daily. This is more likely related to her discomfort because of the lesion, the larger amount of biting flies (she has more slow flowing streams in her paddock that's good breeding ground for Tabanids) and her coming into estrus.

The routine screening of rhinos and their surroundings were carried out on the 13th February 2017. Apart from one water tank (No. 6) with high coliform count, the other checks did not reveal any new treats or impending diseases in the rhinos or keepers. However, the cleanliness and biosecurity of the surroundings around the rhino enclosures were always maintained.

The Voluntary Feed Intake (VFI) for all the rhinos were within normal range. The minimum browse offered (hand fed) to the male and female were 18 and 15 kg respectively. The percentage of browse eaten as compared to the amount offered is 65%.

Puntung was also hand fed inside the paddock a few times as she refused to return for her routine feedings (Plate 7).

Plate 7. Samat Gubin feeding Puntung in her paddock

2.3.1 *Kretam*

a. Hoof chipping

The problem with his hoof was resolved with similar treatment regime as for Iman. The use of Stockholm tar on the affected area and supplementation with 10 grams of oral biotin supplement (Hoofmaker TM®) was very effective.

b. Skin neoplasia (warts)

Recent observation showed that the number of skin tumour (sarcoid or melanoma) had increased in Kretam. In my opinion, this is more age related and surgical removal or treatment at this moment is not necessary or going to be effective in a long run. As it is the tumors are not causing any pain or interfering with his normal lifestyle. They are mainly located around the folds and neck (Plate 8a and b).

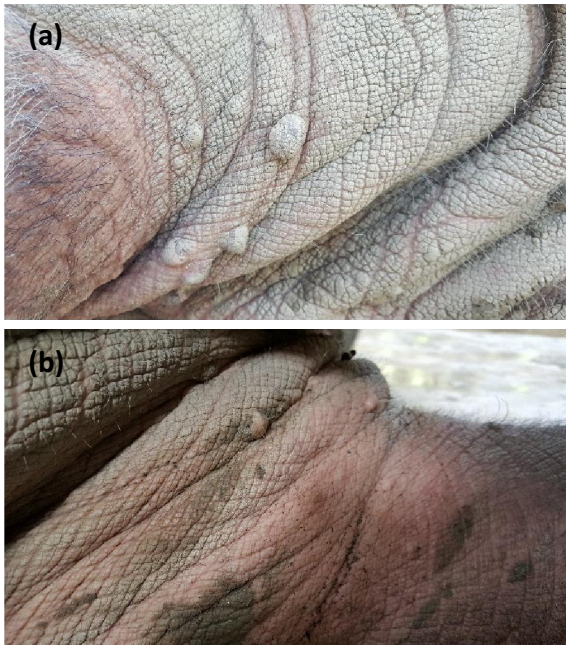

Plate 8. The warts around the hind legs (a) and (b) the neck

It would be interesting to do a biopsy of the neoplasia and investigate its causes, type and possible treatment.

2.3.2 *Puntung*

a. Biting flies

The amount of biting flies in her paddock is more as compared to the other two rhinos. The main reason for this, is the many slow moving streams which are potentially good breeding grounds for Tabanids. The rainy season does increase more wet areas within her paddock which are excellent breeding site for biting flies as the larvae needed such environment to further its life cycle. The bite sites often bleeds and are painful. This is one reason rhinos prefer to remain inside the wallow for long periods and only come back in the later part of the day. There are several species that were observed on the rhino (Plate 9).

Plate 9. The four species of biting flies observed on Puntung inside her paddock.

It would be certainly worthwhile to study the breeding grounds of these biting flies and possibly develop a prophylactic measure to reduce their numbers.

b. Reproductive tract pathology

The routine ultrasonography and blood collection were carried out to establish data base for her reproductive parameters. Simultaneously, her pathology was also monitored using the ultrasound. The cysts, both unilocular and multilocular cysts were visible. Fibrosis were also observed at two locations in the uterus. The elongated fluid filled cavity, about 0.5 cm diameter was also seen in the cervix (Plate 10).

Plate 10. Uterine cysts and cervical cyst (c)

c. Abrasion

The abrasion was always at the perineum and tail base. This is due to rubbing against rough objects. The cause could range from biting insects or some localized allergy. The abrasion usually would heal without treatment (Plate 11).

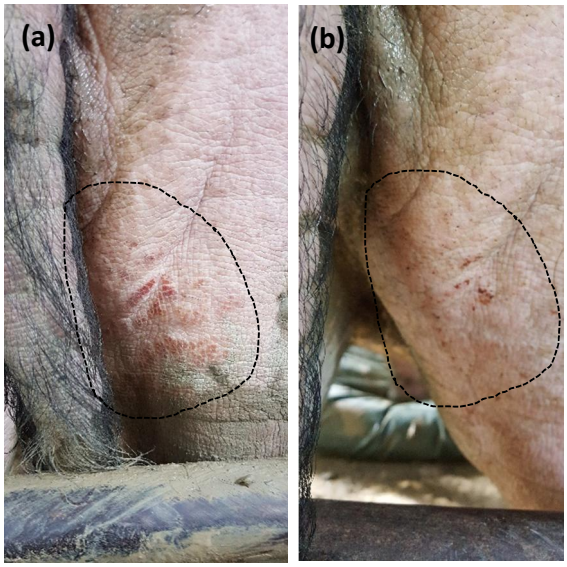

Plate 11. (a) The abrasion at the perineum and (b) two days later

d. Leech bite

Another common injury that is sustained by Puntung is leech bite. The common areas include the neck and inner surface of the thigh. Although this is not severe on the skin but could cause blindness when it involved the inner surface or the third eyelid of the eye. This manifestation was observed in Gelogob.

The leech bite would normally still be oozing blood after three days and could get very irritating to the rhino (Plate 12).

Plate 12. The leech bite and blood oozing down the upper snout (arrow)

e. Facial swelling

In the last few months, Puntung had a problem of not being able to cut or chew off the hard part of the stem. This was associated with some molars and premolars that were worn off on her left cheek, more likely age related.

On the 23 February 2017, a 5 cm swelling was observed on her left cheek, anterior ventral to her left eye. The swelling was irregularly rounded and hard and made her eye looked smaller. The swelling was warm as compared to the opposite cheek. Puntung was also in pain and would refused to eat the normal amount of browse fed to her. She would rubbed the area against lianas or even a tree. The lesion was also redder than the surrounding area (Plate 13).

Plate 13. The swelling is located anterior to the eye, above the mouth (arrows)

Blood was also seen on the floor of her chute and on some food plants that she rejected during hand feeding (Plate 14).

Plate 13. Blood found on the rejected leaves

It was concluded that the injury or lesion occurred from the buccal cavity and developed into an abscess. The swelling or abscess was visible from outside.

She was put on anti – inflammatory flunixin meglumine (Banamine® granules) and an oral antibacterial Amoxicillin and Clavulanate potassium (Augmentin ™) for five consecutive days.

The animal was monitored in the morning and evening. Her ABU (appetite, bowel and urine were closely monitored. She showed lots of signs of pain and discomfort and spent long hours inside the wallow.

On several occasions, she refused to come back for "hand – feeding" inside the night stall. During those days, food were brought out into the paddock and fed to her. Some of the foliage were also hung on the trees.

The abscess will be lanced and drained once it is soft and ready, most likely early March 2017.

2.3.3. *Iman*

a. Vaginal discharge

The discharge was only seen on one occasion on February 7th, 2017. The discharge was about 10 – 15 mls, yellowish white in colour and watery (Plate 14).

Plate 14. The vaginal discharge observed in the night stall

No treatment was administered. Her next Improvac® (GnRF protein conjugate) vaccination is due in March – April 2017. However, this will depend on her next ovum pick – up (OPU) date.

b. Reproductive tract pathology

The overall condition of her reproductive tract is good with less fluids (and blood), hence not much discharge. However, the pathology remained. The few leiomyomas could be seen more clearly, with less fluids in the uterus. The hydrosalpinx (3.2x4.3 cm), despite previous aspiration is still visible. Cysts of various sizes are numerous. The annular folds of the cervix is not clearly defined as in Puntung. This could be due to the more edematous cervix in Iman. The cranial part of the cervix showed an anechoic structure (1x0.4 cm) of fluid accumulation (Plate 15).

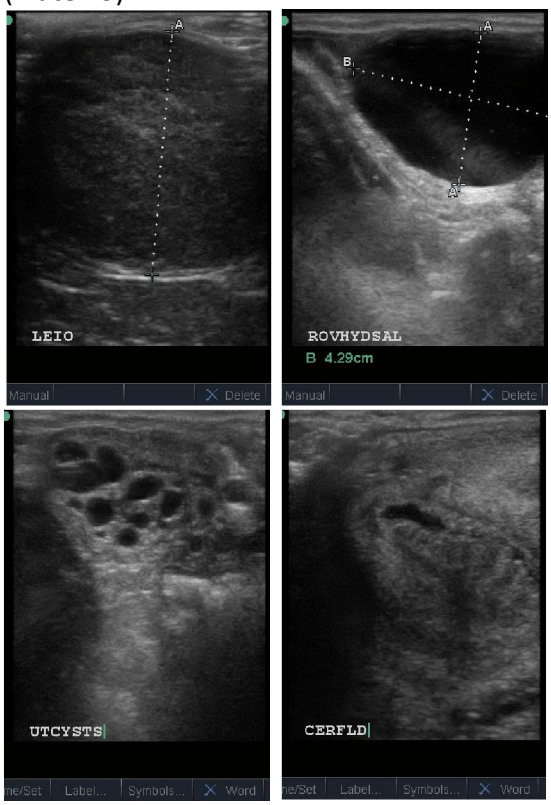

Plate 15. Clockwise (1) Leiomyoma in the uterus (2) Hydrosalpinx in the right oviduct (3) Cysts in the uterus and (4) Fluid in the cervix

3. Feed and feeding

My worry in February 2017 is the increasing body weight, especially Puntung and Iman, despite some effort (including halving the amount of horse pellets supplemented) to bring it down.

The appetite of all three rhinos were excellent. They would finish the set minimum amount at each feeding that is, 15 kg browse for females and 18 kg for Kretam, the bull. However, Puntung's appetite reduced when she had the abscess on her cheek. She did not returned for her feedings on six occasions.

Water is provided ad libitum for the rhinos during the hand – feeding. This is mixed with vitamin – mineral supplements. The supply of water in the paddocks is numerous, especially during the wet month of February. Most of the streams are constantly flowing. Some new species of browse were recorded. One new *Ficus spp* was found during their browse gathering. Others were observed eaten by Puntung when she was in her paddock.

The browse collected were of good quality and volume. The browse inside the RFP wre also harvested to maintained quality and prevent the trees from growing too tall. Most of the *Nangka* (*Artocarpus heterophylus*) browse were obtained from the plantation. The total amount of browse collected in February 2017 is 4975 kilograms. Sixty five percent of these are consumed by the rhinos. Of the total, 27% were hung in the paddock or night stall for night feeding. Of these, the amount eaten (40%) were not much. The daily average for Kretam, Puntung and Iman were 9 kg, 5 kg and 5 kg respectively.

3.1 Voluntary Feed Intake (VFI)

The VFI were based on the amount that was hand fed and those that were hung out in the paddocks or night stall for night feeding. The browse offered during "breakfast" and early "dinner" comprised most of the bulk of food collected from the wildlife reserve and Rhino Food Plantation. In February 2017, this amounted to 4975 kg. The amount and species varies between months of year depending on the weather and special request when a rhino is unwell. Usually, Grade 1 species (Ara manga, Gatal piring, Tambirok etc) are collected when an animal is sick or there is a need to increase the feed intake. On a normal day, all grades (1 – 4) were collected depending on ease of locating them and availability.

In February 2017, the total amount of foliage collected for hand – feeding and those that are hung in the paddocks for Kretam, Puntung and Iman totaled 1946, 1420.5 and 1608.5 kilograms respectively. The percentage consumed by the rhinos averaged 63.6% (60.8 – 66.1%; SD= 2.7). This does not take into consideration, the browse that was fed upon while inside the paddock for almost 20 hours every day. Puntung was observed to consume more browse as compared to the amount of browse offered to her. This could be due to the more selective good quality browse that was offered due to her mastication problem. However, the total amount of food consumed was highest in Kretam (1245.5 kg), followed by Iman (978 kg) and Puntung (939 kg). The total amount of browse eaten as compared to the amount offered was 63.6%. Kretam and Iman (Figure 4).

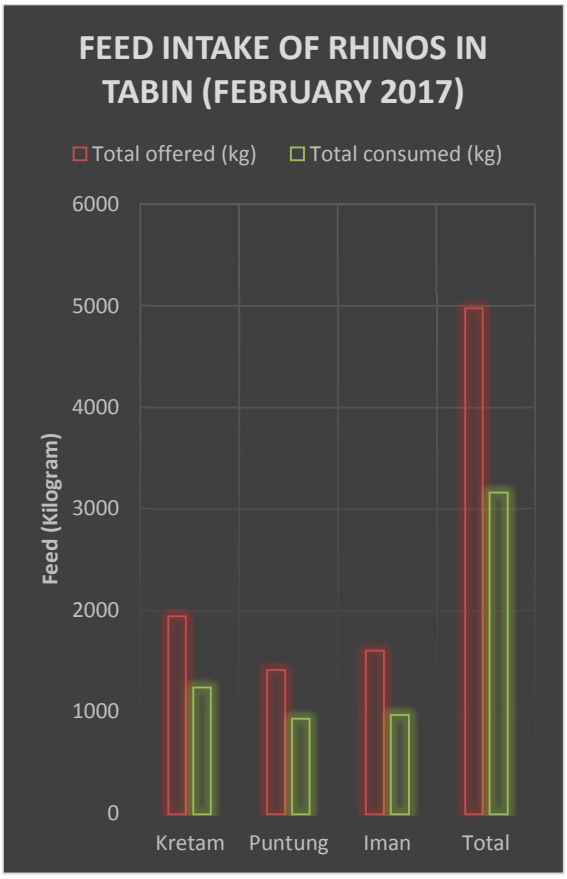

Figure 4. The amount of browse offered to the rhinos and eaten by each individual

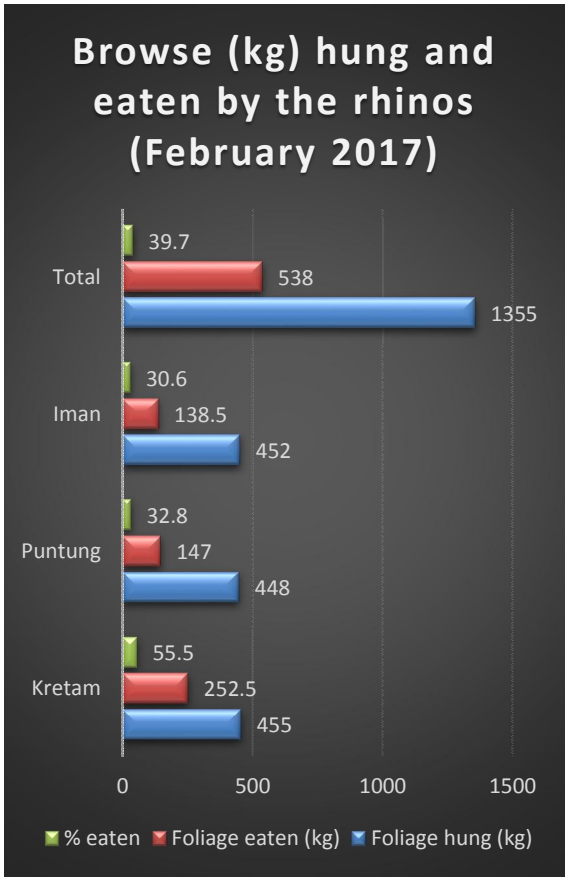

Figure 5. The amount of browse hung and eaten by the rhinos

The amount of browse that was hung inside the paddocks or in the night stall totaled 1355 kg. Of this, the amount consumed is almost 40% and about 60% is discarded. Once the browse is soiled with mud from the wallow, it's not eaten anymore. The rhinos would often put its head and neck into the browse while selecting the best parts to consumed. Sometimes it would just walk through the browse and soiling it further. Occasionally, for unknown reasons, the male would spray the browse with urine.

Kretam consumes 55.5% of the browse hung while Puntung and Iman consumes 32.8% and 30.6% respectively (Figure 5).

During hand – feeding, the VFI for Kertam, Puntung and Iman ranged from 17.5 – 46.5 kg, 6.5 – 36.5 kg and 28 – 31 kg respectively.

Puntung did not return for feeding on six occasions. This is due to her problem with a large abscess. However, it was observed that she does feed on the wild browse inside her paddock.

Supplementation with horse pellets (Gold coin®) is a routine. These were always given wet, that is, mixed with water and wrapped inside large leaves. Kretam and Iman received 500 grams of horse pellets daily while Puntung was given 400 grams. The amount given to Iman will be reduced to 400

grams in March 2017. Banana were the main bulk of fruits given to the rhinos, averaging five kilograms daily. Papaya were obtained and fed to the rhinos when it is in season. Papayas too were excellent medium when medications need to be given to the rhinos. Occasionally, mangoes and jackfruits were also given when in season. 400 – 500 grams of pumpkins (with seeds) were given daily as a supplement. The pumpkin skin were removed prior to feeding.

The number of browse species collected and fed to the rhinos ranged from 11 – 12 (average 12 species). The most common being the jackfruit (*Artocarpus heterophyllus*), Kelawit berbulu (*Uncaria spp*), Akar Sambang (*Merremia spp*) and a few *Ficus spp*.

Iman came back for all the feeding sessions (morning and afternoon). Kretam missed one evening feeding and as expected, Puntong did not come back for four times for her morning feeding and twice for her evening feed. However, In February 2017, Puntung was not well and spend most times in her wallow.

3.2 Rhino Food Plantation (RFP)

In the month of February 2017, the maintenance is high due to the rapid growth of weeds and the frequent flooding of some areas. The water logged areas does causes mortality of some plants especially those that are newly planted. Several small drains were dug out and deepened to increase the flow rate of rain water.

KL – Kepong Sdn. Bhd Plantation in Tabin provided a bull dozer and a driver to help built bigger drains inside the RFP. In addition, the bulldozer was also used to clear our composting site (Plate 16).

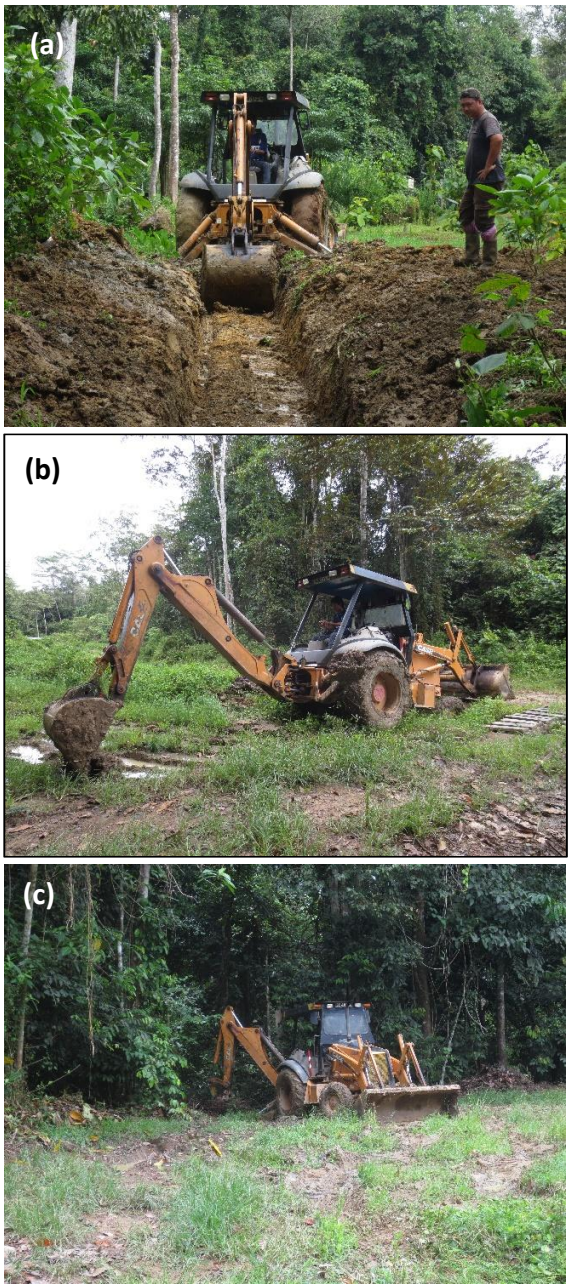

Plate 16. The Kl – Kepong bulldozer making drains (a), repairing a bridge (b) and clearing the composting site (c)

Similarly, cutting grass and removal of weeds is more frequent. It involved both inside and outside the RFP. This is to ensure that the "hot" wire is always at optimum level and that, elephants do not damage the fence (Plate 17).

Plate 17. Hasan Sani mowing the lawn in and outside the RFP fence

The bridge towards the composting site also required repairs and was done in house. Some of the fence were replaced dues to rust and damage (Plate 18).

Plate 18. Davidson replacing old fence with new ones

Although, many of the Grade 1 food plants (Mas Cotek, Tambirok and Ara Ajinomoto) were being propagated but has yet to be planted.

Biosecurity and health monitoring

February 2017, is also a wet month in Tabin with high rainfall and more challenges in biosecurity and maintenance.

The paths inside the paddocks were very muddy and smaller streams were seen flowing throughout the paddocks. New wallows were constructed by the rhinos as old wallows becomes more watery and unsuitable for them.

The sampling of soil, water, floor swabs and feed samples were carried out on the 13th February 2017. In addition, blood, urine, and feces from the three rhinos were also taken for health screening. These samples were send to the Kepayan Veterinary Diagnostic Laboratory in Kota Kinabalu before mid-day on the 14th February 2017. Serum samples were also collected and analyzed at the Pathology and Clinical Laboratory (M) Sdn. Bhd in Sandakan.

4.1. Hematology

Blood was only collected from Kretam as Puntung did not return from her wallow. The site for collection is from the digital plexus of the hind limb.

The blood parameters were within the normal values for the Sumatran rhinos in Tabin and reported previously in Sumatera. Hemoparasites were not detected in the blood samples (Table 1).

Table 1. Complete blood count (CBC) for Kretam (SWD 002)

Date/Parameters	Laboratory Results	
13/2/2017	Kretam	Puntung
Hemoparasites	Nil	
RBC (X10^12/L)	5.42	
WBC (1000/UL)	7.61	
Hb (G/DL)	11.8	
PCV (%)	40	
Seg. Neutrophils (%)	68	
Eosinophils (%)	15	
Lymphocytes (%)	12	
Monocytes (%)	5	
Basophils (%)	0	
Total protein (G/L)	82	
SGPT (ALT)(IU/L)	14	11
Urea (MMOL/L)	2.9	2.6
Serum iron (UMOL/L)		21.4

4.2 Bacteriology

The 20 floor swabs were taken from various location of all the rhino night stalls. Swab 1 and 20 had few *E.coli* and *Bacillus sp*. Swabs 2 – 6, 8 – 10 and 12 – 19 had few *Bacillus sp* while swabs 7 and 11 had few *E.coli*.

The two tyre baths had *Comamonas testosteroni*, a gram negative bacterium that can be found in soil, water and animals.

The 17 soil samples taken in areas surrounding and inside the rhino enclosures were negative for *Bukholderia pseudomallei*. Similarly, the wallows were negative for pathogens. The water from the sumps had few *Aeromonas hydrophilia/caviae*.

All water samples from the 13 tanks had a total bacteria counts of 196 – 1600 cfu/ml. The coliform counts ranged from 0 – 2400 cfu/ml. The *E. coli* colonies were found in tanks 2, 5, 6 and 9. The highest E.coli count was in tank 6. (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for February 2017.

Tank	Total bacteria	Total coliform	*E.coli*
1	196	0	0
2	1200	240	20
3	500	80	0
4	1400	2400	0
5	300	30	20
6	1300	1370	90
7	150	2400	0
8	1620	2400	0
9	300	60	10
10	1400	240	0
11	500	70	0
12	1200	2400	0
13	800	570	0

The water tanks were immediately chlorinated using a 1% chlorine solution at a rate of 1L/10000 liters water. This was carried out at night to ensure the minimum contact time of 30 minutes to kill the pathogens. The water from these tanks were only used the following day.

Abundant *E.coli* were isolated from the urine and feces of the rhinos. However, all rhinos were in good health and constantly being monitored for any signs of a disease.

4.3 Parasitology

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

4.4 Routine prophylaxis

Liming was carried out around the rhino enclosures and staff quarters, mostly sumps and dung piles. All disinfecting were done under the supervision of the head keeper. No liming was allowed inside the night stalls or areas that are too close to the rhinos.

5. Reproductive assessments

In February 2017, routine ultrasonography was not possible on Puntung (twice weekly), as a result of her not coming back regularly. This is due to the abscess on her left cheek. Blood was also taken from her, each time an ultrasonogrphic examination was carried out. These data were then correlated with the interactions with Kretam. Iman was also scanned once in February 2017.

5.1 Hormone profile

5.1.1 Puntung

The progesterone profile was lowest on the 3rd January 2017. Estrus was predicted somewhere between the 1st to 3rd January 2017. P4 was observed to increase on the 5th January 2017.

In February 2017, there were three interactions between Puntung and Kretam (5th, 13th and 21st). Estrus was predicted to be in early February 2017, with the corresponding estrus in early March 2017.

The progesterone profile was decending from 0.30 ng/ml from 17th February to 0.15 on the 24th February and again in March 2017. Behavioral interactions were observed on the 21st February 2017.

5.2 Ultrasonography

5.2.1 Puntung

On the 5th February 2017, there were no follicles observed on both the left and right ovaries. There was a 1.0 cm old luteinizing follicle on the left ovary. On the 17th February 2017, a small follicle was seen on the left ovary. Two follicles emerged on the 20th February 2017, measuring 0.38 and 0.44 cm diameter. By this time the luteinizing follicle was 0.78 cm diameter. These follicles grew to 0.7cm on the 22nd February 2017 and 1.2 cm on the 28th February 2017 (Plate 19)

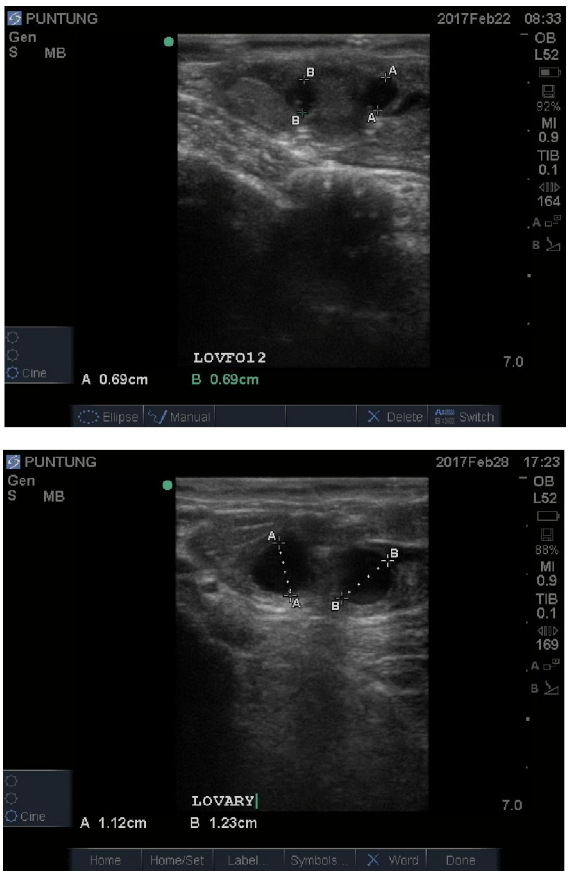

Plate 19. The follicles on the left ovary scanned on the 22 (above) and 28 (below) February 2017

5.2.2 Iman

Iman had a 1.1 cm luteinizing follicle and a 1.0 cm follicle on her left ovary. On her right ovary, 2 – 3 follicles were observed, measuring 0.5 – 1.2 cm diameter.

5.3 Behavioral estrus

The interactions between Puntung and Kretam were observed on three occasions (5th, 13th and 21st February 2017). The one that correlated to estrus was on the 5th February 2017. This occurred inside the forested paddock, about 200 meters from the night stall (Plate 20).

Plate 20. Kretam (right) and Puntung (left) interacting in – between the fence

These interactions can last for two hours and damage to many small vegetation were also visible. During their interactions, the activities included vocalization, scrapping the ground and urine spraying by the bull (Plate 21).

Plate 21. Kretam spraying urine into Puntung's paddock

In some occasion, Kretam was observed to climb an earth mount inside his paddock. Subsequently he would missed one hand – feeding period (Plate 22).

Plate 21. Kretam mounting an earth outcrop inside his paddock after interacting with Puntung

6. Electric fencing

The voltage of all the fences ranged from 6.5 – 10.2 kV throughout the month. The RIF, RQF and RFP recorded 8.9 – 10.2, 9.1 – 9.5 and 6.5 – 9.3 kV respectively. The fence were checked regularly.

The common problems were related to falling branches and leaves. The checks were done regularly, especially prior to releasing the rhinos back into the paddocks. All torn black shade nettings were replaced. The more recent problem was related to the damaged energizer at the Rhino Food Plantation. The voltage is sometimes low at 6500 volts and fluctuated throughout the day. It will be sent for repair soon.

Fresh elephant tracks were seen just outside the RQF fence. This occurred after a rainy day (Plate 22).

Plate 22. Mr. Yap standing beside some elephant tracks. Inset: an elephant track

7. Other activities

7.1 Leaking into Puntung's night stall

In February 2017, many areas inside the paddocks were soggy and water became difficult to drain. Some of these water does flow into the night stall and sand bags were used to resolve the problem.

The zinc roofing of Puntung's night stall was leaking badly due to the heavy rain and numerous holes in the zinc sheets. The leak caused building up of water puddles and water logged areas (Plate 23).

Plate 23. The poor quality zinc sheets with numerous holes (a) and (b), the puddles in her night stall

7.2 Replacement of rusty electric fence in the Rhino Interim Facility

Inspection of the high tensile electric wires were carried out in February 2017. Several sections of the electric fence, especially the "looping" wires and extensions were found to be rusty. This could result in reduction of voltage and ultimately short circuiting. The rusty wires were subsequently replaced with new wires (Plate 24).

Plate 24. Samat Gubin replacing the rusty electric fence wires in RIF

7.3 Resurfacing soggy grounds in Kretam's paddock

The rain caused some areas in Kretam's exercise yard to stagnate water and mud. When it rained heavy, the mud and soil would also enter the night stall and contaminate the floor and chute. The mud and soggy soil were removed and replaced with dry soil and sand (Plate 25).

Plate 25. Joseph and Justine removing the muddy soil in from of Kretam's night stall

7.4. Patching road to RIF and RQF

The rain also created patches of holes and water in some parts of the road towards the paddocks. Apart from creating drainage, roacks from the Lipad River were collected and used to patch up holes and water logged sections of the road (Plate 26).

Plate 26 Collecting rocks from Lipad River (above) and patching the road (below)

7.5 Workshop on reviewing Tabin management Plan

This one – day workshop was held at the office of the Sabah Forestry Department, Lahad Datu on 23rd February 2017. BORA was represented by the Project Manager and his assistant. Other organizations included the Sabah Wildlife Department, adjacent plantations (FELDA and KL – Kepong sdn Bhd), Kampung Dagat village head, Orang Utan UK Appeal, Borneo Sunbear Conservation Center and the Tabin Wildlife Resort.