

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

**April 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)
7. 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.	Puntung	Female	SWD 003
3.	Iman	Female	SWD 004

**1. Introduction**

Since January, the number of rainy days did not fluctuate much. Although, the number of rainfall days increased to 23 in April 2017, the total volume of rain was lower than previous month. The rainfall in April was 407 mm as compared to 522 mm in March 2017. Most of the rain occurred throughout the first week of the month (1 – 10 April 2017). Seventy percent of the rain occurred in the evening and night. The daily rainfall ranged from 2 – 150 mm and averaged 17.7 mm (Figure 1).

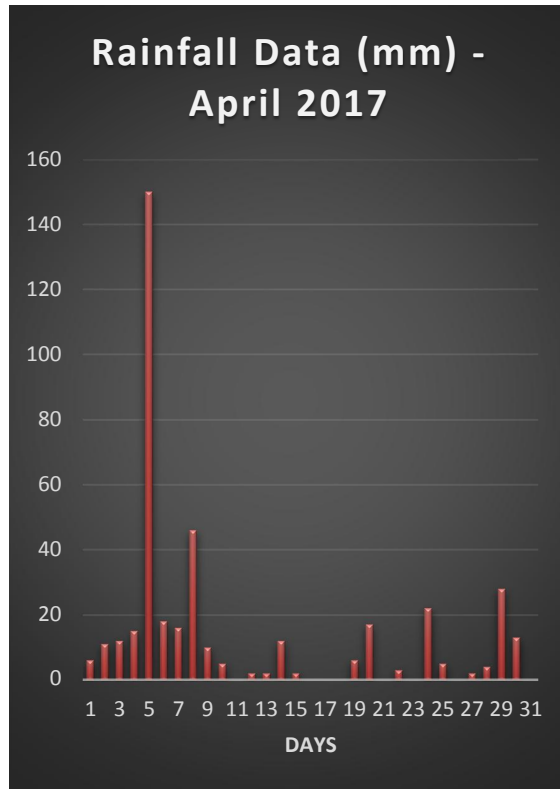


Figure 1. Total monthly rainfall (mm) for April 2017

By comparison, the rainfall is much less as compared to those in January – March 2017 (Ladang Tungku, KL – Kepong, Rainfall Data). The heaviest rainfall occurred in January, followed by March, February and April (Figure 2).

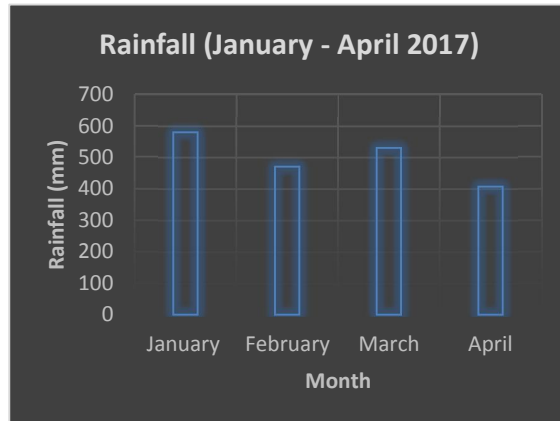


Figure 2. Rainfall data, January – April, 2017

Repairs of the roads in Tabin were frequently carried out with not much success. Many areas were waterlogged and potholes became deeper and larger. These includes the paddocks and some parts of the Rhino Food Plantation. The streams inside the paddocks were also fast flowing during heavy downpours. Work inside the paddock, especially Puntung's enclosure became more difficult. Many streams and rivers were also flooded (Plate 1).



Plate 1. Sungai Badak was fast flowing after the heavy downpour

A letter was sent to the District Engineer, Public Works Department (JKR) to address the problems and a request for repairs.

As Puntung's condition did not improve and affecting her health, it was decided to get a more accurate diagnosis using a radiograph. The organization "Saving the Survivors",

South Africa, contacted BORA and volunteered to provide diagnostic assistance and treatment. Within a short period of time a team was assembled consisting of :

Dr. Johan Marais, Saving the Survivors, Africa  
 Dr. Tum Teerapol Chinkangsadarn, Mahanakorn University of Technology, Bangkok  
 Dr. Zoe Glyphis, Saving the Survivors, Africa

Dr. Abraham Mathew, from Wildlife Reserve Singapore was also called in as an anesthesiologist during the procedures.

Ovum pick – up and semen collection were carried out on the 20<sup>th</sup> April 2017. Iman was also synchronized using deslorelin (Ovuplant®), several days prior to the OPU.

Despite the rain, the water and electricity supplies were not disrupted. Both the generators at RIF and RQF were repaired and functioning. A slight leak of current was suspected on the one from RQF. The matter was being looked at.

Several staff meetings with section heads, were held in April 2017, anticipating the amount of work and preparations for the surgery on Puntung and gametes collection (Iman and Kretam) by the Institute for Zoo and Wildlife Research (IZW). Two meeting was carried out with all of BORA staff to coordinate the work schedule, discuss current issues and staff holidays. Other issues discussed included management of rhinos and purchase of items for the procedures.

## 2. Husbandry

### 2.1 Animal Management

The body scores of Kretam and Iman were maintained at around 3.0. Puntung's

condition deteriorated (body score of 2.0). This is due to the due to the large swelling on her left cheek and oozing abscess from 3 – 4 openings on her cheek. Her diet was changed to only include leafy foliage.

Puntung's condition did not improve despite the treatments using antibiotics, steroids and supplements. She refused to return to her night stall and even into the temporary chute inside her paddock. She would come out for feeding but spend most of her time inside the wallow. It was also decided that the removal of her infected cheek teeth was necessary to prevent the deterioration in her health. After consulting with several specialists from Africa, it was decided that the diagnosis and treatment was scheduled for the 19<sup>th</sup> April 2017.

The first obstacle was to coax Puntung to return to her night stall. Several attempts were done using food and baiting her towards the night stall. When this failed, it was decided to use the black shade netting to reduce the size of her paddock and eventually drive her into the exercise yard and subsequently into the night stall. Finally on the 8<sup>th</sup> April 2017, preparations were made to bring in the black shade nettings and wooden posts to form a fence. This was carried as soon as she comes out of the wallow. Some foliage were used as enticement for her to keep moving forward.

A line of black shade netting was erected across her paddock using wooden posts, about 10 meters behind her and moved closer towards her as she advanced. The objective was to move her across the stream. The weather condition made it very difficult to move the entire net. As it was getting dark and the rain was heavy, a decision was made to erect a line of electric

fencing along the black shade net, about 60 meters from her night stall (Plate 2).



Plate 2. (a) Preparing the wooden posts and (b) the erected black shade net

The present of Tabanids and mosquitoes was quite severe on the rhinos, particularly on Puntung when she was confined in her night stall.

Iman had a pinkish discharge from her vagina but requires no treatment, as her next Improvac<sup>®</sup> vaccine is due in April 2017. It would be given after the ovum pick – up was performed on her on the 20<sup>th</sup> April 2017.

Apart from the problem associated with the posterior horn “rot”, Kretam is in good condition.

## 2.2 Body Weight

Kretam and Iman were weighed at least twice a month, 15<sup>th</sup> and 29<sup>th</sup> April 2017. The electronic weighing scale (TruTest<sup>®</sup>) were calibrated to known weights of the keepers prior to weighing the rhinos. Weighing were done inside the night stall, with the load bar placed on concrete flooring. Puntung were weighed as and when possible. As she was brought in on the 8<sup>th</sup> April 2017 from the paddock, it was possible to weigh her whilst

in her night stall. She was weighed on the 11<sup>th</sup> and 26<sup>th</sup> April 2017.

The bodyweights of Iman and Kretam within normal deviation as many factors does vary the weight, including time and defecation. Rhino feces weighs between 8 – 12 kg. Kretam lost 12 kg as compared to March 2017. He now weighs 652 kg. Iman's weight was down by three kilograms to stand at 546 kg. Puntung's weighs 510 kg, a drop of 20 kg since March 2017 (Figure 3).

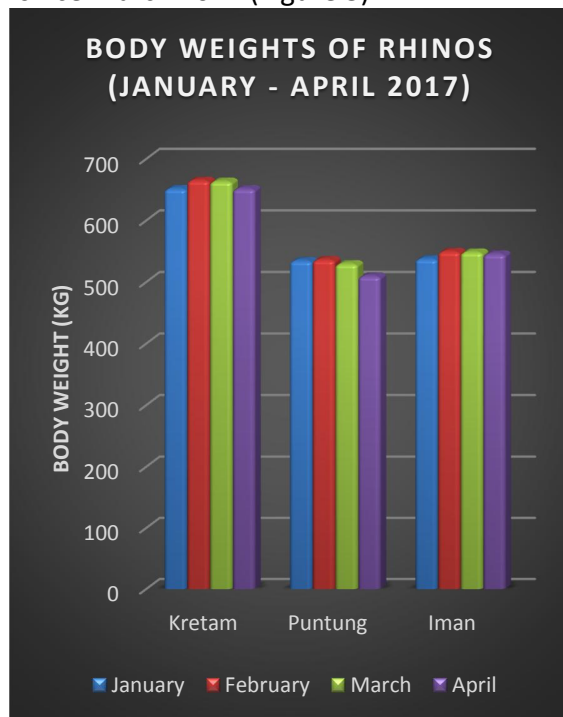


Figure 3. The body weights of Kretam, Iman and Puntung (January - April 2017)

Iman had stabilized in her body weight and was not weighed weekly as previous months. Puntung will be weighed more frequently as the confirmed case of squamous cell carcinoma will certainly have a negative impact on her condition. However the confinement in her night stall without any access to a wallow also will impact her overall condition and might even be deleterious on her health. It was decided

that she be release into her paddock once her surgical wound healed.

## 2.3 Animal Health

Puntung's lesion on her left cheek increased in size. Despite the regular treatments and antibiotics, the flare up was apparent and not improving. This is related to the constant irritation from the suspected infected cheek teeth notably the molars or premolars.

She was coaxed using black shade nets and electric fence to return to the exercise yard and subsequently her night stall. Diagnosis was carried out under general anesthesia. A digital radiograph was used to pin point the problem tooth/teeth. The severe lesion and swelling on Puntung's left cheek was finally diagnosed as a dental root abscess and aberrant granulation. It was agreed that the affected cheek teeth (three) has to be removed as soon as possible.

A pinkish vaginal discharge was seen in Iman as her Improvac<sup>®</sup> vaccine wears off after four months.

The monthly sampling of rhinos and their surroundings for pathogens were carried out on the 26<sup>th</sup> April 2017.

### 2.3.1 Kretam

#### a. Posterior horn rot

The posterior horn was excessively worn off whe Kretam frequently used it to open door ledges. The horn became infected in 2016 and was treated with Povidone (Septidine<sup>®</sup>). The infection was resolved but the horn structure did not grow. The inside of the horn was scrapped and cultured on potato agar media (Plate 3). The result was positive. Treatment was carried out daily with Terbinafine (Lamisil<sup>®</sup>).





Plate 3. The fungal growth in the agar

### 2.3.2 Puntung

#### a. Swelling – abscess – aberrant granulation

The infraorbital swelling/lump on the left maxilla increased in size significantly and coalesce with a smaller fistula that is cranio – dorsal to primary lesion. The entire swelling is oval in shape and raised quite significantly (10 X 14 X 4 cm). The open flesh is almost rounded (5 cm diameter) with a thick layer of granulation tissue around the brim (Plate 4).



Plate 4. The rounded opening resembling “proud flesh” seen on the 1<sup>st</sup> April 2017

A few more raised areas (1 – 2 cm diameter) could be seen above and anterior ventral to it. These raised areas are soft and fluid filled. The entire mass is hard with a few sac – like cavities palpable from the skin.

By the 13<sup>th</sup> April 2017, the swelling had increased in size with two new fistula could be seen with abscess oozing out from the openings. The surface is hard and fibrous and the granulation layer around the brim remained unchanged. Two days later, the swelling became smoother, with the surface, rounded and glistening. Fresh blood was observed flowing down the left nostril. The swelling was seen to spread caudally towards the left eye, closing it slightly. Tears could be seen flowing down. The lesion often drips serous and sometimes serosanguinous discharge from various smaller openings. The skin folds posterior to the lesion were swollen and protrudes, creating deep fissures (Plate 4).



Plate 4. The rapid progression of the granulation tissues on the 13<sup>th</sup> and 15<sup>th</sup> April 2017

On the 7<sup>th</sup> April 2017, Puntung was sedated with Butorphanol and a radiograph was attempted using a computed radiography

(CR). However, due to the difficulty of keeping the head still, the radiograph failed to provide a diagnosis. It was decided that a general anesthesia was needed to provide a definite diagnosis.

The use of a digital radiography (DR) was suggested, followed by extraction. The planned procedures was fixed on the 19<sup>th</sup> April 2017, with specialists coming from South Africa, Thailand and Singapore. The extraction was carried out by an equine dental specialist from Thailand and assisted by veterinary surgeon from South Africa. The anesthetist from Wildlife Reserve Singapore performed the general anesthesia using Butorphanol, Medetomidine, Ketamine and Midazolam for induction. Prior to the surgical extraction, a confirmation of the site and severity of the problem was access via the use of a digital radiograph that was brought over by Dr. Johan Marais and Dr. Zoe Glyphis from Saving the Survivors, South Africa. A total of seven radiographs were taken as the positioning of Puntung's head and maxilla was uneasy as she was still standing. Eventually, the radiographic images revealed the pathology which was immediately interpreted and discussed prior to the teeth extraction (Plate 5).



Plate 5. Dr. Johan and Dr. Zoe taking an X-ray of the left jaw with a Digital Radiograph

The radiograph showed the radiodense cheek teeth, calcified granulation (callus) with probably some bone fragments from the dental alveoli.

In contrast, the radiolucent image (fluids, possibly abscess) could be seen within the cavities inside the tooth sockets and maxilla. The lesion could be seen to involve the first molar and extended dorsally into the maxilla. (Plate 6).

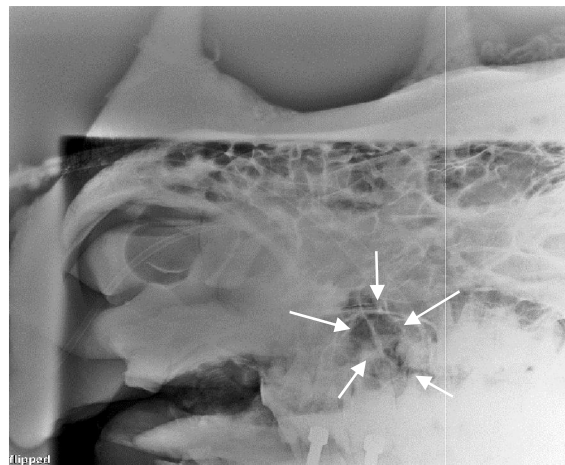


Plate 6. The affected molar – premolar showing the radiolucent fluids (arrow)

*Additional radiograph imaging and interpretation of the periodontal disease could be seen in the report by Dr. Reza Tarmizi (attached).*

After the short diagnostic imaging, Puntung was allowed to go down on sternal recumbency. She was balanced and gently coaxed to go down on a thick mattress with a head support. She was maintained on ketamine, midazolam and butorphanol (mixed in a 500 ml NaCl solution) via a drip line. Her vitals were monitored using a pulse oxymeter. Oxygen supplementation was provided intranasal. A sling was used to hold the head in position (Plate 7).





Plate 7. Puntung on sternum with the sling positioning the head

Dr. Tum Teerapol from Bangkok Animal Dental Services, Thailand performed the extraction of three infected cheek teeth from the left maxilla. He was also assisted by Dr. Um from Thailand and Dr. Johan from South Africa.

The callus formation was extensive and extended inside the socket and loosening the teeth. The extraction was completed in less than one hour, starting with the molar (M1), followed by premolars (P3 and P2), which was also loose.

The bleeding was massive but controlled with pressure packs. Small amounts of bone fragments were also removed. The extraction were done using various tools, used for horses. Initially, the loose cheek teeth, presumably the first molar was removed. The teeth is very loose in its socket. This was followed by the third premolar and subsequently, the second premolar. Extensive amount of hemorrhage was observed throughout the extraction procedures. All extraction was done, with the equine dental specialist and the patient on the floor, cushioned with a pillow or mattress (Plate 8).



Plate 8. Dr. Tum Teerapol and Dr. Johan Marais during the extraction

The loose cheek teeth subsequently, led to food debris getting lodged inside the gums and bacteria built up. The factors that leads to this is very likely old age and the infrequent usage of the teeth as it reached the level of the gums. The three cheek teeth showed extensive amount of callus built up and granulation as observe on the digital radiograph. (Plate 9).

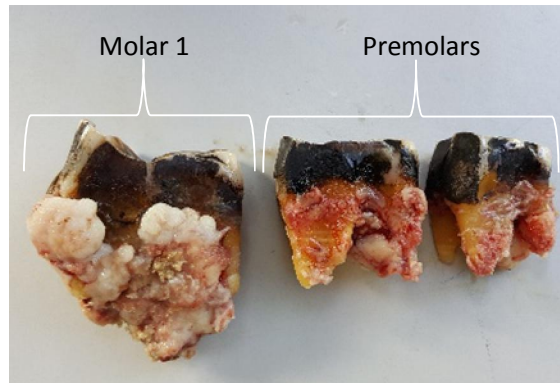


Plate 9. Callus formation and granulation tissues at the base and roots of the teeth

After the cheek teeth extraction, Puntung was stabilized and later reversed with Naltrexone and Atipamizole. Her condition was monitored for 24 hours and was only fed leaves. Her condition was stable although the swelling and open wound was still apparent. The left eye was only half open

due to the blocked naso – lacrimal tear duct (Plate 10).



Plate 10. The open wound and aberrant granulation after the surgery

She was also given Enroflocacin and Flunixin meglumine during the procedure. Post-operative medication included rinsing her surgical site, twice daily with Hexarinse wash/flush (40 ml). The wound was clean with normal saline and dead cells removed over the surface. The fistula were flushed and abscess expressed. She was also given antibiotics (Enrofloxacin and Ceftiofur). All oral medication in the form of tablets were powdered and repacked into capsules before giving her (Plate 11).



Plate 11. The crushed tablets repacked into gelatin capsules.

The swelling below the eye subsided the next day. However, progressive swelling was

observed on the third day and the left eye was almost shut after a week. This is due to the blockage of the naso – lacrimal tear ducts due to the edema or aberrant granulation.

Copious nasal discharge from the left nostril was seen constantly. Bleeding was still observed from the mouth, particularly during feeding. This is more likely due to the chewing action and the sharp edges of the lower cheek teeth cutting against the upper gums or empty dental sockets, from the extraction.

The swelling was observed to increase in size rapidly. The folds on her face began to increase in number and bulge out prominently. Raised areas and fistula were seen dorsal to the open wound (Plate 12).



Plate 12. The swelling surrounding the open wound and points of fistula (white arrow) dorsally. Skin granulation is seen around the open wound (black arrows)



## b. Reproductive tract pathology

Ultrasound was not carried out after the cheek teeth extraction. Prior to that, she was scanned to determine her reproductive status. The numerous cysts were observed in her uterus, uterine horns and one in the cervix. The cysts were also observed very near the right ovary.

### 2.3.3. Iman

#### a. Vaginal discharge

The discharge from the reproductive tract were seen on the 6<sup>th</sup> and 16<sup>th</sup> April 2017. On both occasions, the thin, watery discharge is slightly pink in colour. The volume ranged from 30 – 60 mls. This discharge is usually mixed a thick whitish or translucent mucous. Bubbles were seen on both occasions (Plate 14).

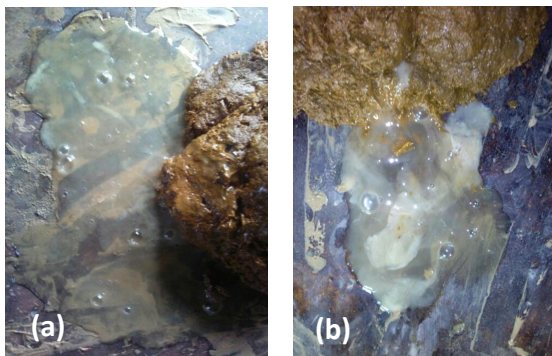


Plate 14. The discharge seen on the 6<sup>th</sup> April 2017 (a) and (b) on the 16<sup>th</sup> April 2017

Usually, these discharges were observed in the morning when she comes back for her morning feeding. It is seen after or during defecation inside her night stall.

She was given 3 mls of Improvac® (600 µg GnRF protein conjugate) subcutaneously on the 21<sup>st</sup> April 2017, after the ovum pick – up procedures. Her next vaccination would be administered on the 21<sup>st</sup> August 2017.

## b. Reproductive tract pathology

The uterus is less fluid and the structures are more distinct. Cysts of various sizes could be seen inside the uterus and uterine horns. The leiomyomata could be seen as round ovoid mass with distinct borders. This is reflected by the hypoechoic images on the ultrasonography. The sizes varied from 1 – 6 centimeters in diameter. The hydrosalpinx observed on the right oviduct since she was brought into captivity in March 2014 is still present even after aspiration in 2015. This is interpreted as an anechoic round structure located in the oviduct of Iman. Hyperechoic, small protrusions seen inside the cavity is indicative of the oviduct (Plate 15).

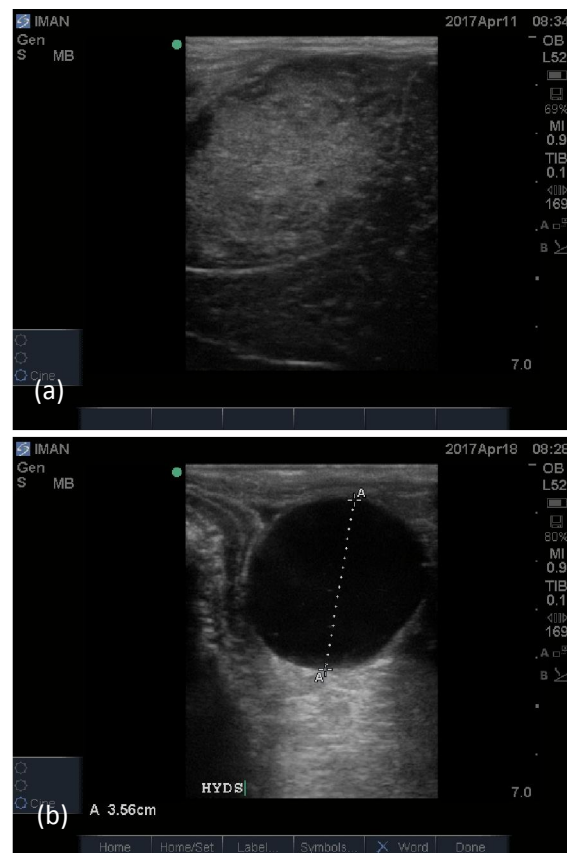


Plate 15. The large 6cm leiomyoma in the uterus (a) and (b) the 3.6cm diameter hydrosalpinx

The annular folds of the cervix is more relaxed and less firm as compared to those of Puntung. A few cervical cysts could be view during ultrasonography (Plate 16).



Plate 16. Cervical cysts during an ultrasound procedure

### 3. Feed and feeding

The browse collected from Tabin Wildlife Reserve and fringes of the plantation (mainly KL – Kepong plantation) were still adequate despite the estimated 2000 ha of replanting each year. However, the impact of replanting of oil palm could also be seen on the over harvesting of foliage from BORA's Rhino Food Plantation.

The amount of foliage collected and fed to Iman and Kretam were within the normal limits. All rhinos would not feed normally after general anesthesia for reproductive manipulations or surgical interventions. The total amount of foliage collected in April amounted to 4712.5 kg and of this, only 65.6% were eaten. Kretam ate 72% of the browse while Puntung managed to consume 58%. Iman averaged 62% (Figure 4).

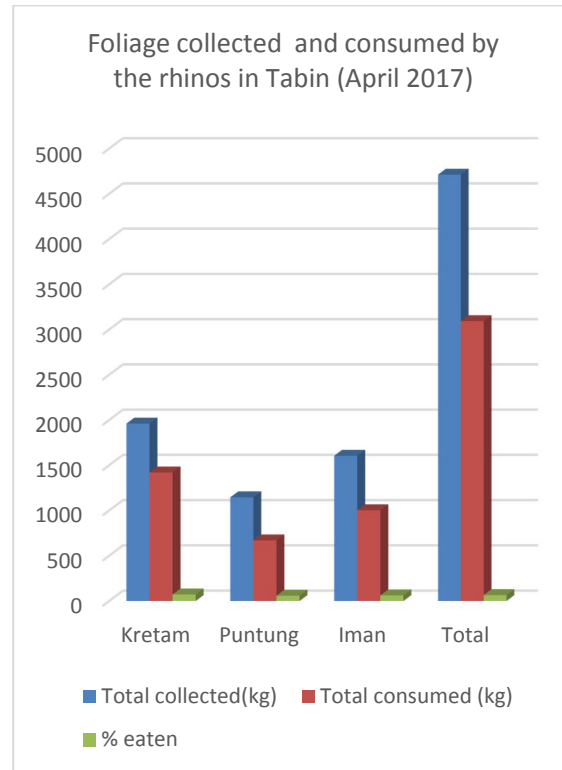


Figure 4. The total amount of browse collected and consumed by the rhinos

The variety of browse were increased mainly to try and encourage Puntung to consume more browse. The browse consisted of more variety of *Ficus* spp including Ara Epal, Ara Piring, Ara Gatal, Ara Belimbing, Ara Prasada, Ara Manggis, Ara Giant, Ara Kopi, Mas Cotek, Ara ajinomoto, Arah Urat Merah etc. Some of the *Artocarpus* spp, including Nangka, Togop, Buruni, Tandirok, Sorosob Rebung and Kalamansi were collected. The other browse includes *Uncaria* spp, *Merremia* spp, Ludai, Macaranga spp and Maidang were also fed to the rhinos.

#### 3.1 Voluntary Feed Intake (VFI)

Hand feeding the rhinos with browse is an excellent way of determining VFI as well as clinical signs of an emerging disease. The foliage were also hung in the paddocks for

the rhinos to eat at night or early morning. These browse also weighed daily, before and after being eaten by the rhinos.

In April 2017, the total amount of browse hand – fed and eaten per day by Kretam, Puntung and Iman were 1108, 603.5 and 858 kilograms respectively (Figure 5).

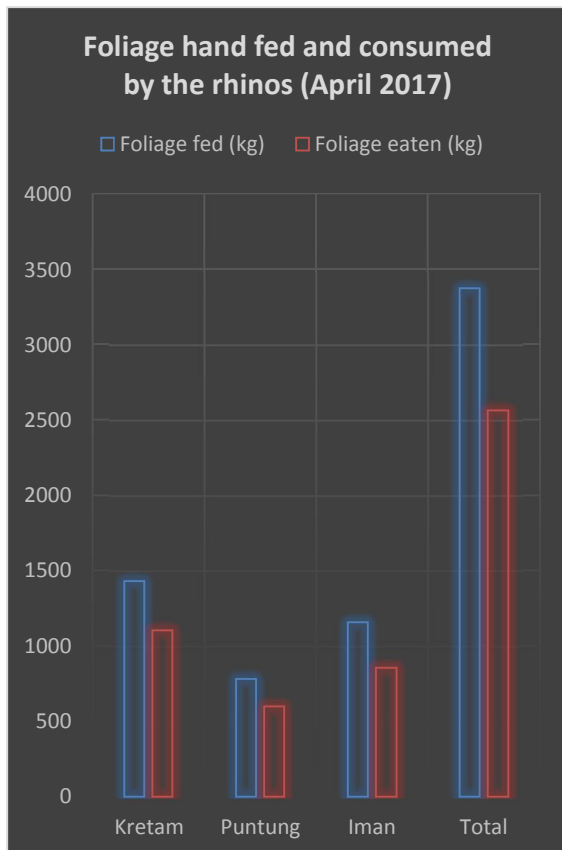


Figure 5. The amount of foliage hand – fed and eaten by the rhinos in Tabin

The amount of browse offered to Puntung consisted of mainly leafy parts of plants or entirely leaves. The amount of waste or rejected foliage from Puntung is small.

After being confined in her night stall for diagnosis and treatment, she was fed 2 – 3 times daily, including at night. Thus her feed intake was markedly increased by 6% or 50 kg, as compared to March 2017.

Except for Puntung, Kretam and Iman were supplemented with 500 grams of equine pellets (Gold coin®) each. In Puntung, the large surgical site, after removal of three upper cheek teeth can cause the concentrates to become a foci for bacteria or fungal infection.

Kertam and Iman gets about 5 kg of banana and daily. Sometimes, papaya and occasionally mangoes were also given. After the removal of the cheek teeth, Puntung was not fed banana for fear of it being lodged inside the socket of the teeth. The oral medications were pounded and placed inside capsules and fed together with the browse. Most of the drugs consisted of deep intramuscular injections.

Kretam and Iman came back for all feedings in April 2017. However, Puntong had to be coaxed to come into her night stall on the 8<sup>th</sup> April 2017. This is to prepare her for sedation and for radiography on the 10<sup>th</sup> April 2017 and subsequently the dental extraction on the 19<sup>th</sup> April 2017. She was also weighed prior to the sedation. She remained and recuperated in her night stall throughout the month.

Here, at the night stall, she was fed three times a day, in small volumes. The food comprised mainly of leaves and shoots. Hard, fibrous, tough and dry leaves were avoided during recuperation. Some of these includes the Ara mangga, Ara Ajinomoto, Maitap and Mas Cotek. She would be fed in the morning and afternoon before she sleeps. She would normally gets up for food at 2100H. The leaves and shoots would be prepared in the evening and fed to her at night (Plate 17).





Plate 17. Puntung being fed at night

Towards the end of April 2017, some of the softer foliage, including the Binuang (*Octomeles sumatrana*) and Sadaman (*Macaranga spp*) were hung inside the night stall. A small portion of these were eaten by her (Plate 18).



Plate 18. Puntung attempting to feed on the Binuang leaves hung in the night stall

### 3.2 Rhino Food Plantation (RFP)

The food plants remained lush and green during the month of April although the

rainfall is less as compared to March 2017. Similarly, weeds were also growing at a fast rate. Several species of food plants were harvested for the rhinos. After the teeth extraction, Puntung were fed mainly on leaves. The leaves and young shoots of the Nangka plants were hand-picked for Puntung (Plate 19).



Plate 19. Hassan plucking selected leaves from the Nangka plants for Puntung

### Biosecurity and health monitoring

Due to the many activities in April 2017 (diagnosis of periodontal problem in Puntung; extraction of infected cheek teeth; ovum pick – up and semen collection), the sampling and dispatching of samples were carried out on the 24<sup>th</sup> April 2017. The collection of samples, including water, floor swabs, feed samples, blood, soil, urine and feces were done on Monday and send to the Veterinary Diagnostic Laboratory (JPHPT) and the Veterinary Public Health Laboratory, in Kepyayan, Kota Kinablu before mid-day on the 25<sup>th</sup> April 2017. Serum samples were also collected from Puntung, centrifuged and transported to the Pathology and Clinical Laboratory (M) Sdn. Bhd (Pathlab) in Sandakan.

**4.1. Hematology**

Blood were taken from Puntung to evaluate her health and status of the periodontal abscess. The blood was send for a complete blood count (CBC) and serum chemistry. The values for the CBC was compared with those for January and March 2017. The most prominent interpretation from her CBC pointed to a moderate anaemia occurring in April 2017 which could be seen by the drop in packed cell volume (PCV) by 11% of the normal. (Table 1, Figure 6).

Table 1. The CBC values for Puntung between January – April 2017

Parameters	Laboratory Results/Month		
	Jan	March	April
Hemoparasites	Nil	Nil	Nil
RBC (X10 <sup>12</sup> /L)	5.75	5.44	4.33
WBC (1000/UL)	8.25	7.53	7.69
Hb (G/DL)	12.6	13	9.5
PCV (%)	41	40	29
S. Neutrophil(%)	66	67	73
Eosinophils (%)	4	0	3
Lymphocyte(%)	22	24	11
Monocytes (%)	7	8	13
Basophils (%)	1	1	0

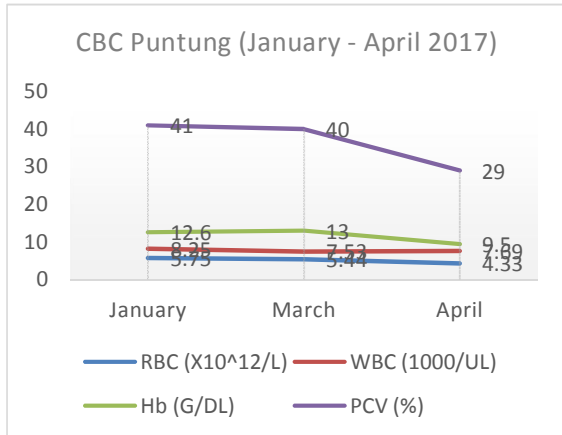


Figure 6. Drastic reduction in PCV as compared to January and March 2017

This is due to the bleeding from the nasal turbinates, gingiva and sometimes from the open wound itself. Bleeding from the open wound was observed when she rubbed against the trees or wall of the wallow. Sometimes bleeding was observed from her gums, around the extraction site. This is due to the cutting edges from the lower cheek teeth hitting against the opposing gums of the upper jaw. Grossly, the severe bleeding was observed from the left nostril on several occasions. (Plate 19).



Plate 19. Bleeding observed from the left nostril while Puntung lies in the wallow

Similarly, Kretam’s PCV (43%), haemoglobin (14.3G/DL) and RBC (6.03 X10<sup>12</sup>/L) were higher than that of Puntung.

The SGPT and SGOT were seen to decrease markedly from the 11<sup>th</sup> April to the 19<sup>th</sup> April 2017.

These decreased values could be related to liver damaged or malnutrition. The drop in SGOT and SGPT is by 45IU/L and 11IU/L respectively (Table 2).

Table 2. Comparison of Puntung's serum chemistry

Date/Parameters	Kretam	Puntung	
		11/4	19/4
Total protein (G/L)	69	78	68
Albumin (G/L)	14	30	26
Globulin (G/L)	55	48	42
A/G Ratio	0.3	0.6	
Tot Bilirubin (UMOL/L)	4	3	
Alk Phosphatase (IU/L)	65	88	
SGOT (AST) (IU/L)	133	136	91
SGPT (ALT) (IU/L)	39	23	12
GGT (IU/L)	29	12	
Glucose (MMOL/L)	NE	8.3	
Urea (MMOL/L)	1.9	1.8	
Creatinine (UMOL/L)	67	77	
Serum iron (UMOL/L)	NE	19.6	18.3
Sodium (MMOL/L)	133	129	
Potassium (MMOL/L)	4.4	4.5	
Chloride (MMOL/L)	99	91	

## 4.2 Bacteriology

The 20 floor swabs were taken from various location inside and around the rhino night stalls. Swabs 1 – 4, 6 – 7, 9 – 10, 13 – 16 and 19 – 20 had scanty to moderate *Bacillus sp.* Swabs 5 had few *Globicatella sulfidifaciens*. Swab 8 had few *Staphilococcus sciuri*. There were scanty growth of *Micrococcus luteus* in

swab 17 while swabs 11 – 13 had no growth. The two tyre baths had *Dermaococcus nishinomiyaensis*. The majority of these strains are non-pathogenic for humans.

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 samples from the sumps had few *Actinobacter baumannii complex*.

There were no pathogens isolated from the feces and urine of the rhinos.

All water samples from the 13 tanks had a total bacteria counts of 40 – 8800 cfu/ml. There were no *Salmonella sp* isolated from the water samples. The coliform counts were negative in five samples and ranged from 10 – 870 cfu/ml. The *E. coli* colonies were found in tanks 1, 4 and 7 (Table 3).

Table 3. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for April 2017.

Tank	Total bacteria	Total coliform	<i>E.coli</i>
1	40	30	20
2	170	60	0
3	200	10	0
4	8800	870	270
5	3370	20	0
6	513	0	0
7	785	140	10
8	470	40	0
9	680	0	0
10	720	0	0
11	2000	120	0
12	150	0	0
13	30	0	0

The three 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.

### 4.3 Parasitology

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

### 4.4 Histopathology

Samples of the gingiva mucosa was send to two separate laboratories. Neoplastic growth was observed replacing the mucosal surface and invaded the stroma in irregular sheets and cords. The neoplastic growth had a squamous differentiation. Keratinization is marked. The lesion was diagnosed as a well differentiated squamous cell carcinoma.

### 4.5 Bacteria sensitivity test

Swabs from the abscess were send to the Pathology and Clinical Laboratory (M) Sdn. Bhd in Sandakan. The organism (s) were sensitive only to Ceftriaxone, Cefuroxime, Enrofloxacin, Gentamycine, Septrin and Ofloxacin. However, the drug of choice would be Ceftriaxone and Enrofloxacin.

### 4.5 Routine prophylaxis

Liming was carried out when necessary, around the rhino enclosures and staff quarters. Sumps and dung piles were usually limed more than once monthly. 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

Puntung was only scanned twice in April 2017. This is associated with her periodontal or periapical abscess which started in March 2017. Iman was also scanned on two occasions prior to the planned ovum pick – up procedures.

### 5.1 Hormone profile

#### 5.1.1 Puntung

Due to her condition hormone profiling was not done in April 2017.

### 5.2 Ultrasonography

#### 5.2.1 Puntung

A scan on Puntung on the 11<sup>th</sup> April 2017 showed two follicles on her left ovary, measuring 0.58 and 0.78 cm diameter (Plate 20).



Plate 20. The two follicles on the left ovary

#### 5.2.2 Iman

She was scanned on the 11<sup>th</sup> and 18<sup>th</sup> April 2017. One follicle was observed on th left and two were seen on the right on the 11<sup>th</sup> April 2017. They measured between 0.7 to 1.0 cm diameter (Plate 21).

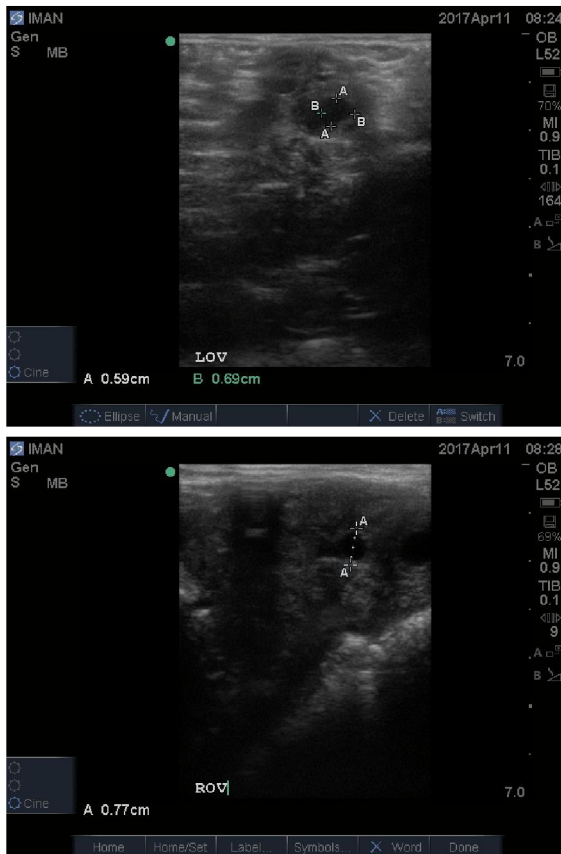


Plate 21. The follicles on the left (above) and right (below) ovary during ultrasound

She was treated with deslorelin implants on the 13<sup>th</sup>, 15<sup>th</sup> and 17<sup>th</sup> April 2017. The implants were administered subcutaneously around the vulva. The ovum pick – up procedures was scheduled on the 20<sup>th</sup> April 2017.

She was once again scanned on the 18<sup>th</sup> April 2017. The change in size and number was not significantly high when compared to the normal growth of follicles in the Sumatran rhinos, that is about 1mm per day.

There were four follicles in total for the ovum pick – up procedures on the 20<sup>th</sup> April 2017 (Plate 22).



Plate 22. The four follicles (arrow) detected via ultrasound on the 18<sup>th</sup> April 2017

### 5.3 Behavioral estrus

Kretam and Puntung interacted slightly on the morning of the 24 and 25<sup>th</sup> April 2017 in the central part of the paddock. There were some vocalizations and scrapping of the ground by Kretam

### 6. Electric fencing

The voltage along the Rhino Food Plantation was between 8 to 9 kV. This is due to the low battery charge by the photo voltaic cells. The cloudy weather and rain was partly the reasons for this. The RQF recorded a low of 8.7 kV and a high of 9.4kV in the month of April. The RIF recorded a range of 6.5 – 9.0 kV.

## 7. Other issues/activities

### 7.1 Install *papak* on tall rhino food plant species

A group of three experience climbers with skill to install *papak* was brought in to Tabin to try the system on a few trees. The *papak* uses belian (*Eusideroxylon zwageri*) wood that is sharpened and flattened. These were nailed into the bole of the trees. (Plate 23).



Plate 23. The wooden stakes were prepared from the belian wood

Subsequently, polypipes or tree vines were attached to the *papak* as guide rails to hold on to when climbing. It was observed that the Tambirok tree (*Artocarpus spp*) was impenetrable with the belian stakes.

The trees are between 10 – 15 meters tall and DBH of 40 – 60 cm. Once the *papak* were secured, the vines or wooden posts or polypipes were attached to the *papak* and secured by ropes (Plate 24).



Plate 24. The *papak* in place with the climber on top

The use of *papak* would certainly increase the harvest of rhino food plants especially to provide Puntung with better and more palatable diet. The trees selected were based on it being a Grade 1 species and liked by all rhinos. Most of these trees were located a distance from the main Tabin road.