EAZA

BEST PRACTICE GUIDELINES

Malayan Tapir (*Tapirus indicus*)

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PREAMBLE

Right from the very beginning, it has been the concern of EAZA and the EEPs to encourage and promote the highest possible standards for husbandry of zoo and aquarium animals. For this reason, quite early on, EAZA developed the „Minimum Standards for the Accommodation and Care of Animals in Zoos and Aquaria“. These standards lay down general principles of

animal keeping, to which the members of EAZA feel themselves committed. Above and beyond this, some countries have defined regulatory minimum standards for the keeping of individual species regarding the size and furnishings of enclosures etc., which, according to the opinion of the authors, should definitely be fulfilled before allowing such animals to be kept within the area of the jurisdiction of those countries. These minimum standards are intended to determine the borderline of acceptable animal welfare. It is not permitted to fall short of these standards. How difficult it is to determine the standards, however, can be seen in the fact that minimum standards vary from country to country.

Above and beyond this, specialists of the EEPs and TAGs have undertaken the considerable task of laying down guidelines for keeping individual animal species. Whilst some aspects of husbandry reported in the guidelines will define minimum standards, in general, these guidelines are not to be understood as minimum requirements; they represent best practice. As such, the EAZA Best Practice Guidelines for keeping animals intend rather to describe the desirable design of enclosures and prerequisites for animal keeping that are, according to the present state of knowledge, considered as being optimal for each species. They intend above all to indicate how enclosures should be designed and what conditions should be fulfilled for the optimal care of individual species.

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ZOO DORTMUND
ZOOPARC de BEAUVAL
ORIENTARIUM ZOO ŁÓDŹ
ZOOPARC TREGOMEUR
Terre d'Asie
ZOO LEIPZIG
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PARC DE LA TÊTE D'OR
MÉNAGERIE
ZOO DU JARDIN DES PLANTES
Mandai Night Safari
ZOO PRAHA
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ZOO BOISSIÈRE DU DORÉ
Chester Zoo
Wilhelma
Zoologisch-Botanischer Garten Stuttgart
ZOO ANTWERPEN

SUMMARY

This document serves as a current synopsis of Malayan tapir biology and a detailed description of how to adequately keep this species under human care. These guidelines are intended to support current holders with improving their husbandry and offer consultation to institutions that are planning to build enclosures for Malayan tapirs. It is important to note that some of the recommendations given in this document are not based on hard scientific facts, as there are not enough resources to answer all husbandry questions definitively, but on the combined experience and knowledge of many experts. All holders should be aware of the requirements for excellent tapir husbandry and shall strive to provide the best conditions for their animals. Notably, the minimum requirements and best practice for dimensions, water bodies, and feeding will be discussed in this document: Holders must be equipped to hold at least three adult individuals in sufficiently spacious enclosures that offer room for all their behavioural, physiological, mental, and social needs. This implicitly includes the permanent accessibility of water bodies, not only for defecation, but also for swimming, diving, and social behaviour. Diet and feeding methods must be adapted to accommodate Malayan tapirs' natural foraging behaviour and preferences, i.e. the ad libitum availability of roughage such as browse and alfalfa hay. Furthermore, safety requirements for animals, staff, and visitors will be examined. These guidelines will also present comprehensive information on the reproduction of Malayan tapirs, including mating behaviour, pregnancy detection, birth, and rearing. This information will hopefully aid holders in their breeding efforts and improve the success of the breeding programme. Another important chapter of this paper is the veterinary section, which offers information on the most frequent injuries, diseases, and health risks in Malayan tapirs as well as recommendations for preventative medicine and treatments. This will assist holders in early detection and medical care of conditions and improve health and longevity in the population. To sum up, this document provides essential information for everyone involved in the husbandry and care of *Tapirus indicus*. Nevertheless, there is much more research needed to fill the gaps in our knowledge of Malayan tapirs to improve our understanding, and thereby the state of the population, even further.

TABLE OF CONTENT

1 BIOLOGY AND FIELD DATA

1.1 TAXONOMY

ORDER: Perissodactyla

FAMILY: Tapiridae

GENUS: *Tapirus*

SPECIES: *Tapirus indicus* Desmarest, 1819

SUB-SPECIES: none

COMMON NAMES: Malayan Tapir, Malay Tapir, Asian Tapir, Asiatic Tapir, Indian Tapir

Tapirs are part of the order of Perissodactyla, which consists of the three families of odd-toed mammals, rhinoceroses (Rhinoceridae), horses (Equidae), and tapirs (Tapiridae). There are currently four extant tapir species; all of them belong to the genus *Tapirus*:

Table 1: Extant tapir species and their IUCN status (source: https://www.iucnredlist.org, 2025)

Scientific name	Common name	Distribution	Population trend	IUCN
Tapirus terrestris	Lowland Tapir	South America	Decreasing	VU
Tapirus pinchaque	Mountain Tapir	South America	Decreasing	EN
Tapirus bairdii	Baird's Tapir	Central America	Decreasing	EN
Tapirus indicus	Malayan Tapir	South-east Asia	Decreasing	EN

A fifth extant species, the Kabomani tapir (*Tapirus kabomani*) has been described but its genetic role has not been universally verified (Cozzuol et al., 2013).

The first palaeontological trace of tapirs dates back 50 million years to the Eocene. Traces of the genus *Tapirus* can be found 25 to 5 million years ago in the Miocene, when tapirs were distributed not only in their extant range of South America and South-East Asia, but also in Europe, North America and East Asia. The outer appearance and physiology has not seen big changes since then, which is why tapirs are often regarded as living fossils (Medici, 2011).

1.2 MORPHOLOGY

HEIGHT

Compared to the other extant tapir species, Malayan tapirs are the largest, with females usually being bigger than males.

Head to body: 180-250 cm

Shoulder height: 100-130 cm

WEIGHT

280-400 kg

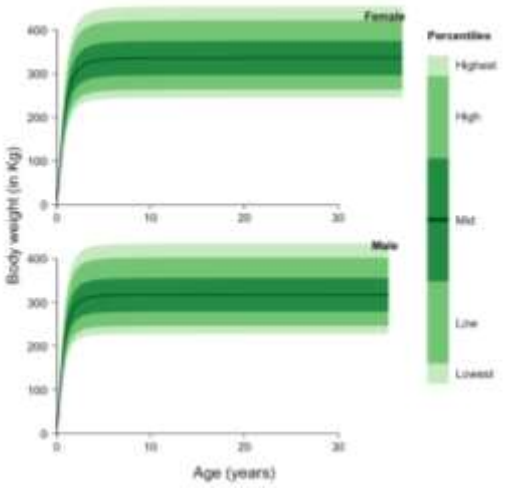

Figure 1: Percentiles of body sizes on all captive individuals in ZIMS alive after 1 December 1980. © ZIMS Species 360, 2023.

COLORATION

Malayan tapirs display a coloration that is very different to the other extant species. Their pelage is

black with a saddlecloth shaped white part on their back. This type of coat is likely an adaptation to the light and shadow changes in the rainforest and allows tapirs to blend into the background of their environment (Medici, 2011). At the tip of the ears, there is a small white spot, which likely facilitates communication between conspecifics (Zenzinger, 2010).

Figure 2: Malayan tapir colouration: Light and shadow make the tapir difficult to distinguish. © T. Burger

When Malayan tapirs are born, the fur of the young is black with a pattern of white stripes and dots, similar to that of a shote, which is typical for all tapir species. It takes around two months for the characteristic saddlecloth shape to begin to shine through. The adult pelage is completed at the age of about six months (Medici, 2011).

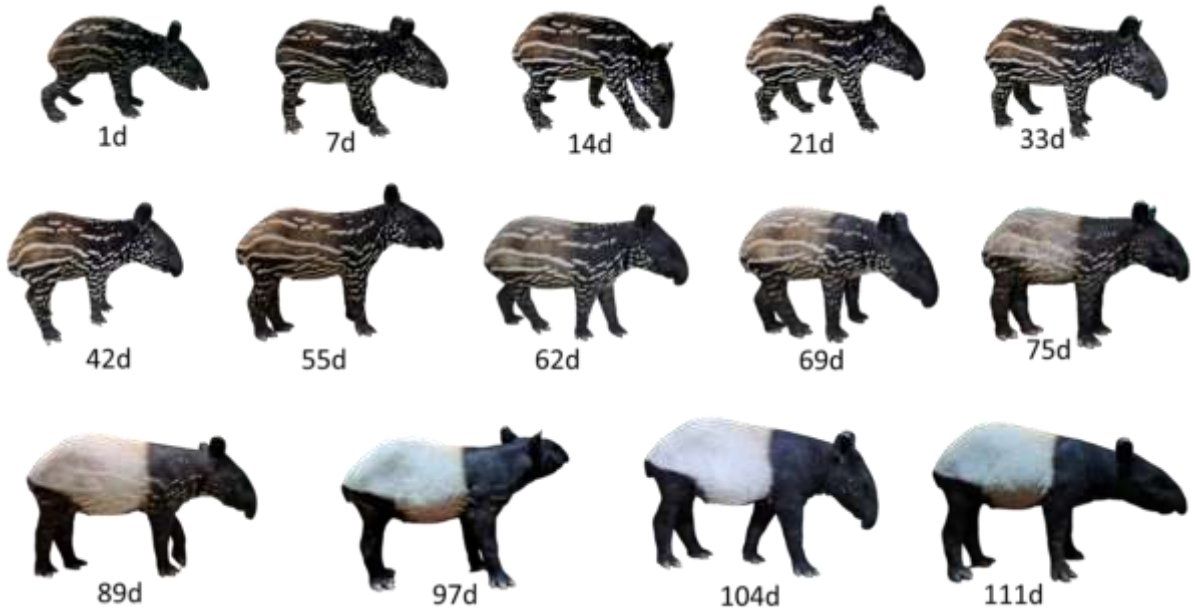

Figure 3: Coat pattern and colour transition from birth to full adult colouration. © Donny Y.

*Figure 4: Difference in adult and juvenile Malayan tapir colouration: the calf is born with striped fur (**left**) and develops the characteristic saddlecloth pattern within a few months (**right**). © T. Burger*

There have been several instances of melanistic tapirs that were captured in camera traps (Asrulsani et al., 2017). Adult Malayan tapirs can be distinguished by the exact border of their pattern, differences in permanent scars, and colour differences along their coat.

*Figure 5: Individual differentiation: specific colour patterns (**left**); individual scarring (**right**). © D. Koch*

DESCRIPTION

Tapirus indicus has the typical body shape of a forest dwelling prey species as its tapered front and broad back allows it to quickly slip through rainforest shrubbery. As is the case for all tapir species, the characteristic proboscis is an important organ for sniffing, gripping, and eating. Tapirs can also use it as a snorkel while diving. Olfactory and auditory sensation seem to be the most relevant of their senses, whereas their visual skills are likely limited by short-sightedness and colour-blindness (Medici, 2011).

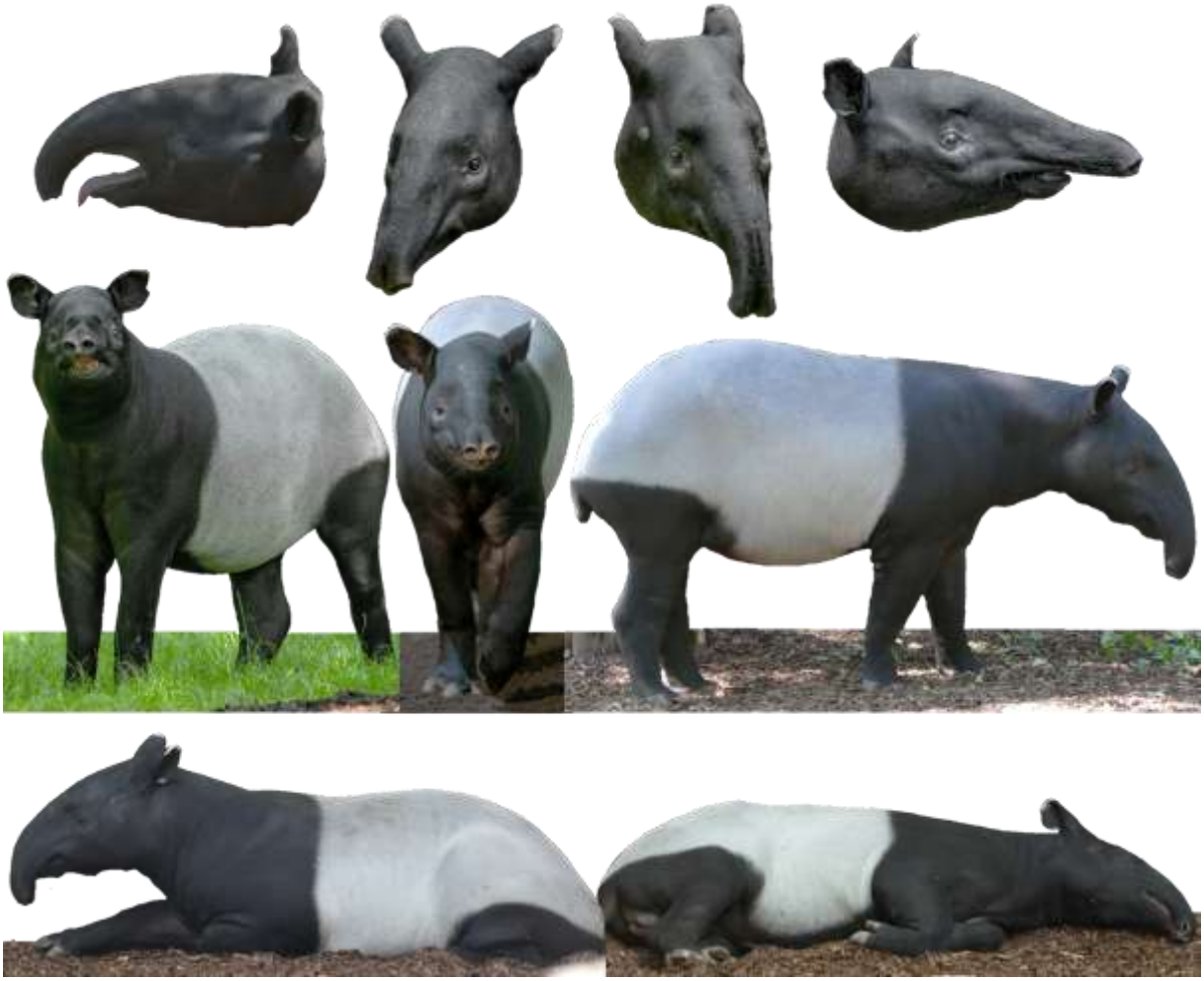

Figure 6: Malayan tapir appearance. © D. Koch, T. Burger

The tapir's skin is quite thick, especially at the nape where it measures up to 3 cm, which protects it against predators and damages from their environment. The hair is rather short and hard. The feet of tapirs consist of four toes on the forefoot and three toes on the hind foot, each toe possessing a hoof. They are able to walk on muddy substrate by splaying their feet (Medici, 2011).

*Figure 7: tapir fur (**left**); tapir feet (**right**). © T. Burger, D. Koch.*

The teeth formula of tapirs is primitive unreduced: I 3/3, C 1/1, P 4/3, M 3/3 (x2) = 42. The upper canines and lower third incisors are reduced, whilst the opposite teeth are enlarged. The upper incisor can be used as defence. There is a diastema between the canines and the premolars (Medici, 2011; Puschmann et al., 2009).

1.3 PHYSIOLOGY

HEART RATE

45 beats/minute resting, 52 +/- 9 beats/minute anaesthetised

RESPIRATORY RATE

8-21 beats/minute under anaesthesia (Zimmerman & Hernandez, 2015)

1.4 LONGEVITY

The oldest noted Malayan tapir female reached an age of 45 years and 6 months; the oldest male was 44 years and 8 months old. Both lived at Zoo Negara Kuala Lumpur in Malaysia. Even though it is difficult to determine the longevity of wild individuals, they likely do not get older than 20-25 years in their natural habitat. The average life expectancy of the current living captive population lies at 15.7 years (Prastiti, 2020); the generation length is 12 years (Medici, 2011).

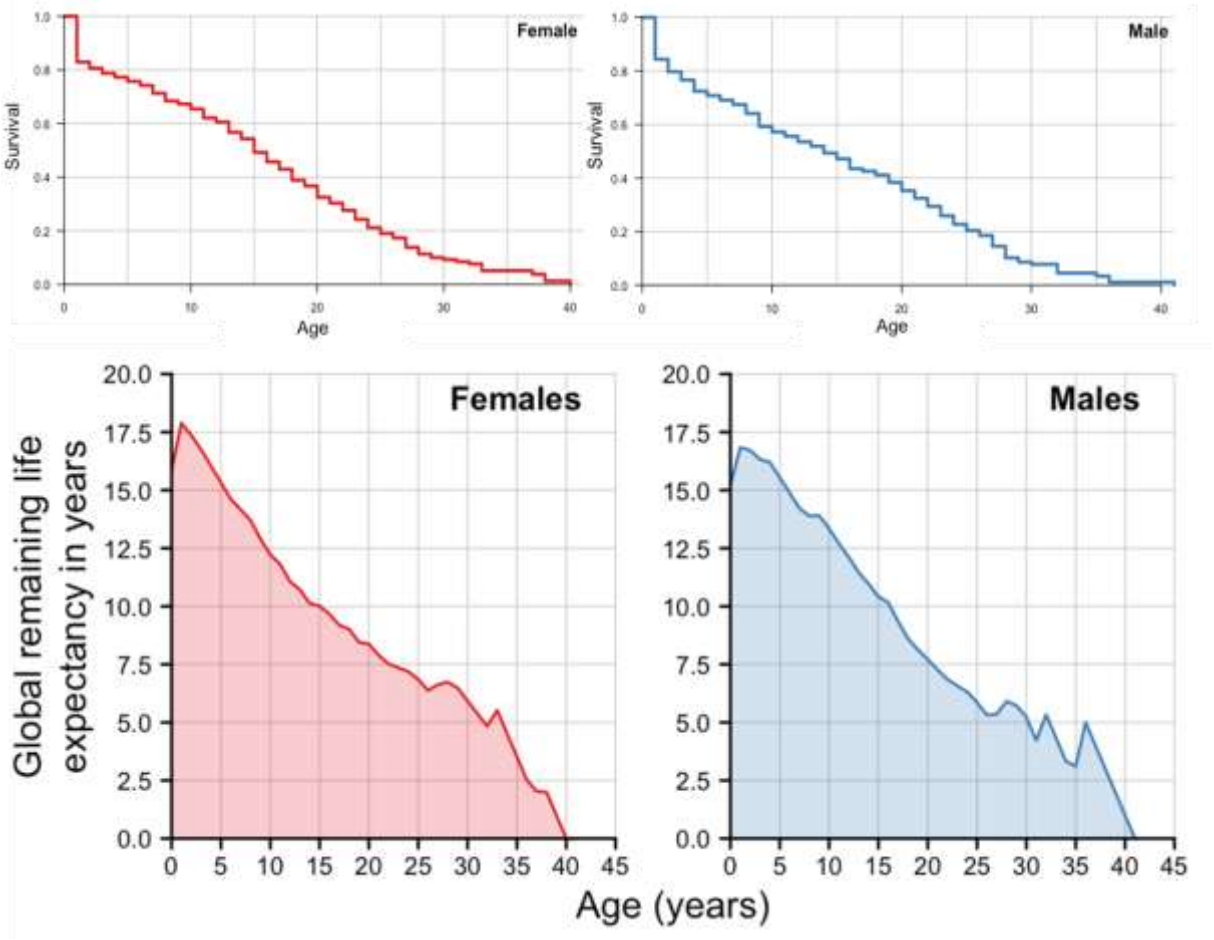

*Figure 8: Captive Malayan tapir survival probability by age (i.e. probability of surviving to a given age) (**top**); remaining life expectancy (average remaining life at a given age) (**bottom**) for all individuals in ZIMS with records available after 1 January 1980. © ZIMS Species 360, 2023*

1.5 CONSERVATION STATUS/ZOOGEOGRAPHY/ECOLOGY

1.5.1 Distribution

Once distributed in bigger parts of South-East Asia, including Cambodia, Vietnam, China, and Laos, the current distribution of Malayan tapirs is limited to Indonesia, Malaysia, Thailand, and Myanmar, where the population is fragmented into three subpopulations. The Indonesian population, restricted to the island of Sumatra, occurs in the centre of the island as well as smaller fragments along the South-West (e.g. Kerinci Seblat National Park). The subpopulation of Malaysia and Southern Thailand inhabits the countries' border, central Malaysia, and very small areas in Southern Malaysia (e.g. Krau Wildlife Reserve, Sungai Dusun Wildlife Reserve, Taman Negara National Park). The Myanmar and Thailand subpopulation occupies Western and Southern Thailand, the Tenasserim Ranges between the two countries (Taninkhayi Nature Reserve), as well as transboundary forest along the Thailand-Myanmar border (i.e. 12 protected areas and 18,730 km² at the Western Forest complex, and 1,850 km² at the Hala-Bala Forest) (Traeholt et al., 2016).

Figure 9: Malayan tapir range map © Traeholt et al., 2016

1.5.2 Habitat

Malayan tapirs choose habitats in primary and secondary forests, usually in lowland areas below 2000 metres. Preferred habitats exhibit a dense vegetation, i.e. trees of all sizes, thick shrubbery, saplings, canopy cover, and vines. The proximity to water bodies is an important factor and areas of humidity are preferred. Salt licks seem to play a huge role for Malayan tapirs, as they visit them regularly every few weeks in order to satisfy their mineral needs and interact with conspecifics. Tapirs can also be found at oil palm and rubber plantations, where they strip the trees of their bark and are therefore considered pests (Medici, 2011; Mohamed & Traeholt, 2010; Samantha et al., 2020; Tawa et al., 2021; Traeholt & Sanusi, 2024). In their current habitats, as far as it can be determined, temperatures average 16-35°C, with water temperatures of up to 30°C, mean annual precipitation of 2000-3000 mm and humidity of 65-92% (Khadija-Ghani, 2010; meteoblue AG, 2006-2024; WeatherOnline Ltd., 1999-2024; TamanNegara.Asia, 2009-2019).

*Figure 10: T. indicus habitat in Malaysia: Sungai Atok near Taman Negara National Park (**left**); Sungai Dusun Wildlife Conservation Centre (**right**). © D. Koch*

The recorded density of Malayan tapirs in their natural habitat varies between 0.02 and 10 adult individuals per 100 km² (Mohamed & Traeholt, 2010; Samantha et al., 2020; Medici, 2011). Home range sizes vary from 0.6 to 12.75 km², at times overlapping with those of other individuals, especially in sub adults (Khadija-Ghani, 2010; Mohamed & Traeholt, 2010; Williams, 1978). The largest recorded home range size measured 70 km². Daily average travel distance is 0.32 km (Medici, 2011).

1.5.3 Population

The three main populations are estimated to consist of fewer than 500 adults on Sumatra, 1,300 to 1,700 individuals in Malaysia and Southern Thailand, and a maximum of 250 adult individuals in Myanmar and Thailand. These populations, however, are highly fragmented and count about 10-15 individuals per subpopulation. Southern Malaysian subpopulations are even smaller with only 3-5 individuals respectively, causing severe genetic separation (Traeholt et al., 2016).

1.5.4 Conservation status

The latest IUCN red list classification of the Malayan tapir, dated from the 17th November 2014, lists *T. indicus* as endangered with a decreasing population trend. In Sumatra, the population decreased by almost 50%, in Malaysia and Thailand by more than 50% and the entire *in situ* population is expected to shrink by another 20% within the next two generations. Even though

the species is protected in its entire habitat, with Action Plans in place in Indonesia and Malaysia, not all areas of its habitat are parts of protected areas, particularly in Sumatra and Myanmar. The existential threat that affects Malayan tapirs in all their range is the destruction and fragmentation of rainforest in order to build plantations. This fragmentation also leads to genetic changes due to inbreeding. Other threats to Malayan tapirs include traffic accidents, accidental snaring, and hunting for meat, local zoos, and markets (Traeholt et al., 2016; Traeholt & Sanusi, 2024). *T. indicus* is protected in Appendix I under CITES and Appendix A under EU Council Regulation (EC) No 338/97.

1.6 DIET AND FEEDING BEHAVIOUR

Malayan tapirs subsist herbivorously as hindgut-fermenters that are often compared to horses when it comes to digestion and feeding physiology. They possess a relatively large caecum and colon for digesting plant fibres and are specialised in browse. Even though there is huge individual variation between animals, in general, tapirs consume less mass than horses and defecate much more seldomly, i.e. twice per day. Tapirs have several small feeding bouts in a day because their stomach capacity is comparatively small. The passage time from eating to excretion is significantly longer compared to horses (Lang-Deuerling, 2008). Tapirs have relatively simple teeth and do not have a lateral 'grinding' chewing stroke (Hohl et al., 2020). While this does not compromise their chewing efficacy on their natural diet, it probably contributes to difficulties in chewing other material, in particularly grass forages (Hummel et al., 2008).

T. indicus is a generalist but selective browser, thus feeding on a large variety of plants yet preferring a small number of species, if available. Its diet's main elements are sapling trees and shrubs, but it also consists of vines, woody lianas, herbaceous plants, and aquatic vegetation. Leaves are the biggest component (87%), but wild (non-cultivated) fruits (8.1%) and twig matter (5%) also make up a small part of the diet. Nevertheless, there are also studies of tapirs feeding on mosses, herbs, stems, and buds. Usually, only the fresh leaves, shoots, and twigs are consumed so that a bigger part of the feeding plant's foliage is often left intact. Furthermore, tapirs frequently visit natural licks, presumably to meet their sodium requirements. It has been reported that Malayan tapirs raid cultivations of watermelon and gambir and strip oil palm trees of their bark. *T. indicus* can feed on taller sapling trees by breaking, bending, or pushing them down; stems of up to 4.2 cm in diameter can be snapped with their teeth and trees of up to 7 cm in stem diameter can be forced down. Up to 90% of the daily activity budget of Malayan tapirs is spent foraging. Even though there is little information on their role in forest ecology, seed dispersal seems to be trivial, while the choice of food is of more ecological importance (Medici, 2011; Khadija-Ghani, 2010; Simpson et al., 2013; Mohamed & Traeholt, 2010; Tawa et al., 2021).

The natural diet of *T. indicus* consists of a vast number of over 200 plant species from more than 40 families. However, only 30 species made up more than half of the overall diet. There are different sources concerning the most consumed families. Depending on location, season, and environment, several families have been cited as the most notable diet components: Euphorbiaceae, Rubiaceae, Melastomataceae, Aspleniaceae, Phyllanthaceae, Myristaceae, Moraceae, Gardeniae, Sapindaceae, and Symplocaceae. Malayan tapirs seem to dislike

succulents, bananas, and gingers, and reject several common species in their habitat (Medici, 2011; Khadija-Ghani, 2010; Simpson et al., 2013).

1.7 Reproduction

In the wild, Malayan tapirs presumably live as facultative polygamists; females only mate with one male, while males have several partners. While there is usually no seasonal variation in matings or births in captivity in the Northern hemisphere, wild animals generally breed from April to June (Pukazhenthi et al., 2012; Medici, 2011; Traeholt & Sanusi, 2024).

In the wild, Malayan tapirs generally do not mate before the age of five and presumably leave the reproductive age at 24 ± 2 years. Under human care, sexual development can be influenced by a number of factors and widely vary between individuals. Thus, puberty in females is reached before 30 months of age, and dams are sexually mature between the ages of two and four years. The earliest recorded conception happened at the age of 36 months. Reproductive age for females under human care lies at over 30 years (Medici, 2011; Barongi, 1993; Kusuda et al., 2008; Pukazhenthi et al., 2012).

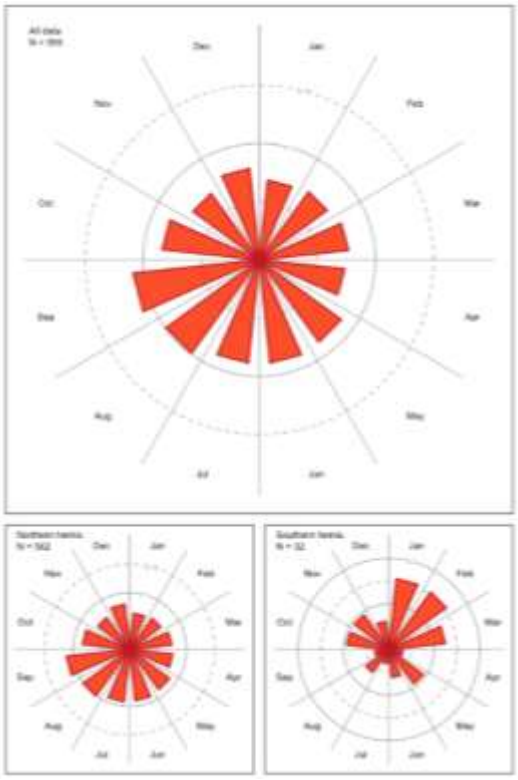

*Figure 11: Proportion of births per month from parents in ZIMS after January 1, 1980 for all data combined (**top**), and only northern or southern hemisphere (**bottom**). © ZIMS Species360, 2023*

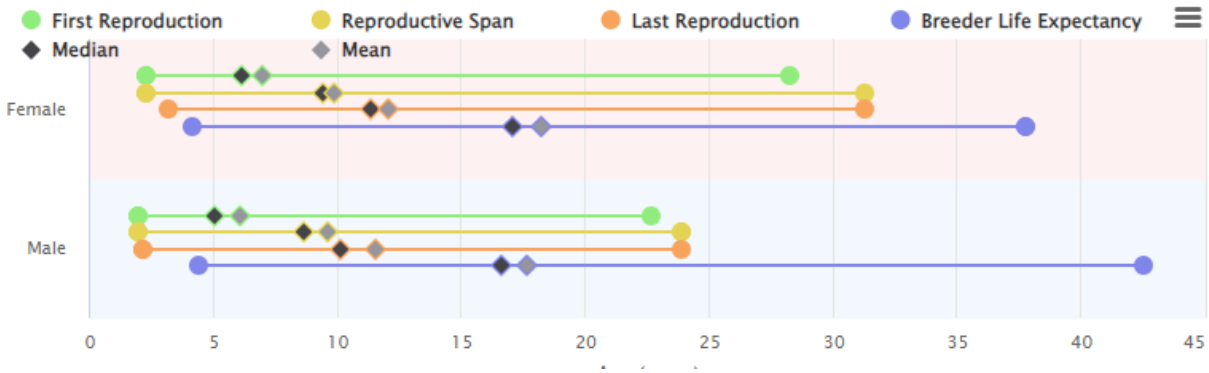

Figure 12: Reproductive age summary of the captive population © ZIMS Species360, 2023.

There is different information regarding Malayan tapir oestrous cycles. Some sources detected one type of cycle ranging from 41 to 84 days (de Boer, 2007; Kusuda et al., 2007; Schaftenaar et al., 2006). Others found evidence for two different types of cycles – a short one of ca. 30 days and a long one of ca. 60 days (de Boer, 2007; Pukazhenthi et al., 2012) – which would be different from the other tapir species, which only exhibit one type of cycle. During their cycle, copulation happens at least once, with an intromission time of 15-20 minutes (Medici, 2011).

About two weeks after parturition, females resume cycling and can exhibit post-partum oestrous. It is possible to conceive within that first post-partum oestrous (AZA Tapir TAG, 2013).

BIRTH DETAILS

The length of gestation is 13 months (390-410 days), but pregnancy can often only be detected several weeks before parturition. *T. indicus* gives birth to a single offspring; there have only been very few recorded incidents of twins. In total, a female can give birth to five to 15 calves with a generation length of twelve years and an interbirth-interval of 14 to 18 months. In the wild, interbirth-intervals seem to be longer than under captive conditions, presumably at least three years. The sex ratio in the wild is presumably 1:1 (Medici, 2011; Pukazhenthi et al., 2012; Traeholt & Sanusi, 2024).

Labour is usually short and the calf is able to stand up on its own after a few hours. In the first week, the calf stays in a safe spot where the dam regularly visits to nurse it. After that, it begins to follow its mother. Weaning occurs at four months of age but offspring usually stay with the mother until an age of up to 18 months. For the dam, postpartum oestrus sets in only 9 to 27 days after parturition (Medici, 2011; Pukazhenthi et al., 2012).

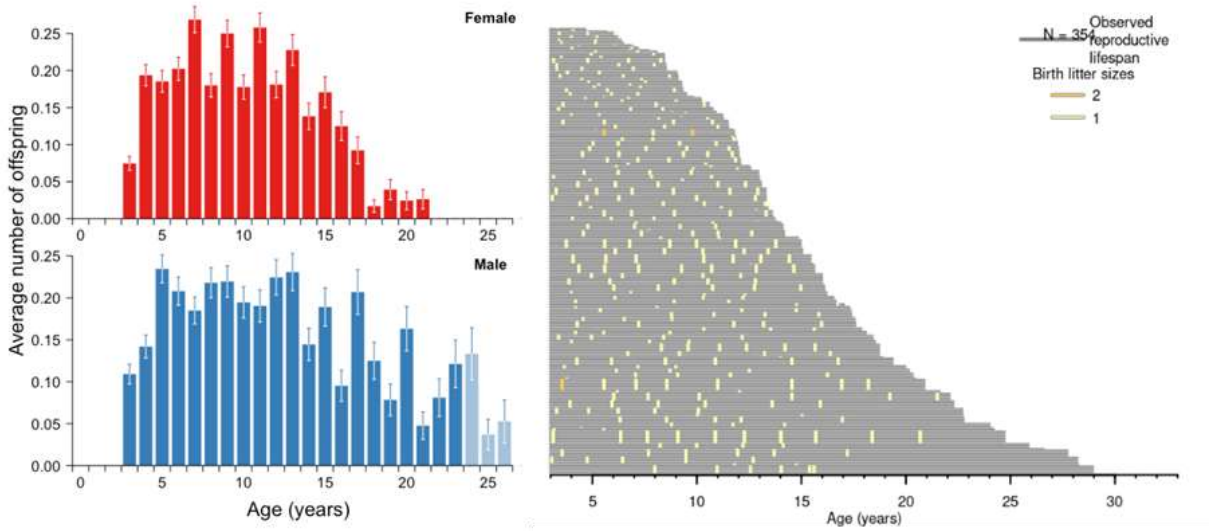

*Figure 13: Average number of offspring produced per age and sex in the captive population. The vertical coloured white lines represent the standard errors of the values (i.e. measure of uncertainty in the values). Bars are faded when less than 30 females or males were available for analysis (**left**); observed reproductive lifespan for all mothers in ZIMS after January 1, 1980 and with maternities known at least to 80% certainty. Birth events are shown in yellow to red as a function of number of offspring per event (**right**). © ZIMS Species360, 2023.*

1.8 BEHAVIOUR

ACTIVITY

In the wild, Malayan tapirs are primarily nocturnal animals (Novarino, 2005). Under human care, however, they often exhibit crepuscular or diurnal behaviour. Here, they sleep for six to ten hours per day but break them down in several smaller bouts (Harahap et al., 2014). During their awake periods, captive tapirs spend 50-70% their time resting. In both the wild and under human care, their active time is mostly filled with foraging (Gilmore, 2001; Medici, 2011; Suwannaphong et al., 2018).

LOCOMOTION

Tapirs move quadrupedally and exhibit different gaits for different speeds: walk, trot, and gallop. Locomotion makes up only a smaller part of the daily activity budget and in observations, movement was often targeted towards obtaining food (Suwannaphong et al., 2018).

*Figure 14: Modes of tapir locomotion, walk (**left**), trot (**centre**), and gallop (**right**). © T. Burger*

PREDATION

As prey animals, tapirs usually flee from predation, either into the forest or into the nearest water body. However, they can become defensive and bite or knock down their attacker (Zenzinger, 2018). Natural predator species include tigers, leopards, and dholes (Medici, 2011).

SOCIAL BEHAVIOUR

In the wild, Malayan tapirs live mostly solitarily but can be observed in groups of two to three, with home ranges commonly overlapping (Traeholt & Sanusi, 2024). Under human care, they can be tolerant towards conspecifics of the opposite sex. Here, social behaviours only make up a very small (<1%) part of their activity budget and juveniles as well as females with offspring exhibit more social behaviours than adult non-rearing tapirs. Intraspecific vocal communication functions via different squeal and hiccup sounds. Females are more frequently observed using vocalisations, whereas males prefer physical interactions like pushing or biting. The sounds are used during exploration behaviour, when agitated, as warning sounds, or during initiation. In order to mark their territories, tapirs urinate and defecate at special areas within their territory, e.g. near their sleeping site or close to water bodies (Arumugam et al., 2020; Gilmore, 2001; Medici, 2011; Novarino, 2005; Suwannaphong et al., 2018; Zenzinger, 2018).

SEXUAL BEHAVIOUR

During the receptive period of the female, the social behaviour changes and many sexual behaviours can be observed: Males exhibit initiation behaviours towards the female, such as sniffing the female's genitals, licking, touching, and rubbing. Tapirs might also exhibit increased play, locomotion, and vocalisation behaviour. There may also be an increase in aggression, i.e. biting or chasing, especially by the male towards the female. Females have been observed to increase their rate of spray urination. In the copulatory period, the resting rate decreases significantly, and courtship behaviour such as circling and chasing can be seen. On the day of copulation, mounting occurs, and the tapirs copulate in the water or on land (Pukazhenthi et al., 2012; Barongi, 1993; Kusuda et al., 2007; Arumugam et al., 2020; Zenzinger, 2018; Lang, 2022).

*Figure 15: Tapir reproductive behaviour: Circling (**top**); mating in water and on land (**bottom**). © Lyon Zoo, Tiergarten Nürnberg, Prague Zoo.*

2 MANAGEMENT IN ZOOS AND AQUARIUMS

2.1 ENCLOSURE

2.1.1 Boundary

Several boundary types have been successfully used in tapir husbandry. It is important to choose materials that are sturdy enough to withstand the impact of a 400 kg animal running or rubbing against or climbing the barrier. Malayan tapirs can climb fences of at least 120 cm, especially in a state of arousal or panic. The barriers should therefore be constructed in a way that makes them more difficult to climb, for example by using vertical poles, and it is recommended that they stand at least 150 cm tall. It should also be noted that the urine marking of Malayan tapirs could lead to a swift decay of certain materials. Thus, all barriers should be regularly inspected for sturdiness, or double barriers should be used.

Recommended boundaries for Malayan tapirs include wooden or metal fencing or palisades, double wire mesh fencing, chain-link fence, and stone or concrete walls. Furthermore, glass panels have been successfully used with the necessary habituation. A ready-built solution for inside-enclosures is prebuilt barriers for commercial horse stables, with a combination of wood on the bottom and metal bars on the top. In order to facilitate protected contact, fencing between tapirs and keepers can consist of wide-spaced bars to engage with the animals safely

through the barrier. Electric fencing can be used to protect plants or add an additional level of security to already existing barriers but should be used sparsely and not be accessible by the tapirs from the water.

*Figure 16: Examples of suitable indoor barriers for Malayan tapirs: horse stable barriers (**left**); metal separation for protected contact (**centre**); spaced wood palisades (**right**). © D. Koch, D. Ordonneau*

*Figure 17: Examples of suitable outdoor barriers for Malayan tapirs: wood palisades with additional electric wiring at the top (**left**); bamboo palisades (**centre**); metal double rod mat fence (**right**). © D. Koch*

In addition to the barriers on the perimeter of the enclosure, visual barriers should be installed within the exhibit to permit temporary cover from potentially aggressive conspecifics. For this, plants, stones, or wood barriers are preferred elements.

Doors and slides should be made from metal or wood and measure at least 100 cm in width and 120 cm in height. Depending on their location, they can be either fully covered or partially open to grant contact amid the animals. The space between the bars can measure up to 13 cm to allow contact without the risk of injury through aggressions. Since young calves can stick their head and feet through gaps as small as 5 cm, it is necessary to temporarily close those gaps during the rearing of an offspring, e.g. by adding wooden boards or a fine fence on top. Ideally, doors between stalls can be fitted with both options, depending on the compatibility of the individuals and presence of a calf. It is necessary that doors and slides can be operated from outside of the animal area to allow for protected contact.

Figure 18: Different types of (sliding) doors for Malayan tapirs. © D. Koch, Zoo Leipzig

2.1.2 Substrate

The substrate for Malayan tapirs should accomplish several tasks: it should offer a comfortable ground for all behaviours (i.e. enough grip for running, comfort for sleeping), offer insulation from the cold, not cause damage to the locomotor system, not be easily ingestible, be hygienic, and easy to work with for the staff. In inside-enclosures, concrete or cement flooring or poured asphalt can be used as a base. This layer should be supplemented with softer, insulating substrates such as rubber matting (at least 1.8 cm thickness) or screed, hay, fine bark mulch, or coconut soil. Holders should be aware that hard substrates can cause lameness, and rough floors can cause foot abrasions, while rubber and other smooth substrates can become very slippery when wet. While wood bark substrate has proven most beneficial for the feet, some individuals ingest textured substrate like mulch or bite rubber mats, which can lead to congestions; similarly, the ingestion of straw can lead to lumpy jaw syndrome. Thus, new substrate must be closely monitored in the beginning. It is advisable to offer several different substrates for the tapirs to choose and plan the enclosure in a way that mulch/soil substrate can easily be removed and exchanged.

*Figure 19: Examples of suitable substrates for indoor enclosures: coconut soil (**top left**); forest floor (**top right**); poured asphalt (**bottom left**); rubber matting on concrete floor (**bottom right**). © D. Koch, Zoo Leipzig*

The outside enclosure can be equipped with soft substrates, such as natural soil, grass, or forest floor, as well as the bedding used on the inside. The substrate should not be coarse as this can cause inflammations on the feet.

*Figure 20: Examples of suitable substrates for outside enclosures: natural soil (**left**); wood chips (**right**). © D. Koch*

2.1.3 Furnishings and Maintenance

POOL

Water bodies are a vital need for all tapirs. The lack of adequate access to water can lead to rectal prolapse, skin problems, and behavioural abnormalities (Arumugam et al., 2018). Malayan tapirs urgently need water bodies for healthy defecation. Therefore, the availability of

pools is required inside and outside. Small pools (at least 1 m² with 0.2 m depth) are needed in every temporary or permanent holding facility for each individual.

Figure 21: Examples of minimum water bodies that must be available at temporary holding facilities. © D. Koch

Long-term exhibits should offer all tapirs the possibility to submerge themselves completely in the water every day. Thus, enclosures must offer a pool of at least 1 m depth for proper bathing that is always accessible, especially if access to a larger pool is restricted for extended durations (e.g. cold weather, nights).

Figure 22: Indoor pools for complete submersion of Malayan tapirs. © D. Koch

However, to satisfy their need to display all their natural behaviours, including swimming and diving, it is necessary to offer large pools with variable depths and several shallow exits for the tapirs (Duoying et al., 2014).

Figure 23: Outdoor bathing pools with adequate size for swimming and diving, varying depths, and shallow exits. © Taipei Zoo, D. Koch

Due to the contamination from faeces, all pools should either be cleaned daily or be equipped with a filter. In order to increase comfort and usage, especially during colder weather, water should be kept at an ambient temperature of 20-27°C; this temperature range is obligatory for young offspring.

FEEDING AND DRINKING

Food can be presented in different forms: it can be offered on the clean ground, scattered for enrichment, and served in troughs or hayracks. To mimic the natural feeding position, hay and browse can be fed from an elevated level. Installations that simplify the presentation of browse can be useful. Multiple feeding sites should be offered to tapirs to counteract aggression between individuals during feeding time. Salt licks should be available to the animals at all times.

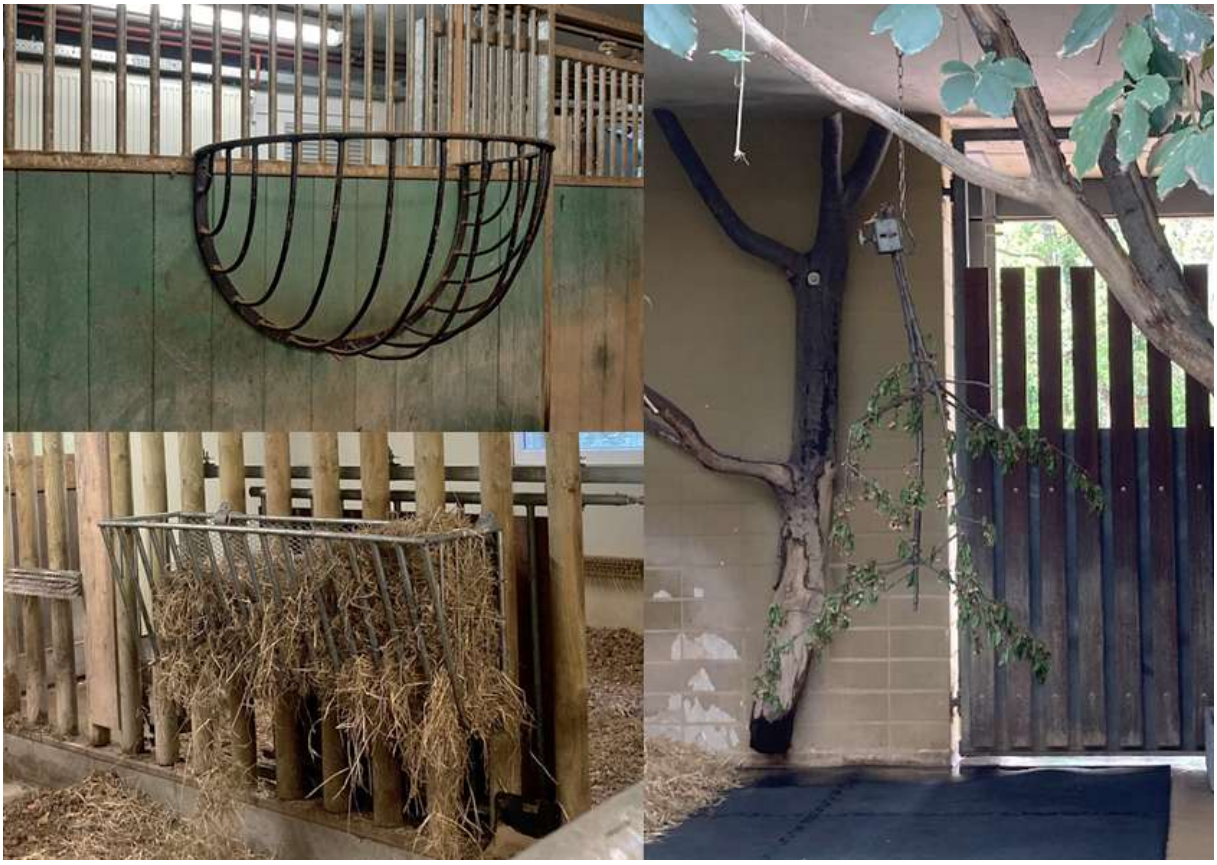

*Figure 24: Hay feeders (**left**); device for presenting hanging browse (**right**). © Antwerp Zoo, D. Koch*

Since tapirs defecate into their water bodies, typical drinkers commonly used for horses are recommended. They should be available at all times and sturdy enough to withstand the impact of tapirs.

Figure 25: Automatic drinking fountains for tapirs. © D. Koch

WELLNESS

Additional furnishings that are recommended for Malayan tapir enclosures are instalments for skin care like rubbing trees, brushes, or rubbing mats. Mud wallows can be offered additionally to the water bodies for skin care and comfort behaviour. Tapirs should be able to choose a soft substrate for lying down. Furthermore, there should be enough shelter from the weather in the outside enclosure and at least a quarter of the outdoor area should be shaded to avoid ocular and dermatologic pathologies (AZA Tapir TAG, 2013). An in-built scale in the enclosure facilitates regular weight-checks and early detection of pregnancy.

Figure 26: Scratching and comfort possibilities for tapirs. © Antwerp Zoo, D. Koch

MAINTENANCE

Husbandry should be kept to a high hygienic standard to prevent the susceptibility to diseases and parasites, especially with regard to the pools. The functional condition of all barriers should be checked regularly due to the swift degradation arising from urine markings. In order to save energy during the colder months and offer spaces with fewer insects, open doors can be covered with lamella. Caution should be placed on whether the tapirs bite or ingest the material. It may be necessary to devote a larger area of the facility to technical equipment, especially if filters are used for the pools.

Figure 27: Lamella for minimising temperature loss, made out of plastic or fire hose. © Paris Zoo, D. Koch

PLANTS

A variety of plants can be presented in the enclosures; however, many species will be decimated by browsing. Therefore, it can be

necessary to preserve certain weeds, shrubs, and trees from browsing by adding protection such as fencing, wood, rope, or wire.

Figure 28: Different types of browsing protection: rope, wood and plastic, wire, and wood palisades. © D. Koch

Table 2: Selection of recommended plant species for tapir enclosure design.

Scientific name	Common name	Scientific name	Common name
Acanthus mollis	Bear's breeches	***Alnus cordata***	Italian alder
Alchemilla mollis	Lady's mantle	***Alnus glutinosa***	European alder
Asplenium scolopendrium	Hart's-tongue fern	***Alnus incana***	Grey alder
Astilboides tabularis	Common Atilboides	***Arbutus unedo***	Strawberry tree
Aucuba japonica	Spotted laurel	***Betula* sp.**	Birch
Bidens pilosa	Beggarticks	***Castanea sativa***	Sweet chestnut
Choisya ternata	Mexican orange blossom	***Chamaerops excelsa***	European fan palm
Gunnera manicata	Giant rhubarb	***Corylus colurna***	Turkish hazel
Kniphofia uvaria	Torch lily	***Cydonia oblonga***	Quince
Laurus nobilis	Bay laurel	***Dimocarpus longan***	Dragon's eye
Ocimum basilicum	Basil	***Eriobotrya japonica***	Loquat
Pachysandra terminalis	Carpet box	***Ficus benghalensis***	Banyan
Polystichum setiferum	Soft shield fern	***Ficus carica***	Common fig
Tropaeolum majus	Nasturtium	***Fraxinus spec.***	Ash
Urtica dioica	Stinging nettle	***Gleditsia triacanthos***	Honey locust
Vinca minor	Lesser periwinkle	***Koelreuteria paniculata***	Golden rain tree
Carex secta	Makura grass	***Liquidambar styraciflua***	American sweetgum
Chasmanthium latifolium	River oats	***Morus nigra***	Black Mulberry
Miscanthus sinensis	Chinese silver grass	***Musa* sp.**	Banana
Pennisetum orientale	Oriental fountain grass	***Olea europaea***	Olive
Phormium tenax variegatum	New Zealand Flax	***Pinus* sp.**	Pine
Bambusoideae	Bamboo	***Platanus* sp.**	Plane
Cotinus coggygria	Eurasian smoke tree	***Pterocarya fraxinifolia***	Caucasian wingnut

Eucalyptus gunnii	Cider gum	***Salix* sp.**	Willow
Osmanthus* x *burkwoodii	Burkwood osmanthus	***Tetrapanax papyrifer***	Rice paper plant
Pittosporum tobira	Japanese mock orange	***Tilia cordata***	Small-leaved lime
***Rubus* sp.**	Bramble	***Tilia* x *europaea***	Common lime
		Vitex agnus-castus	Chaste tree

VISITORS

Malayan tapirs should have the possibility to avoid noise and vibration exposure caused by large numbers of visitors by retreating to more sheltered parts of their enclosures. The accessibility of enclosure parts in which comfort and relaxation behaviour are regularly shown must be ensured, even when visitor numbers are peaking, to avoid the formation of behavioural abnormalities (Arumugam et al., 2018).

2.1.4 Environment

TEMPERATURE

Temperatures of 16-30°C are comparable to the climate in the Malayan tapir's natural habitat and are therefore recommended for inside enclosures. Temperatures above 30°C should be avoided. Animals should be given the choice between different temperatures, sunny and shaded areas, as well as access to water to regulate their body temperature. Heating systems like water heating, air heating, or heated floors and panels can be used. If the floors are not heated, they should be insulated with the adequate substrate. Caution is advised to the influence of the heating system on air humidity. Heat accumulation, respiration problems, the spread of airborne diseases, and moisture build-up should be prevented by providing appropriate ventilation by active air renwal. To avoid large temperature differences between indoor and outdoor enclosure during the winter, thus limiting the animals' access to the outside, it can be useful to down-regulate the indoor temperature to 16-18°C. If slowly adapted to it, Malayan tapirs can then spend prolonged amounts of time outside in temperatures lower than 16°C. Depending on humidity, wind, and precipitation, temperatures of 5-15°C are unproblematic as long as access to the indoor enclosure is freely granted. However, offspring should not be kept at a temperature below 10°C for the first three months and newborn calves require an ambiance of 20-30°C in the first few weeks of life (AZA Tapir TAG, 2013).

HUMIDITY

Air humidity in tapir inside enclosures should be closely monitored. Analogous to their natural habitat, humidity should lie between 65% and 95%. In any case, access to water must always be granted. Animals can additionally be offered showers or sprinklers to their liking.

LIGHT

Malayan tapir indoor enclosures should have access to natural light. It can be supplemented by LED lighting. The lighting regime can be adapted to match local daylight patterns, since animals continue to have access to outdoor enclosures and no negative outcomes linked to seasonal photoperiod changes have been reported in the Northern Hemisphere.

2.1.5 Dimensions

Optimal exhibit dimensions depend on a variety of factors such as complexity, usability of outdoor space according to climate, and presence of other species. All holders should have enough space to comfortably hold three individuals in separate inside and outside enclosures

that offer enough space and water bodies for all behavioural, social, physical, and mental needs. This includes space for social and play behaviour such as running and chasing without any dead ends or sharp angles. Temporary inside pens for restraining or holding of less than an hour daily can be smaller in size, but inside enclosures for permanent keeping must be big enough for all behaviours mentioned above and be combinable to offer more space for compatible individuals.

An outside enclosure should be accessible for every animal, even if separated. Thus, there should be at least two outdoor enclosures in each facility that can be combined if pair compatibility is given. For the determination of ideal exhibit size, please get in touch with the EEP coordinator.

2.2 FEEDING

2.2.1 Basic Diet

With diseases of the digestive tract and kidney insufficiencies being a common cause of death in tapirs under human care, it is of utmost importance to feed the animals according to their physiological needs. A high volume of roughage closely mirrors fibre content of the natural diet in the wild and is important for adequate faecal consistency – which prevents rectal prolapse –, and appropriate energy intake, which counteracts obesity. Therefore, the main components of the diet should be browse and lucerne hay. Browse can be fed fresh, dried, or as silage. Pure grass hay is not an appropriate roughage for tapirs, due to its palatability and protein content. To facilitate ingestion, hay should be soft without any rough or thick stems. It can be additionally chopped or soaked. Fruits should be completely avoided due to the high sugar content in commercially available fruit. A variety of browse species can be offered; leaves, shoots, twigs, and bark are all readily consumed by tapirs (Clauss et al., 2009; Clauss et al., 2025).

*Table 3: Selected recommended browse species for tapirs. Asterisk * indicates potentially toxic fruits, therefore caution is advised when feeding browse with fruits (supplemented by https://www.zooplants.net)*

Scientific name	Common name	Scientific name	Common name
Acacia dealbata	Silver wattle	***Corylus colurna***	Turkish hazel
Actinidia deliciosa	Kiwi fruit	***Eriobotrya japonica***	Loquat
Buddleja davidii	Butterfly bush	***Fagus sylvatica****	European beech*
Eruca sativa	Rocket	***Fraxinus excelsior***	Common ash
Fuchsia magellanica	Hardy fuchsia	***Inga edulis***	Ice-cream bean
Hypericum perforatum	St John's wort	***Malus sylvestris***	European crab apple
Neopanax laetus	Shrub panax	***Musa basjoo***	Hardy banana
Petroselinum crispum	Parsley	***Paulownia tomentosa***	Princess tree
Salvia elegans	Pineapple sage	***Populus alba***	White poplar
Taraxacum officinale	Dandelion	***Populus nigra***	Black poplar
Urtica dioica	Stinging nettle	***Populus tremula***	Aspen
Arundo donax	Elephant grass	***Populus x canadensis***	Hybrid black poplar
Salix viminalis	Osier	***Prunus avium****	Wild cherry*
Corylus avellana	European hazel	***Prunus cerasifera****	Cherry plum*

Hippophae rhamnoides	Sea buckthorn	***Quercus cerris***	Turkey oak
Acer campestre	Field maple	***Quercus ilex***	Holly oak
Acer platanoides	Norway maple	***Quercus petrea****	Sessile oak*
Aesculus indica	Indian horse chestnut	***Quercus robur****	Common oak*
Aria edulis	Whitebeam	***Salix caprea***	Goat willow
Betula pendula	Silver birch	***Salix x sepulcralis***	Weeping willow
Carpinus betulus	Common hornbeam	***Sorbus aucuparia****	Rowan*
Castanea sativa	Sweet chestnut	***Ulmus procera***	English elm

Tapirs also urgently need access to salt licks at all times to meet their mineral requirements. In addition to the feeding of browse and hay ad libitum, which should ideally account for 70-80% of the diet, high-fibre (>19%) herbivore or browser pellets with low iron content should be fed (Jessen & Ordonneau, 2024).

Table 4: Example of a daily feeding plan for one adult Malayan tapir. Quantities to be appraised individually.

Time	Type	Quantity	Presentation
Ad libitum	Alfalfa hay	ad libitum	in hay rack or on ground
	Browse	ad libitum	distributed in enclosure
Morning	Category A vegetables	~1.5 kg	scattered
	herbivore/browser pellets	~0.5 kg	in trough
Noon	Category A vegetables	~1.5 kg	in water as enrichment
	Category B vegetables	~0.5 kg	for training or enrichment
Evening	Category A vegetables	~1.5 kg	hidden as enrichment
	herbivore/browser pellets	~0.5 kg	scattered
Category A: leafy vegetables	cabbage, celery, fennel, chicory, spinach, leek, chard, kale, endive, lettuce		
Category B: low starch vegetables	broccoli, cauliflower, eggplant, cucumber, corn, asparagus, tomato, radish, zucchini, pumpkin, green bean		

2.2.2 Special Dietary Requirements

Amounts of vegetables can be increased or decreased according to season, individual health status, pregnancy, age, body condition score, or weight. Pregnant females and dams nursing offspring should be monitored closely to adapt the diet and feed quantities. Due to their susceptibility to iron storage disease, caution should be placed on the intake of iron and iron absorption enhancers.

2.2.3 Method of Feeding

Tapirs should be fed at least three meals a day, preferably more, to account for their stomach capacity and reduce the risk of colic. However, roughage should always be available to the animals, day and night, to allow continuous feeding. Food can be presented to tapirs in a variety of ways. The main components, i.e. browse and alfalfa hay, should be offered in a position that mimics the natural mode of ingestion, thus elevated above the ground and spread throughout the enclosure. However, hay can also be fed from cleaned grounds. Vegetables can be scattered through the exhibit, used in enrichment, e.g. hung on strings, swimming in the water, or fed in troughs (see chapter 2.5). Pellets can be scattered or used in enrichment

devices such as barrels or balls. In any case, there should be multiple feeding sites to avoid aggression between individuals.

2.2.4 Water

Tapirs consume up to 18 litres of water per day, or up to 6,5 litres per 100 kg of body mass (Lang-Deuerling, 2008). Fresh, clean water must be available to all animals at all times, preferably through automatic drinking troughs. Water within pools must be cleaned daily through water changes or filters so as not to compromise the tapirs' health should they drink from these water bodies.

2.3 Social Structure

2.3.1 Basic social structure

As solitary animals, tapirs are not kept in groups but rather in pair or single housing. If the male and female are socially compatible, they can live together continuously. If not, they must be housed separately and only introduced during heat, or be temporarily separated, e.g. during the night or during feeding. It is beneficial for the tapirs to be habituated to both situations, even if they are housed as a pair. Males should be separated from the female and offspring during the first months of nursing. After that, it can be determined individually if the group is compatible (see chapter 2.4.5). Offspring stay with their mothers for at least four months. Between the ages of one to two years, tolerance of the dam usually decreases so that the young must be permanently separated.

2.3.2 Changing group structure

The introduction of a new pair can take time. It is advisable to let the animals have olfactory, visual, and tactile contact through a fence or door before they are fully introduced. Barriers should thus be high and sturdy enough to prevent unwanted full contact. Both animals should be familiar with the entire enclosure and have had time to carefully inspect the area with its boundaries and furnishings by themselves. When limited contact is socio-positive and the animals do not seem stressed, they can be introduced. It is advisable to first limit introduction to the daytime, separating for the night. During introduction, the tapirs must be offered ample space to run without hindrance, dead ends, or sharp angles, so that the chased animal is always able to escape. Chasing, as well as a certain level of aggression such as biting, is typical in tapir introductions and does not have to be prevented unless there is serious concern for the health of one of the animals. If introductions fail, the animals can be separated and introduced again at a later time. If introduction fails repeatedly, it can be attempted during heat or the partners have to be exchanged. Regularly separating introduced individuals for short amounts of time as part of a daily routine facilitates husbandry procedures and emergency actions.

Figure 29: Narrowly spaced bars between enclosures offer opportunities for visual, olfactory, and tactile contact between unfamiliar individuals before introduction. © Antwerp Zoo, D. Koch

2.3.3 Sharing enclosure with other species

Malayan tapirs have successfully been kept with a variety of different species. Few problems are to be expected with most bird species. Successful mixed-species exhibits include Malayan tapirs with water-dwelling birds (*Anser indicus*, *Pelecanus crispus*, several duck species), cranes (*Antigone vipio, Grus japonensis*), and others (e.g. *Vanellus miles*, *Lophotibis cristata*, *Leucopsar rothschildi, Rhabdotorrhinus corrugatus, Threskiornis melanocephalus, Lophura edwardsi*). Another effective combination is the addition of predominantly arboreal mammals like binturongs (*Arctictis binturong*), crested macaques (*Macaca nigra*), gibbons (*Hylobates lar*), or orangutans (*Pongo abelii*). Other smaller mammals have also been successfully kept together with Malayan tapirs, such as Reeves' muntjacs (*Muntiacus reevesi*), Indian hog deer (*Axis porcinus)*, Asian small-clawed otters (*Aonyx cinereus*), and babirusas (*Babyrousa babyrussa*).

*Figure 30: Mixed-species exhibits with T. indicus: Macaca nigra (**top left**); Muntiacus reevesi (**top right**); Aonyx cinereus (**bottom**) © Mulhouse Zoo: B. Quintard, MNHN: F.-G. Grandin, Zoo Łódź: M. Pacholczyk.*

Depending on the enclosure layout and design as well as the individuals of each species, certain combinations might not be compatible in every institution. The smaller – or less dominant – species should always have the opportunity to retreat to a part of the enclosure reserved for itself.

2.4 BREEDING

2.4.1 Mating

There is no seasonality in matings or pregnancies in Malayan tapirs. Female oestrous lasts 2-5 days and is indicated by presentation of the labia, frequent urination, contact calls, as well as chasing and circling (see chapter 1.8). Therefore, generous space devoid of dead-ends, sharp angles, or tripping hazards should be available. Matings – on land or in the water – can be observed in short intervals (Puschmann et al., 2009) with intromission times of 15-20 minutes (AZA Tapir TAG, 2013). Frequent matings can lead to skin lesions on the female's back.

2.4.2 Pregnancy

Gestation lasts 390-410 days and is difficult to detect morphologically. If after copulation, no more oestrous behaviour is observed, the female should regularly be checked by weighing, ultrasound, and blood sampling. Body weight should slowly increase by 10% and regularly analysed hormone levels should indicate a steady increase of progesterone concentration over the course of multiple weeks. Caution is advised if hormone levels are not constantly monitored, as isolated progesterone peaks can also be signs of oestrous. Pregnancy can be detected by ultrasound from the 3rd to 4th month onwards.

*Figure 31: Ultrasound of a pregnant female at 8 months (**top left**) and 12.5 months of pregnancy (**top right**); foetus at 5.5 months (**bottom left**), 8 months (**bottom centre**), and 11 months of pregnancy (**bottom right**). Habituated females can be examined without anaesthetics by feeding and stroking them during the procedure. © D. Koch, K. Baumgartner, Tiergarten Nürnberg*

If pregnancy is probable, the female should be separated from the male before the expected date of parturition, pools should be drained and secured from the calf, and generous bedding should be provided in the quarters to prevent hypothermia and splaying. The enclosure should be inspected for risks of injury, gaps, and crevices. The space between the bars of barriers and doors should be closed. Additionally, the enclosure can be fitted with a camera system that records the behaviour of the dam. If the system is accessible remotely, regular monitoring around the due date is helpful to witness the birth without disruption to the dam and arrange any necessary interventions.

Table 5: Example of a birth protocol checklist with necessary preparations for a Malayan tapir birth.

Time frame	Actions
Up to one week before birth	✓ eliminate risks of injury, gaps, and crevices ✓ block spaces between bars of barriers and doors ✓ set up boundaries towards pools ✓ install a surveillance system ✓ clean enclosure and provide fresh new substrate ✓ separate female from male
Up to expected day of birth	✓ restrict female's access to pools ✓ provide thick bedding in female enclosure ✓ procure material for bottle feeding (foal milk replacer, bottle, teat) ✓ train mother to be stroked down in protected contact
Directly after birth	✓ raise temperature indoors to 23°C ✓ check surveillance footage for drinking bouts and defecation ✓ only interact with dam in protected contact ✓ if necessary, restrict visitor presence for the first few days

Close to the date of parturition, several signs can hint at an approaching delivery: Vulvar oedema, an enlarged udder, and mucous discharge can proceed parturition two to three weeks (Medici, 2011; Pukazhenthi et al., 2012; Puschmann et al., 2009); seven to ten days before birth, progesterone and oestrogen levels should have reached their peak and then strongly decline. Shortly before parturition, colostrum secretion can be a sign of imminent birth (AZA Tapir TAG, 2013).

Figure 32: Development of udder and vulva leading up to parturition © B. Quintard, Mulhouse Zoo

2.4.3 Details on contraception possibilities

In case no more offspring is needed from a certain individual, or there is a medical reason to prevent pregnancy in a female, breeding should be avoided. Instead of temporary or permanent contraception by castration, sterilisation, or chemical birth control, Malayan tapirs should be physically separated from a breeding partner. This facilitates the possibility of reproduction at a later point in time. Non-breeding animals can also be kept together with infertile individuals of the opposite sex.

2.4.4 Birth

The birthing female can be observed showing restless behaviour, lying down and getting up several times in the immediate anticipation of birth. The process of parturition can be very quick, lasting less than a minute, but within up to two hours, the – usually single – calf should be born headfirst.

*Figure 33: The birth of a Malayan tapir, this process (lying on the side, pressing) lasted 13 seconds (**top**); dam removes amniotic sac (**bottom**). © Tiergarten Nürnberg*

The offspring weighs 6.4-10.2 kg (average 8.5 kg) and is able to stand up and walk within 20 minutes to a few hours after parturition. After 45-90 minutes, the placenta is delivered and partially or fully consumed by the dam. The calf begins to suckle one to five hours after birth (Puschmann et al., 2009). While always is possible, no case of abnormal maternal behaviour or unsuccessful rearing has been reported in the Malayan tapir EEP in the last 12 years.

2.4.5 Development and Care of young

In order to monitor offspring health with as little disturbance as possible, it is advised to equip the enclosure with a camera system that records all activity. In the beginning, it makes sense to check the videos for feeding bouts, defecation, and overall behaviour. The tapir dam typically feeds her young lying down; however, first-time mothers might initially try nursing while standing up. The first nursing bout should take place within one to five hours after parturition. Suckling periods can last up to 30 minutes and should be terminated by the calf, which can fall asleep after each feeding session. Calves are fed five to ten times per day.

Figure 34: Nursing occurs lying down in bouts of up to 30 minutes with the calf alternating between the two teats of the udder. © Tiergarten Nürnberg

It is possible that the dam consumes all of the offspring's excretions, thus the recordings should be consulted. If no defecation can be observed, it is possible that the offspring has not consumed enough milk or that it is constipated. It may be necessary to either administer an enema and/or supplement by bottle-feeding (see Chapter 2.4.6).

During the first days after parturition, camera recordings should be reviewed daily with time and length of feeding bouts and defecation being noted. To identify whether the offspring receives enough milk, it can be weighed regularly in order to track weight gain. This can be achieved with minimal impact by separating the mother temporarily and luring the calf onto a scale. Distressed calves produce a high-pitched cry that will prompt a stress reaction from the dam. Therefore, one should try to handle the calf without picking it up. Even usually calm and well-trained females can become extremely aggressive during rearing; therefore, staff should avoid direct contact with the mother in the beginning of the rearing period. Friendly interactions with the calf can nevertheless offer information on weight and health status during rearing and facilitate handling and training of the adult tapir. If the dam shows no signs of aggression during rearing, training and contact can carefully be resumed to habituate mother and calf to human contact.

*Figure 35: Careful handling of the tapir calf minimises stress and can be used to check the overall health status (**left**), monitor weight (**centre**), and check/treat the umbilicus (**right**). Just like adult tapirs, calves can be gently stroked down and be examined voluntarily. © D. Koch*

Within the first 2-3 weeks, the birth weight should have doubled; by the age of 4-5 months, it should have multiplied by ten.

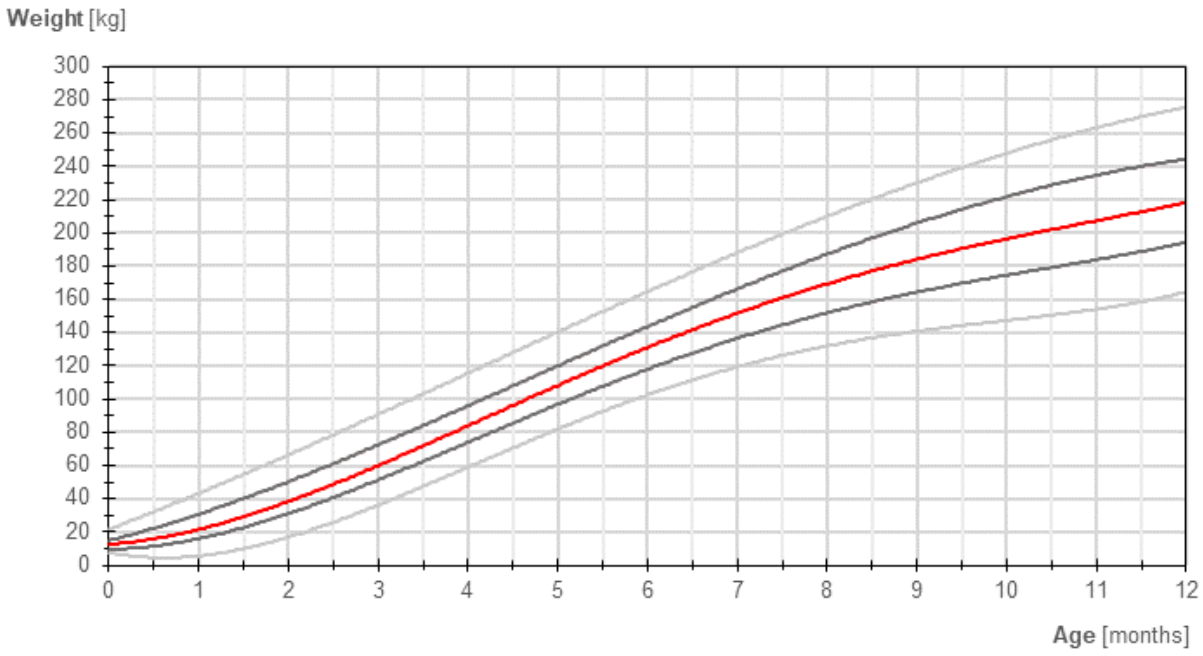

*Figure 36: weight curve for the first year of age of Malayan tapirs. **Light grey**: minimum and maximum values, **dark grey**: quarters closest to the median, **red**: median (generated with data from ZIMS Species360: Global data. Number of animals: 218, number of weight records: 3082). © ZIMS Species 360*

The primary teeth erupt within the first three weeks and thus tapir calves will cautiously try solid foods from the age of two weeks onwards; however, weaning does not begin before the age of 4-5 months and should be completed at 11 months of age. By that time, the offspring should be independent, but calves can stay with their mothers as long as they are tolerated (Medici, 2011; Pukazhenthi et al., 2012; Puschmann et al., 2009; Lang-Deuerling, 2008).

*Figure 37: Primary teeth at the age of 21 days (**left**); offspring will try solid food (**centre**) and browse (**right**) from the age of two weeks onwards. © K. Baumgartner, T. Hahn, T. Burger.*

Tapir offspring can swim at a very young age, and it is recommended to familiarise them to water bodies as early as possible, if not prohibited for veterinary or management reasons. This coincidentally allows the dam to take frequent baths and defecate in the water, which benefits skin, digestion, and behaviour. Pools should be prepped in a way that enables easy entrance and exit, minimises the chances of slipping and splaying, and allows the calf to easily find its way back to land. It is recommended to offer shallow water at first, to reduce the risk of drowning, and steadily increase the water level according to the calf's constitution. Ambient and water temperature should be closely monitored to prevent hypothermia (see chapter 2.1.4).

*Figure 38: In the beginning, shallow water can be offered to ease the calf into bathing and reduce the risk of drowning (**left**); however, tapirs can swim from an early age if easily accessible exits from the pool are provided (**right**). © T. Burger, Wilhelma Stuttgart.*

Mother and offspring should either be separated from the male until the young is transferred to another institution or can be cautiously introduced to the male three to four months after birth. Compatibility is highly individual and therefore cannot be assured (AZA Tapir TAG, 2013).

Figure 39: Successful socialisation of sire with dam and offspring (3 months old) who have had visual and olfactory contact since birth. © Mulhouse Zoo

2.4.6 Hand-rearing

If the mother tolerates the calf but does not let it suckle, holders can try to stroke her down and place the offspring at the udder. If the calf cannot be observed drinking regularly, or it does not gain weight constantly, supplementary bottle feeding can be administered in accordance with the EEP coordinator. For this, equine foal milk replacer can be used. The milk replacer must be prepared according to the manufacturer's instructions. The teat has to be long enough to grant space for the proboscis (at least 8 cm) and be secured with a rim so that it cannot be swallowed (e.g. teat for cattle rearing). Bottle-feeding should only be used as supplementation; parent-rearing is always preferable. It is thus sensible to only offer the minimal necessary amount of milk replacer so as not to discourage natural feeding. Bottle-feeding bouts and amount of milk replacer must therefore be carefully adjusted to the daily natural feeding bouts, weight, and apparent hunger of the calf. It can be phased out if the amount of milk received by the mother increases. The calf should only be handled in direct contact when the mother is separated. During feeding, the condition of the umbilicus can be inspected, and weight and sex can be determined.

*Figure 40: Supplementary bottle-feeding of a young calf (**left**); rubber nipple with rim, suitable for tapir bottle-feeding (**right**). © D. Koch*

2.4.7 Population management

Mature individuals should be placed into a breeding situation as soon as possible. If the maximum capacity of Malayan tapirs in the population is reached, new holders should be recruited to exhibit the species. If that strategy does not suffice to accommodate all animals, over-represented pairs should temporarily cease breeding in favour of genetically under-represented pairs. For this, inter-birth intervals can be prolonged by temporary separation of males and females. Old animals, who have successfully bred before, can also be permanently taken out of a breeding situation. Chemical contraception is not recommended.

2.5 BEHAVIOURAL ENRICHMENT

Behavioural enrichment in Malayan tapirs should accomplish a variety of goals: It should offer the animals the opportunity to express their species-specific behaviour in ways that resemble their natural activity budgets and it should set up competent animals who are able to cope with new situations. This can be implemented by increasing mental and physical stimulation through the introduction of new stimuli and challenges, as well as offering choice and control in their environment, food, activity, and social stimuli. Due to their active time mostly spent foraging by roaming their home range and feeding from a variety of plants (see chapter 1.8), increasing foraging and exploration times can play a pivotal role when planning goal-based enrichment strategies in tapirs.

ENVIRONMENTAL ENRICHMENT

Enclosures should be enriched with amenities that allow tapirs to exhibit the whole range of their natural behaviour, including comfort behaviour. Therefore, the presence of pools, mud wallows, streams, waterfalls, shrubs, and grasses are highly encouraged. Different substrates and a variable topography with possibilities for climbing or wading can additionally invite diverse locomotion. Tapirs should also have the possibility to experience different weathers and climates with the enclosure offering varied exposure to wind, precipitation, and sun, so that the animals are able to choose their preferred atmosphere. If certain parameters of the environment can additionally be controlled by the animals, such as water showers or heat

sources, this can add an additional welfare aspect. Novel objects can be periodically introduced to induce exploration behaviour and offer mental stimulation, e.g. piles of branches, stems, or food enrichment devices.

FEEDING ENRICHMENT

As Malayan tapirs' waking activity budget is mostly filled by foraging behaviour, holders should offer the animals possibilities of prolonged feeding times. Additionally to browse and hay – which should always be available ad libitum – a variety of enrichment techniques can be used for this: scatter feedings, devices such as branches, balls, hoses, or barrels that have to be moved around to receive the food, hiding pieces of produce throughout the enclosure, smearing honey on branches or furnishings for the tapirs to lick off, hanging feed or browse higher up in the enclosure, or scattering food in the pools or placing it on rafts, thus making it harder to reach (Leach, 2022).

Figure 41: Different types of tapir feeding enrichment. © D. Koch, Paris Zoo, Antwerp Zoo

SOCIAL ENRICHMENT

Social behaviour plays a big part in daily tapir activity under human care. Therefore, holders should try to offer their animals (protected) contact to a partner of the opposite sex. The whole range of behaviour related to reproduction, i.e. mating, birth, nursing, and rearing is also an important aspect of natural behaviour that should be granted to all animals to the extent deemed possible. Other species in mixed-species exhibits can also enhance social activity.

OLFACTORY ENRICHMENT

Another form of mental stimulation can be achieved by targeting the highly developed olfactory senses of tapirs. Examples for olfactory enrichment in tapirs include hiding strong-smelling food items within the enclosure, e.g. under branches or buried in the ground. Additionally, unfamiliar scents such as essential oils or the scents of predators such as tigers can be distributed within the exhibit. An alternating use of the enclosure with other species increases

this perception even further. Tapirs seem to be particularly interested in familiar odours; therefore, the application of other tapirs' scents often intensifies exploration behaviour (Leach, 2022).

TACTILE ENRICHMENT

Tactile enrichment can be granted tapirs by supplying a variety of materials as substrate, boundaries, and furnishings. Brushes, rubbing trees, or mats (see chapter 2.1.3) offer self-paced tactile stimulation for comfort and wellness. Additionally, keeper interactions, such as regular training or check-ups while stroking and brushing the animals, grant further stimulation while simultaneously being useful for medical training.

AUDITORY ENRICHMENT

Auditory enrichment is rarely used in tapirs and has not yet shown to significantly alter their behaviour. Nevertheless, sound recordings of different stimuli such as other tapirs' or predator vocalisations can be experimented with (Rose et al., 2006; Leach, 2022).

2.6 HANDLING

2.6.1 Individual identification and sexing

Individual identification within one institution should be easily manageable due to primary sexual characteristics. Furthermore, animals can be identified by their colouration or scars. All animals must be individually distinguishable by a logical identifier such as a transponder. Sexing of young offspring is possible from day one via morphological examination as the reproductive organs of males and females are clearly distinct early on.

*Figure 42: Comparison of Malayan tapir reproductive organs: genitalia of a female calf (**left** and **centre left**) and a juvenile (**centre right**) and adult male (**right**). © S. Krüger, D. Koch, Zoo de La Boissière du Doré.*

2.6.2 General handling

Most tapirs can be trained to lie down from scratching their back, ventral abdomen, or neck; this can be achieved in direct contact as well as in protected contact, e.g. by using brushes or scrubbers. In this state, general check-ups and minor medical procedures can be performed. It is important to note that tapirs can stand up suddenly and may bite. For safety, it is recommended to approach from behind when working near the head. When accessing the intern saphenous vein, abdomen, or nipples, positioning behind the animal is advised, with caution taken around the upper hind leg. If no handling is possible with an individual, target training and operant conditioning should be implemented to improve tolerance to touch. As rewards, food and scratches have been successfully used. This type of handling is preferable to treatment under anaesthesia due to the possible health complications and should regularly

be performed from the earliest age to enable stress-free anaesthesia, examinations, and medical treatment. Therefore, the following routines should be regularly practiced from an early age:

- Handling/touching all areas of the body
- Blood sampling at the saphenous vein
- Hand injection
- Wound treatment
- Rectal temperature measurement
- Eye drop application
- Auscultation
- Transabdominal ultrasonography
- X-ray exam
- Dental exam (incisors and premolars)
- Weighing

Furthermore, tapirs can be trained to voluntarily shift to separation areas, restraining cages, and crates or trailers. Individuals should be habituated to regular separations from their conspecifics. It is especially important to train and habituate offspring to be separated from their mother before they are transported to a new institution.

*Figure 43: Direct contact (**top**) and protected contact (**bottom**): Stroking down in direct contact (**top left**), training lying down in direct contact (**top centre**), and stroking down in protected contact (**bottom left**). When working in direct contact with mother and calf (**top right**), keepers should never work alone and pay close attention to the general and momentary disposition of the dam. For protected contact, permanent barriers (**bottom right**) can be used as well as temporary options, such as chains (**bottom centre**). © T. Hahn, Lyon Zoo, D. Koch, Antwerp Zoo*

2.6.3 Catching/Restraining

Malayan tapirs should not be caught; their natural response would be an uncontrolled flight or aggression towards the catcher, which can lead to serious injuries or escape. It is recommended to either train them as described in the chapter above, or have restraining cages in place, in which they can be temporarily confined. These metal cages can be placed in passageways the tapirs regularly traverse so that there is no pressure associated with restraint.

Figure 44: Restraining cages for Malayan tapirs. © Taipei Zoo, D. Koch

2.6.4 Transportation

Malayan tapirs should be transported individually in a way that allows them to fully turn around, lie or sit down, and stand up at any time. Therefore, we recommend unrestrained transportation in a horse or cattle trailer of at least the following dimensions: 250 x 150 x 160 cm. If crates must be used, they should be big enough for the animal to sit down and stand up and turn around easily. They should also be padded at the top. Any form of transportation must be adequately ventilated, and temperature controlled at 15-25°C. It is recommended to utilise video surveillance during the transport. Soft substrates, such as hay, soil, or fine mulch can be offered as subsurface and should cover the ramp while entering. Voluntary loading via trailer or crate training is the preferred method. To facilitate loading, a direct access from the enclosure to the trailer is practical and decreases risks. This should be considered during the construction of new enclosures. The trailers should be equipped with drinking and feeding possibilities that are serviceable from the outside. For transfers longer than 12 hours, water must be available to the tapir. For transfers longer than 24 hours, food (hay, pellets) should be offered.

Figure 45: Examples of trailers for Malayan tapir transports. © Tiergarten Nürnberg, Chester Zoo.

2.6.5 Safety

Risk assessment in Malayan tapirs should be considered on an individual level. Depending on the animal, it can be necessary to work in protected contact at all times, while other individuals can be handled in direct contact, depending on the situation (see chapter 2.6.2). Tapirs can be unpredictable in their behaviour and cause injury by actively biting or tackling humans or running people over during flight responses. Malayan tapirs are documented to have inflicted serious wounds on humans. Rearing dams have been described as especially aggressive and should thus only be handled with additional security measures in place if direct contact is unavoidable. It is therefore advised that enclosures be constructed in a way that allows keepers and veterinarians to work in protected contact, i.e. by establishing boundaries through which training, check-ups, and veterinary measures are possible, all doors and sliders being visible and accessible from outside the enclosure, and the possibility of separating animals to another pen for feeding and cleaning. Staff should always be aware of tapirs' nature: sudden movements or noises can easily spook the animals and lead to sudden flight responses or aggression towards the handler.

For visitor safety, barriers should have the necessary height required by state law and be equipped with railing on the visitor side. A distance of 1.5 m is obligatory between the reach of the animals and the visitors' reach to prevent interactions between animals and humans.

2.7 VETERINARY: CONSIDERATIONS FOR HEALTH AND WELFARE

All the information compiled in this chapter is derived from bibliographic references, a 2024 study of mortality cases in EEP population over the last twelve years, and the evaluation of the vet advisor (Ordonneau et al., 2024).

2.7.1 Routine health inspection

DAILY HEALTH OBSERVATIONS

Daily observations of the animals are essential to detect health problems as early as possible. As wild prey animals, tapirs have a high capacity to mask their symptoms. Any small change in a tapir should alert its zookeeper. The more familiar the keeper is with their animals, the earlier they will be able to detect health issues. On a daily basis, attention must be paid to the amount of forage consumed, the quantity and quality of faeces, the animal's appetite, its locomotion, the quality of its skin and hooves, its breathing, and the appearance of its eyes. Since infections in Malayan tapirs can quickly turn into septicaemia, early detection of symptoms is of utmost importance. Please refer to chapter 2.6.2 for details on medical training and preventive measures.

*Figure 46: Routine health inspections and medical procedures possible without anaesthesia. treatment of abscess (**left**), blood draw (**centre left**), eye inspection (**centre right**), weighing (**right**). © D. Koch, Zoo CERZA, Chester Zoo.*

SIGNS OF ILLNESS

Like horses, tapirs can easily suffer from colics, comprising abdominal pain from digestive discomfort to peritonitis with perforation of the digestive tract. Symptoms related to these pathologies are decreased appetite, anorexia, transit stop, and restlessness. These issues can be worsened by a low-fibre diet rich in carbohydrates and starch. Unlike horses, tapirs can vomit. Tapirs are generally opportunistic feeders; therefore, any decrease in appetite should be examined. A first measure can be an abdominal auscultation, during which slight digestive noises should always be audible. In case of abdominal discomfort, high fibre food like browse should be offered.

Tapirs have very large frontal sinuses and large lungs, which make them very sensitive to respiratory diseases, warranting high air quality. Any nasal discharge, sneezing, or difficulty to breathe must be examined by blood sampling, swabs, auscultations, and/or x-ray exams. Tapirs' jaws can swell abnormally, potentially due to dental infections and/or osteomyelitis.

Lameness can sometimes be observed in tapirs and be caused by several factors. Consequently, all the hooves should be checked looking for wounds or foreign bodies. Any swelling of the crown hoof should be examined. If nothing is evident, X-ray exams of the legs can be conducted by training. Lameness can be caused by light trauma of the muscles and can be remedied by a few days of rest. Osteomyelitis should be treated quickly, as infections are known to quickly turn into septicaemia.

Tapirs, as primarily nocturnal forest dwellers, exhibit ophthalmic sensitivity to sunlight. Intense exposition to sunlight or strong reflections from the substrate can lead to keratitis and even corneal ulcers. In these cases, tapirs can show discomfort outside, blinking eyes, and corneal opacity. A fluorescein test can easily be performed via medical training.

Weight loss can be easily monitored by regular weighing using a scale, in order to detect irregularities early. Alternatively, body condition scoring can be used if weighing is not possible.

Table 6: Body condition scoring (BCS) table for Malayan tapirs from Clauss et al., 2009; adapted with own example photo for 1.

BCS	General	Ribs	Back	Neck/shoulder	Hip/tailhead	Example
1	**Bony, skeletal**	Very prominent and easily visible	Prominent ridge	Emaciated, bony structure of shoulders and neck extremely visible	Prominent tailhead, hip, and pelvic bones	
2	**Thin**	Prominent	Ridge defined	Thin neck and shoulders	Flat tailhead, hip, and pelvic bones	
3	**Moderate, fit**	Not visible	Flat, no crease evident	Moderately thick neck, shoulders flat	Moderate fat around tailhead, flat pelvic and hip bones	
4	**Fat, plump**	Not visible	Inverted crease	Thick neck, shoulders slightly rounded, fat deposits evident	Fat around tailhead, hips rounded	
5	**Obese**	Not visible	Prominent inverted crease	Thick neck, rounded shoulders, fat deposits extremely evident	Excessive fat around tailhead, hips, and pelvic bones very rounded, rotund	

RECORDS

As with all zoo animals, it is essential to record as much information as possible in an adequate database. Most institutions keeping Malayan tapirs work with Species360/ZIMS. The medical part of ZIMS enables the complete documentation of medical data concerning each individual (i.e. blood parameters, symptoms, anaesthesia, treatments, etc.) We strongly recommend to share all medical data with the Malayan Tapir EEP vet-advisor ("MATAEEPVA") in the tab "External sharing", and to report all data in English.

2.7.2 Preventive health

PARASITE MANAGEMENT

Tapirs can carry the same endoparasites as other Perissodactyla species. As a browser species, they are less prone to recontamination issues; thus, a biannual faecal check is generally sufficient. All well-established treatments for horses and their posologies can safely be used on tapirs. Ectoparasite treatments can be challenging in tapirs due to their frequent exposure to water. Long-term efficiency is therefore rarely achieved.

VACCINATION

Each vaccination must be carefully considered in the light of the epidemiological context in which the animals live. There have been three suspected cases of tetanus in Malayan tapirs in the EEP in the last twelve years. As this disease is difficult to diagnose, it is usually diagnosed by exclusion. Due to the hazard it poses to the animals, which can die from tetanus at any life stage, it is recommended to vaccinate Malayan tapirs annually, like horses.

DENTAL PROPHYLAXIS

As for any herbivorous species, it is important for tapirs to maintain healthy teeth throughout their lives. This is made possible by a suitable, low-sugar diet. Every opportunity to check teeth should be used: direct examination of incisors and first premolars, X-ray exams of the jaws during training, and direct examination of the mouth during anaesthesia. Gunther's donkey step is well suited for tapir mouths, providing good access to the oral cavity on an anaesthetised animal. Tapirs with dental issues generally begin decreasing their fibre consumption (hay, pellets) to feed on easier to chew items and can produce hay plugs, which can often be found behind their hay rack.

VETERINARY REQUIREMENTS BEFORE DEPARTURE

At the minimum, a bacteriological and parasitological faecal examination should be carried out; the diet sheet and medical data should be shared, preferably via ZIMS Species360; and the transponder should be checked. Regarding tuberculosis, the current tests available (IDR, DPP VetTB assay Chembio) are not reliable on tapirs, and the only recommended test is a bronchoalveolar lavage, followed by a PCR or a culture.

2.7.3 Infectious diseases

A recent study on the mortality causes in the EEP population within the last twelve years has highlighted some sensitivity of Malayan tapir for several pathologies:

- Malayan tapirs can easily develop severe bacterial infections mainly affecting the respiratory system
- Pulmonary infections and osteomyelitis can easily lead to septicaemia
- For reasons still to be investigated, Malayan tapir seems to be very sensitive to renal failure
- *Streptococcus zooepidemicus* seems to be one of the most problematic bacteria, leading to pneumonia in all age groups

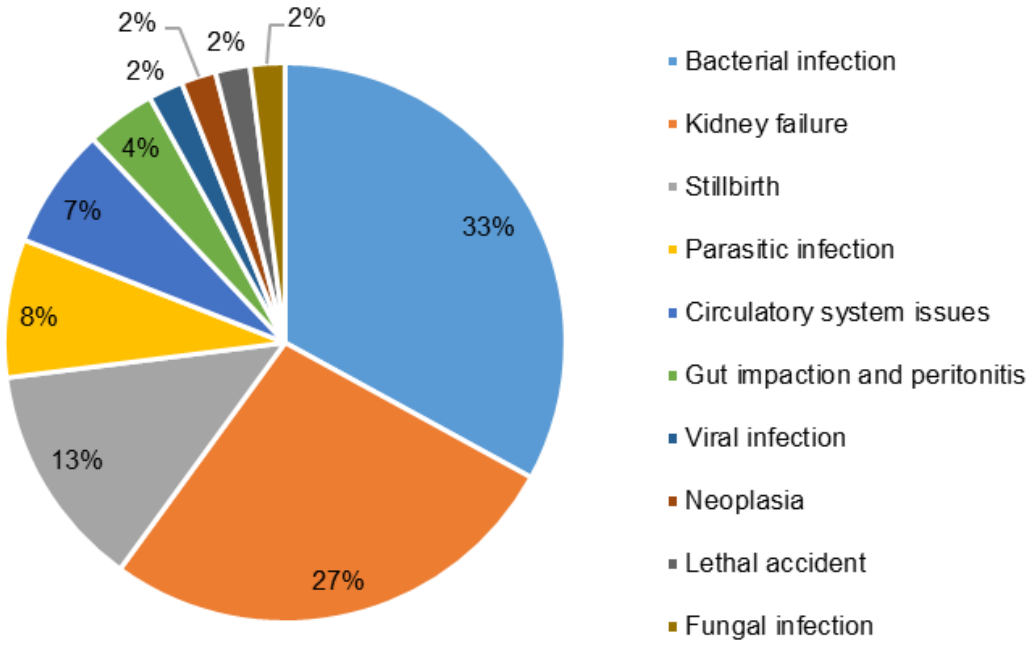

Figure 47: Causes for mortality in Malayan tapirs within the EEP between 2012 and 2024

2.7.3.1 Bacterial infections

Even though Malayan tapirs are susceptible to the same bacterial infections as other mammals, the majority of the infections observed in human care concern the respiratory system. As large mammals from Neotropical regions, they spend a majority of their time in Europe inside, making them particularly sensitive due to the large size of their sinus. That is why it is essential to keep this species in very well-ventilated buildings.

Common bacterial respiratory pathogens include *Streptococcus* spp., *Klebsiella* spp., *Corynebacterium* spp., *Actinomyces* spp., and *Fusobacterium* spp. (AZA Tapir TAG, 2013).

Table 7: List of bacteria found on dead Malayan tapirs under human care within the last twelve years

Pulmonary system	Kidney	Bone	Digestive	Other
Pseudomonas **spp**.	*Leptospira*	*Salmonella enteritidis*	*Clostridium perfringens*	*Clostridium tetani*
Aeromonas hydrophila, A. caviae		*Actinobacillus equuli*		
Pasteurella multocida		*Staphylococcus aureus*		
Streptococcus zooepidemicus, *S. gallolyticus, S. sanguinis*		*Streptococcus* spp.		
Serratia odorifera				
Weissella **spp**.				
Actinobacillus equuli				

For instance, *Streptococcus equi zooepidemicus* infections have caused respiratory diseases ranging from chronic rhinitis to severe bronchopneumonia in captive Malayan and lowland

tapirs, resulting in the death of two animals (Debar et al., 2023). Therefore, any nasal discharge should be noted, analysed, and treated.

TUBERCULOSIS

As a zoonosis, tuberculosis, particularly following an outbreak caused by *Mycobacterium pinnipedii,* must be carefully considered due to its potential to be lethal. In tapirs, *Mycobacterium bovis* is isolated most commonly; however, *M. tuberculosis, M. avium*, and *M. pinnipedii* have also been found. Symptoms mainly concern the respiratory system (nasal discharge, cough, dyspnea), but the ante mortem diagnosis can be challenging. Of all methods of diagnosis currently available in Europe, only a bronchoalveolar lavage followed by PCR and culture is recommended as reliable. Despite the relatively recent outbreak of *M. pinnipedii*, followed by increased testing for tuberculosis, no Malayan tapirs in the EEP have died from tuberculosis in the last twelve years.

LEPTOSPIROSIS

Like horses, tapirs can be infected by *Leptospira spp*.; several wild tapirs have been found with positive serology, and one fatal case under human care was reported (Goddard et al., 2020). The respective animal was tested positive serologically, with positive renal tissue, whereas PCR performed on blood and urine yielded negative results.

CLOSTRIDIOSIS

Several cases of tetanus caused by *Clostridium tetani* resulted in the deaths of Malayan tapirs in human care at various ages. Vaccination of captive tapirs against tetanus can be used as a preventive measure, which is already being applied in several zoos without any side effects. Tapirs are also susceptible to enterotoxaemia caused by *Clostridium perfringens* or *C. difficile*. A high-calorie diet and an imbalanced gut flora (e.g. due to antibiotic treatment) are risk factors for enterotoxaemia, which can lead to severe colic, diarrhoea, vomiting, and ultimately death.

ANTIBIOTIC TREATMENTS

The use of long-acting injectable antibiotics is not recommended, regarding the huge risk of septicaemia and the little knowledge that exists on pharmacodynamics of such antibiotics on tapirs. Several oral antibiotherapies are now established and successful on tapirs. If possible, an antibiogram should always be performed before launching any antibiotic therapy. All antibiotics commonly used in horses can be applied on tapirs. Even if an antibiotic treatment has to be started by injection, it is always recommended to follow up with oral administration, for different reasons:

- It allows long-lasting treatments (usually three weeks)
- There is no available data on the pharmacodynamics of long-acting injectable antibiotics in tapirs, and as such, the injection of such large volumes can be painful.
- A number of antibiotics can safely be administered orally (see table 8). Probiotics should be included in the treatment on a daily basis but administered at a time spaced apart from the antibiotic.

Table 8: Oral antibiotherapy in tapirs

Antibiotic	Speciality	Posology		Therapeutic indications	Remarks
TMP/ sulfamides	EQUIBACT IN AVEMIX	5mg Trimethoprime and 25 mg Sulfadiazine/ kg (same as horse)	SID	In horses, treatment of infections caused by bacteria sensitive to the combination of trimethoprim and sulfadiazine, in particular: ● respiratory tract infections associated with *Streptococcus* spp. and *Staphylococcus aureus* ● gastrointestinal infections associated with *Escherichia coli* ● Urogenital infections associated with β-haemolytic streptococci ● wound infections and open or drained abscesses associated with *Streptococcus* spp. and *Staphylococcus aureus*	Easy to give
Amoxicillin/ clavulanic acid	KESIUM 400 mg/100mg	20 mg/kg amox and 2.5 mg/kg Clavulanic acid	BID	● Dermal infections due to *Staphylococcus* spp. ● Urinary infections due to *Staphylococcus* spp., *Streptococcus* spp., *E. coli* and *Proteus mirabilis* ● Respiratory infections due to *Staphylococcus* spp. *Streptococcus* spp. and *Pasteurella* spp. ● Digestive infections due to *E. coli* ● Oral infections due to *Pasteurella* spp. *Streptococcus* spp., *E. coli*	Can quickly lead to diarrhoea, to be used carefully
Doxycycline	DOXYVAL 20 (200mg/g)	10 mg/kg Doxycycline, so 50 mg/kg Doxyval	SID	Gastrointestinal and respiratory infections	Can be mixed with apple sauce
	RONAXAN (500 mg/g)	10 mg/kg Doxycycline, so 20 mg/kg Ronaxan			
Enrofloxacine	BAYTRIL 10%	5-10 mg/kg	SID	Digestive, respiratory, urinary infections due to *Pasteurella* spp. *E. coli*, *Staphylococcus* spp., *Mycoplasma* spp.	Not always easy to give because of its taste
Metronidazole	Pure active substance by COOPER	18 mg/kg	BID	Anaeroby or oral infections. To use in combination with TMP/sulfa or doxycycline	Not very tasty, can be mixed with apple sauce
IMPORTANT: Every antibiotherapy must be completed by a probiotic treatment for horses Every antibiotherapy must be administered for at least 15 to 21 days (not less!) Whenever possible, the choice of antibiotics should be supported with an antibiogram					

2.7.3.2 Viral infections

Even if several studies show serologic positivity for viruses on wild and captive tapirs, only few cases of viral infections have been described on *Tapirus* sp., including herpesvirus, encephalomyocarditis virus, foot-and-mouth disease, and rabies (Janssen, 2003; Mangini et al. 2012; Quse & Fernandes-Santos, 2014; Pereira et al., 2022). Within the last twelve years, in the Malayan tapir EEP population only one case of encephalomyocarditis has been reported in a young animal.

2.7.3.3 Fungal infections

Some fungal infections due to *Microsporum gypseum*, *M. canis*, and *Trichophytum tonsurans* have been described in tapirs, leading to the typical lesions of dermatophytosis as areas of circumscribed alopecia and mild scaling (Janssen, 2003).

2.7.3.4 Parasites

Endoparasites have thus far been a minor issue in Malayan tapirs under human care as their food is served in a sterile manner and they do not graze frequently. However, regular coproscopies and treatments can act as preventive measures.

Even though blood parasites are mainly an issue in the wild, species like *Neospora caninum* can be a severe problem in human care, leading to abortions, stillbirths, or neonatal death of the calf. After the primary infection, adults remain carriers of the parasite and the foetus is contaminated by transplacental infection. As of today, no treatment has been successful in clearing adult carriers.

2.7.3.5 Non-infectious diseases

TRAUMATIC INJURIES

Tapirs can hurt themselves in their enclosure or bite their partner. The classical treatment of the wounds usually consists of daily disinfection and the application of healing ointments. Cracks or wounds on hooves should receive particular focus.

SKIN PATHOLOGIES

The most common skin issue reported is the “vesicular skin syndrome”. Symptoms are papules and vesicles in the dorsal thoracic and lumbosacral regions, which can rupture, releasing serosanguineous fluid. Some neurological signs can rarely be associated. Even if lesions usually resolve spontaneously, local disinfection and healing ointments can be useful.

DENTAL DISEASES

The dental formula of adult tapirs, male and female, is I 3/3, C 1/1, P 4/3, M 3/3 = 42. It should be noted that the third molar emerges rather late, at approximately 8-9 years old. Dental pathologies include periapical abscess, osteomyelitis, tooth fractures, diastema, tooth resorption, and neoplasia. Of course, old age and a diet too rich in sugar are risk factors. A decrease in appetite is usually linked to a dental issue in need of treatment and should hence always be examined. In order to investigate dental issues, X-ray exams can be performed via medical training, still the use of Gunther’s mouth gag under anaesthesia can be useful to obtain better X-ray images (less superposition) and a direct look at all the teeth.

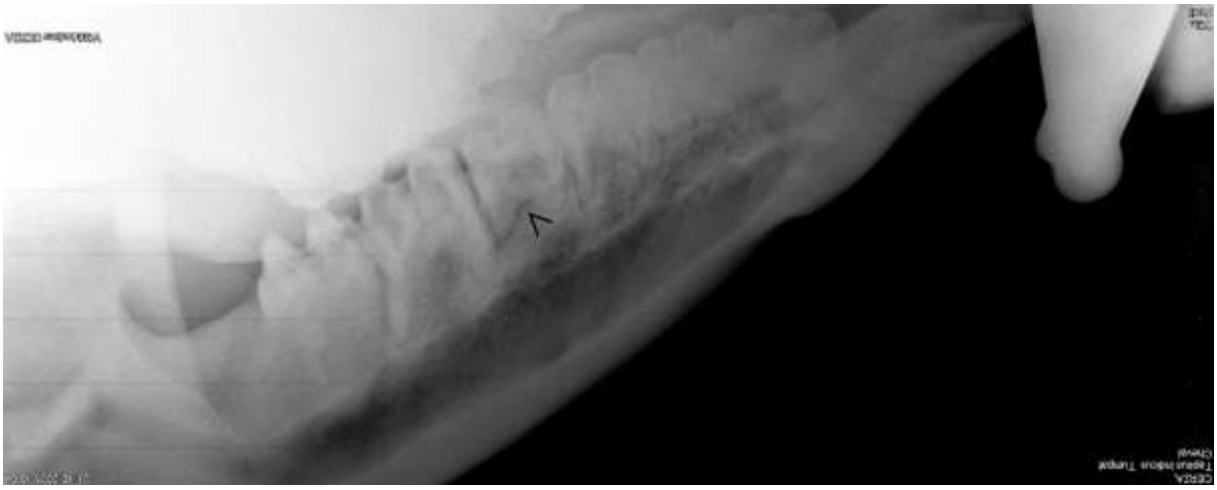

Figure 48: Example of the x-ray exam of the mandible that shows abnormal dental roots on M1, that need to be extracted. © D. Ordonneau

DIGESTIVE DISEASES

In addition to the bacterial infections described above, Malayan tapirs can suffer from colics due to mechanical abnormalities like obstruction, intussusception, and volvulus. Major issues like these have to be treated in the same manner as in horses. Risk factors are sand ingestion, lack of fibre in the diet, and excess of sugar. Transit effectiveness can be easily inspected by auscultation or ultrasound exam, and depending on the symptoms, treatments can vary from a fasting period to painkillers and antispasmodics administration. Any diet change shown by the animal should also be explored, as it can be linked to gastric ulcers that can be identified by endoscopy or bloody faeces.

UROGENITAL DISEASES

The retrospective study done on the mortality causes between 2012 and 2024 has shown that 28% of the mortalities observed during this period are due to renal failure. In the age category of one to 20 years, renal failure is not age-dependent and may or may not be preceded by an infection. Different parts of the renal tissues can be affected. In the age category of 20 years old and above, renal disorders are usually associated with other organs failures.

Further studies have to be undertaken to research the potential development of renal insufficiency in Malayan tapirs, i.e. by exploring histological results, the diet in human care, chronic bladder infections, and all the risk factors linked to renal issues. In the meantime, renal function and urine parameters should be regularly monitored and any infections that could affect renal tissue and the bladder should be treated quickly.

OCULAR DISEASES

As nocturnal species, Malayan tapirs' eyes are quite sensitive to excessive exposure to sunlight, which can lead to corneal opacity, keratitis, and corneal ulcers, and can represent a risk factor for ocular viral and bacterial infections. Medical training is thus a very important tool to be able to apply the frequent topic treatments.

HOOF AND MUSCULOSKELETAL DISEASES

Tapirs can suffer from hoof cracks that should be monitored closely, as they can easily turn into osteomyelitis, and then septicaemia. The indoor substrate should therefore be as non-abrasive as possible, and the use of wood barks is highly recommended (see chapter 2.1.2).

Any lameness has to be investigated through X-ray exams, blood sampling, and direct exams. A number of painkillers can be used, if needed (i.e. flunixin-meglumine, phenylbutazone, meloxicam, or tramadol).

2.7.3.6 Anaesthesia

Even if a majority of examinations and treatments can be implemented via medical training, anaesthesia is often necessary to thoroughly investigate a symptom or perform the tests required before the transfer to another institution. Anaesthetising a Malayan tapir should not be dreaded, as no fatal anaesthetic accident has been reported in the EEP within the last twelve years. One of the most important concerns is to know the exact weight of the animal.

Before anaesthesia, a fasting period of 12-24 hours is recommended. Anaesthesia induction, even if it could be done by darting, will be more efficient by hand injection, e.g. during a scratch session. Pre-anaesthetic drugs (butorphanol combined with α_2 adrenergic agonists) can be first injected I.M. and lead to a lateral decubitus in 10-20 minutes.

As soon as the tapir is sufficiently sedated, it can be placed in right lateral decubitus, and an intravenous catheter can be set on the internal saphenous vein. Depending on the context, additional bolus of ketamine can be then given I.V. Midazolam injected I.M. or I.V. can improve myorelaxation, if needed. Intubation can be performed to avoid false deglutition, or administer oxygen or anaesthetic gas, by the use of tracheal probes of 16-20 mm of diameter.

A constant rate infusion (C.R.I.) of ketamine and midazolam could also be an interesting option either when anaesthetic gas is not available or in old animals (Douay et. al., 2021).

If better ventilation is needed for long procedures, right lateral recumbency is preferred because the large caecum can compress abdominal organs and impair ventilation. Moving the animal to sternal recumbency may also facilitate ventilation.

Table 9: Tapir anaesthetic protocol in human care

Drugs		Dosage		Reversal drugs	Dosage	
Opioids	**Butorphanol**	0.15 mg/kg	I.M	**Naltrexone**	0.6 mg/kg	i.v. or i.m.
	In combination with					
α_2 agonists	**Medetomidine**	0.3 mg/kg (zims)	I.M.	**Atipamezole**	0.15 mg/kg	i.m.
	or					
	Detomidine	0.05 mg/kg	I.M.		0.25 mg/kg	i.m.
	or					
	Xylazine	0.3 mg/kg	I.M.			

	In addition, if needed					
Dissociative anaesthetics	**Ketamine**	0.5-1 mg/kg	I.V. bolus as requested			
Benzodiazepines	**Midazolam**	0.03-0.1 mg/kg	I.M.	**Flumazenil**		
	OR					
Opioids	**Etorphine**	0.009 mg/kg	I.M.	**Naltrexone or Diprenorphine**		

Oral induction				
α_2 agonists	**Detomidine**	0.17 mg/kg	p.o.	
Opioids	**Carfentanil**	0.008 mg/kg	p.o.	

Constant Rate Infusion (C.R.I.)				
Induction	**Butorphanol**	0.03 mg/kg	I.M.	Light sedation/decreased mentation: 5.5 ± 2.7 min
	In combination with			
	Medetomidine	0.03 mg/kg (zims)	I.M.	
	Ketamine	1 mg/kg	I.V.	Deep sedation/recumbency: 10.5 ± 4.5
	Midazolam	0.02 mg/kg	I.V.	
C.R.I.	**Ketamine**	0.5 mg/kg	I.V.	1-5 drops/min with average 3-5 drops/min
	Midazolam	5 µg/kg/h	I.V.	
Reversal	**Naltrexone**	0.2 mg/kg	I.M.	Arousal: 5.5 ± 4.2 min, control of head/standing: 14.8 ± 6.8 min, Return to normal: 81.0 ± 71.5 min
	Atipamezole	0.15 mg/kg	I.M.	

α_2 adrenergic agonists can be reversed by atipamezole, I.M., and it has been regularly noticed that the use of naltrexone (to antagonize butorphanol) significantly reduces the awakening phase. Like in other species, midazolam can be reversed with flumazenil.

Figure 49: Anaesthesia in Malayan tapir. © Chester Zoo, Zoo de CERZA

2.7.3.7 Haematology and biochemistry

Blood parameters for Malayan tapirs are available on the Species360 ZIMS database. An increase of the WBC should be investigated, as any infection in Malayan tapirs can quickly turn into septicaemia. Anaemia can also reveal a chronic inflammatory issue (e g. dental infection), depleting iron reserves. Renal function should be regularly evaluated, in addition to calcaemia and phosphoremia.

2.7.3.8 Necropsy

During the necropsy, all the main organs should be photographed with a size scale, even if they look normal, in addition to any lesion. Regarding the kidney issues observed in the European captive population, specific attention should be placed on the kidney, bladder, and urine. To further investigate dental pathologies, the skull can be prepared. Please notice that Malayan tapirs have adhesions between the chest wall and the lungs, and their kidneys are not lobulated. The liver should be histologically assessed for iron overload disease.

Table 10: Storage of organs after tapir necropsy

Organs	Stored at -20°C	Stored in 10 % buffered formalin	Other analysis
Brain	X	X	
Skull			Osteological preparation
Lungs	X	X	
Heart		X	
Muscle		X	
Liver	X	X	
Stomach		X	
Small intestine		X	
Caecum		X	
Spleen		X	
Kidney	X	X	bacteriology
Bladder		X	bacteriology
Uterus		X	
Ovary	X	X	
Testicle		X	
Skin		X	
Other abnormal tissue	X	X	bacteriology

For any update regarding the necropsy protocol or any studies ongoing on Malayan tapir carcasses, please get in touch with the vet advisor. Please do not forget to freeze tissue samples (e.g. liver), for the EAZA Biobank.

2.8 RECOMMENDED RESEARCH

To be able to care for Malayan tapirs even better, a greater understanding of the species is needed. It is therefore essential to intensify our research endeavours, especially with regard to reproductive biology and veterinary medicine. The information gained from this research will help protect a viable, self-sustaining meta-population of this endangered species. Research topics of particular interest include:

HUSBANDRY

- diet
- temperature tolerance
- stress response
- welfare assessment
- enrichment

REPRODUCTIVE BIOLOGY

- pair compatibility
- cycle analysis
- pregnancy detection
- fertility assessment
- assisted reproduction
  - sperm collection
  - cryopreservation
  - artificial insemination
- causes for infant mortality and stillbirths
- timing of dam-offspring separation

VETERINARY MEDICINE

- causes of death
- tuberculosis detection
- kidney issues
- *Neospora caninum*

CONSERVATION

- genetic diversity of in-situ population
- conservation education
- habitat suitability

3 SECTION 3

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