A comprehensive review of the scientific methods used to assess the welfare status of captive Asian elephants, Elephas maximus

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Executive Summary:

  The Asian elephant, *Elephas maximus*, is classified as Endangered today by the International Union for the Conservation of Nature. The population of the Asian elephants has declined by around 50 percent over the past 75 years with their suitable habitat shrinking by 85 percent. On a global scale, there are about one third of all Asian elephants living in captivity which demand long-term human care. As of today, the breeding of captive elephants in zoos outside of range countries is not self-sustaining. In Asian elephant range countries, the explosion of the elephant tourism industry over the recent decades has led to an increase in the number of elephants in captivity. However, keeping elephants in captivity has generated a heated debate around the globe regarding captive elephant welfare.

  Compared with the long history of captive Asian elephants in their range countries, animal welfare in general is a quite recent development of which the significant progress was not made until the late 20th century in Western countries. In Asian elephant ranging countries, animal welfare science is just starting to emerge. In countries such as China and Myanmar, there is still a lack of animal welfare legislation as of today. Although there has not been a consensus on what animal welfare really is, there has been an ongoing discussion on what criteria should be used to evaluate it in a scientific and objective way. It is generally believed that good animal welfare practices should provide animals with the environment allowing for natural behaviors. Five Freedoms and Five Domains are commonly used to describe animal welfare, both of which are continuing to be improved. The welfare assessment covers multiple aspects of an animal health such as biology, physiology, behavior, and psychology. While some of the welfare assessing parameters used might be straightforward such as body condition score and foot score, other parameters such as the glucocorticoid metabolites and immunoglobulin A might be tricky and should always be interpreted according to the context and be combined with other welfare measures.

  Zoo elephants in the Western countries and tourist elephants in range countries such as Thailand have been suggested to share some health issues, even though the causation might be different. There is a consensus that good captive elephant welfare requires an environment that is as natural as possible, satisfies social needs, and provides a balanced diet as well as exercising opportunities. With the aim of improving zoo elephant welfare, many accrediting associations around the world such as the AZA, WAZA, and BIAZA have developed their own guidelines and standards for managing captive elephants. Although these guidelines mainly focus on animal care, proposals for including the assessment of psychological wellbeing has been made recently by scientists. In elephant range countries, however, evidence-based standards and guidelines for captive elephants are often lacking or under developing. Although there have been movements such as the Asian Elephant Captive Working Group actively seeking the improvement of captive elephant welfare, the involvement of the governments in implementation, enforcement, and regulation a guideline is necessary to make a revolutionary and transformational change for the whole captive elephant group.

Chapter One: All About the Asian Elephant

Population Status:

The Asian elephant, *Elephas maximus*, is the largest extant land mammal on the Asian continent. In the past, *E. maximus* once occurred in western Asia, from the Tigris-Euphrates to Iran and South of the Himalayas, and throughout South and Southeast Asia including the islands of Sri Lanka and Sumatra, and into mainland China northwards as far as the Yangtze river. *E.maximus* is the only species of the Asian elephant and it consists of four extant subspecies, including *E.m. hirsute* (Malayan elephant), *E.m. indicus* (Indian elephant), *E.m.maximus* (Sri Lankan elephant), and *E.m. sumatranus* (Sumatran elephant) (Asian Elephants, 2020). In fact, there were over 100,000 Asian elephants roaming from the Persian Gulf to India and China at the beginning of the 20th century (The Status, 2020). However, over the past 75 years, the population of the Asian elephant has declined by an estimated 50 percent and the suitable habitat for Asian elephants has shrunk to only 15 percent of their historic range. Asian elephants have disappeared entirely from western Asia, Iran, and most of China. Today, they only exist in 13 range countries spanning South and Southeast Asia living in dry and wet forests and grasslands, with the majority of them in India, Thailand, Myanmar, and Sri Lanka. The Asian elephant is classified as Endangered by the International Union for the Conservation of Nature (IUCN) that fewer than 50,000 elephants today live in the wild and more than 50 percent are in India where their range is the largest (the status, 2020).

Compared with the African elephant, *Loxodonta Africana,* the Asian elephant is smaller in size with smaller ears and rounder back. Asian elephants also have smaller tusks in general, and tusks are often absent in females as well as in some males. Asian elephants are more endangered compared with African elephants because their biggest threat is not poaching but habitat loss due to the rapid human development across Asia, the most populous continent on Earth.
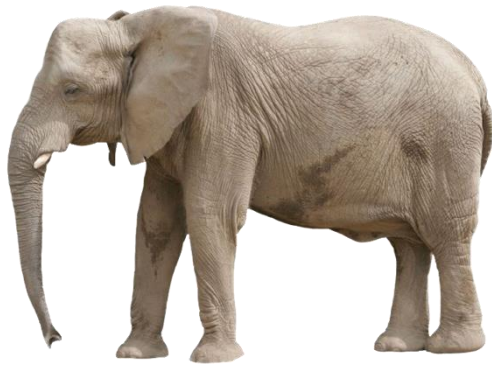

| Figure 1: African elephant- *Elephas loxodonta* | Figure 2: Asian elephant- *Elephas maximus* |

Asian elephant population are facing several threats. The biggest threat is habitat loss and fragmentation (Asian Elephant, 2020). Asian elephants are extremely social animals that form groups of six to seven related females led by the matriarch, the oldest female. They like to migrate with the seasons to find the best feeding areas. However, the expand of human development in recent decades has forced the elephant population to be squeezed into smaller pockets of forest surrounded by human settlements that often block traditional migratory routes. This leads to another significant threat of Asian elephant population, human-elephant conflict. According to the World Wildlife Fund (WWF), 70 percent of elephants are found outside protected areas (Asian Elephant, 2020), which could also partially explain the high occurrence of

human-elephant conflict incidents. As elephant crop-raiding on farmers has become increasingly common, frequent human-elephant conflict could generate resentment from both parties which may negatively impact both human and elephant's life. Additionally, poaching and illegal wildlife trade remain a threat to Asian elephant population. Although most ivory poaching is associated with African elephants, Asian elephants are also poached occasionally for their ivories. According to the WWF, Asian elephants also suffer from fuel poaching as there is a steady market in Asia for other elephant products including elephant skin, tail hair, and meat. Furthermore, as is rooted in the history of the relationship between elephants and humans in Asia, Asian elephant population face great pressure from live elephant trade both internationally and among range countries, especially for tourism industries.

Elephants in Captivity:

Globally, there are about one third of all Asian elephants live in captivity, mainly in India, Thailand, and Myanmar (Asian Elephant, 2020). In North America, captive Asian elephants are kept in zoos. Today, about 140 captive Asian elephants are kept in more than 30 American Zoo and Aquarium- accredited zoos there (Brown et al., 2020). The last importation of an Asian elephant from a range country was recorded in 1996 and captive breeding has been used ever since to contribute to the captive Asian elephant population in North America (Prado-Oviedo et al., 2016). However, studies have shown that the zoo population of Asian elephants outside of range countries are not self-sustaining as a result of a skewed age structure, low genetic diversity, and unpromising reproductive rates (Clubb & Mason, 2002; Hutchins & Smith, 2001).

In Asia, besides zoo elephants, Asian elephants are used for many other purposes, as they are important cultural icons there and have lived closely with humans over many centuries. A 2017 study estimated a total elephant population of 45,000 in 13 range countries, approximately 15,000 of which are kept in captivity (Sakamoto, 2017). Historically, elephants in Asia were used in the logging industry, agriculture, and even warfare. Although Asian elephants have worked alongside humans for a long period of time, they are not viewed as domesticated, as there are no domesticated breeds of Asian elephants or any history of artificial selection for specific traits (Lair, 1997). They were mostly captured in the wild and tamed for use by human. Therefore, captive elephants are, in fact, wild because they share identical gene and behaviors as the free-range elephants (Lair, 1997). In India, there were around 3400-3600 captive elephants in 2004 in almost all states (Anonymous, 2004). As a species with irreplaceable cultural and religious values, captive elephants live closely with humans and are kept in zoos, religious temples, and private facilities (Vanitha, Thiyagesan, & Baskaran, 2010a). However, most of the temple elephants and elephants owned by private owners there live in isolation and have little opportunity to socialize with conspecifics (Vanitha, Thiyagesan, & Baskaran, 2011). In Thailand, After the 1986 logging ban in the last century, more captive elephants there nowadays are used in tourism industry where elephants are trained to perform in shows for tourists. There were estimated 2673 captive elephants working in 223 tourism venues throughout Thailand in 2017 (Plangsangmas et al., 2020). Because of this high demand of elephants in tourism industry, illegal trade of live elephants is exacerbated where young wild elephants are captured and trafficked within or among range countries, which poses a serious threat to the survival of the wild elephant population.

Chapter Two: Animal Welfare

The term animal welfare arose from a debate in society instead of science (Keeling, 2005). Although the topic of animal welfare, especially farm animal welfare, has existed for decades, animal welfare associated with exotic animals such as animals in zoos and aquariums is a quite recent development (Kagan, Carter, & Allard, 2015). Animal wellbeing is often times used interchangeably with animal welfare (Fraser, 1998). However, it is worth mentioning that animal welfare is not animal rights. Animal welfare is discussed under the premise that it is acceptable to exploit animals in a humane way for human purposes such as food, clothing, and research. On the other hand, the term of animal rights is to say that animals should not be used for human purposes because they are entitled to the possession of their own existence (Dolby, Duncan, & Mason, 2008).

As of today, there is still a lack of consensus on the definition of animal welfare. This is due to the differences in people's attitudes, background, and interpretations (Czycholl et al., 2015). Broom described welfare as "the state of the individual as regards to try to cope with its environment" (Broom, 1986). Hughes defined it as "a state of complete mental and physical health, where the animal is in harmony with its environment" (Hughes, 1976), which is close to the definition of human health by the World Health Organization (Czycholl et al., 2015). Additionally, a lot of entities today such as AZA Animal Welfare Committee, American Medical Association, and the World Organization of Animal Health have developed their own definitions of animal welfare (Kagan, Carter, & Allard, 2015). The most common ways in which animal welfare is described are the Five Freedoms and Five Domains. Five Freedoms include the freedom from thirst and hunger, freedom from fear and distress, freedom from discomfort, freedom from pain and suffering, and freedom to express normal behaviors (Brambell, 1965). The model of Five Domains is developed later which consists of four physical and functional domains including nutrition, environment, health, and behavior, as well as an affective experience domain of mental state (Mellor, Patterson-Kane, & Stafford, 2009; Mellor & Beausoleil, 2015). Additionally, animal welfare is sometimes described to be associated with three aspects: physical health and biological functioning; natural living, which is related to the ability of an animal to express its natural behavior; and the affective state, which concerns the positive emotions of an animal (Duncan & Fraser, 1997; Fraser, 2008).

Keeping elephants in captivity has become increasingly controversial worldwide with concerns surrounding captive elephant welfare. In both the United Kingdom and the United States, captive zoo elephants suffer from obesity, lack of exercise, foot problem, abnormal activities, social composition, fecundity, and survivorship issues (Clubb et al., 2008; Cohn, 2006; Harris et al., 2010; Hutchins, Smith & Keele, 2008). In South East Asia, the treatment of captive elephants in tourism industry has become an ethical concern due to a lack of proper government regulations. A study in Thailand examined 106 elephant venues and claimed that most captive elephants there lived in harsh conditions such as limited freedom to move, lack of veterinary care, and poor hygiene (Schmidt et al., 2001). In addition, most captive elephants in Northern Thailand showed high body condition score (BCS) between four to five, suggesting a general trend of being overweight (Bansiddhi et al., 2019). As the highly profitable elephant tourism industry across South East Asia is unlikely to disappear in the foreseeable future due to various socioeconomic constraints, captive Asian elephants will always need human care and how to improve their wellbeing will remain an ethical issue. Although a lot of effort has been made to scientifically and objectively discuss about animal welfare, there are no stringent elephant

welfare standards or guidelines besides in accredited zoos, and these are especially lacking in most elephant range countries. There is also a lack of policies in tourist camps to control tourist numbers which could contribute to compromised elephant welfare as high level of tourist activities can lead to excessive noise or higher workload for elephants (Bansiddhi et al., 2020). Another study also showed higher body condition scores and adrenal steroid hormone levels during high tourist activity season, which might be improved by limiting tourist interactions with elephants (Norkaew et al., 2019). In addition, emotional discussions about animal welfare prevail as different stakeholders of society have different opinions about what animal welfare is (Lassen et al., 2006). In elephant range countries such as Thailand, the lack of standards that objectively evaluate elephant welfare in tourism industry has been suggested to lead to unfounded claims simply based on anecdote or emotions by animal activist groups that all tourist activities of elephants are brutal to elephants (Bansiddhi et al., 2020). In fact, some tourist activities such as elephant riding seemed to have some positive welfare effects on elephants as more overweight captive elephants in camps were seen after a decline in elephant riding opportunities as a result of campaigns against all tourist activities related to elephants (Norkaew et al., 2018, 2019). Developing implementable guidelines to both scientifically and objectively assess captive elephant welfare has been suggested to be helpful with overcoming emotional discussions of animal welfare (Webster, 2005). Although developing a single, universal captive elephant welfare guideline and assessment plan might be unrealistic and unpractical for all captive elephants around the globe, having a guidance from governing bodies in place to inform positive elephant welfare practices regarding a certain group of captive elephants is urgently needed in most elephant range countries. Likewise, for a long-live and intelligent animal like elephants that has a complex social structure, even though we might never be able to provide an environment for captive elephants that resembles the one that free-range conspecifics live in, efforts can and should be put in to create conditions that lead to best possible captive elephant welfare. This might also create a positive feedback loop for animal welfare as was suggested in a study that more welfare-encouraging behaviors were observed for animals in a good welfare state (Franks, Champagne, & Higgins, 2013).

Chapter Three: Elephant Welfare Assessment Parameters

Although there is not a universally accepted single accepted measure of animal welfare, there is a consensus that good welfare practices provide animals with the environment allowing for natural behaviors. Today, there is a large variety of parameters that are used in captive elephant management or suggested in literature to assess captive elephant welfare. Welfare indicators can be evaluated on their reliability as well as validity. Good welfare indicators are suggested to be different among animals with various welfare states, to be capable of repeatable measurement, and to be assessed consistently (Yon et al., 2019). The methods of studying elephant welfare can be groups in different ways. In this report, the assessment approaches of captive elephant welfare will be categorized into three main types: physiological (including biological), behavioral, and psychological. While some elephant welfare indicators are directly related to one of the three types, some may overlap two types or are not directly related to any of the three types. It is recommended to use multiple welfare indicators when assessing one animal's welfare state (Hill & Broom, 2009).

Physiological:

The most straightforward measure of assessing captive elephant welfare is through the measurements of fitness or physical health. Body condition score (BCS) is commonly used to assess physical health. Three standardized photos including lateral, rear, and rear angle of an elephant's ribs, backbone, and pelvic bone are used together to assign a score on a scale of one to five, with five being obese and one being too thin (Morfeld et al., 2016). In addition, foot health examination is often included in physical assessment as well. It is often recorded as foot score (FS). It has been suggested that keeping elephants on soft substrates is good for their foot health (Brown et al., 2020). There are different ways to record foot score. Take the method of Miller et al. For example, information of each foot including any issue with the pad, sole, and toenail such as bruises, ulcerations, cracks, fissures, abscesses, or horn growth is recorded and scored on a three-point scale, with 1 representing one abnormality and 3 representing three or more abnormalities of this foot (Miller, Hogan, & Meehan, 2016). Skin lesions and wounds are often examined as well for physical health and they are often recorded as wound score (WS). For instance, wounds can be scored on a three-point scare with 0 representing none and 3 representing severe (Schein et al., 2013). While good physical health does not necessarily mean good welfare, poor health can indicate a compromised welfare. Problem of gait is also generally viewed as biological indicators of poor elephant welfare (Harris et al., 2008; 2010). Shortened lifespan, poor reproductive outcome (Clubb & Mason, 2002; Clubb et al., 2008), female acyclicity, infant mortality rates, and premature adult death (Hartley, 2016; Mason & Veasey, 2010; Prado-Oviedo et al., 2016) have been used as biological welfare indicators as well.

Hormone compound levels are suggested to be another effective tool to assess animal welfare as they are released by animals in complex stress responses. They have been suggested to be promising early stress detection tools which can help to prevent potential costs associated with stress (Webb et al., 2020). Any threat to an individual's homeostasis or wellbeing is generally recognized as stress (Kogler et al., 2015; Ulrich-Lai & Herman, 2009; Rushen, Passillé, & Keyserlingk, 2008). One of the most widely used stress indices is glucocorticoid. Glucocorticoids are synthesized and released by the hypothalamic-pituitary-adrenal (HPA) axis in response to a range of stimuli and are often used as a measure of animal welfare (Ralph & Tilbrook, 2016; Tilbrook & Ralph, 2018). An elevated glucocorticoid level in elephants has been shown in various highly stressful situations, such as during the open period of a zoo (Menargues et al., 2008), participating in public festivals and processions (Kumar et al., 2014), and during construction (Boyle et al., 2015). A lower fecal glucocorticoid metabolite (FGM) level has been suggested to be associated with adequate walking distance, walking time, and working hours in elephant camps in Thailand where elephants are used for tourist activities (Bansiddhi et al., 2019). Glucocorticoids, together with androgens, have been validated as indices of injury stress in wild male African elephants (Rasmussen et al., 2008). The glucocorticoid level can be measured in blood, urine (Brown et al., 2010), feces, and saliva (Menargues et al., 2012). However, although immunoassays have been developed to effectively measure cortisol, a type of glucocorticoid, in serum (Brown & Lehnhardt, 1995; Brown, Wemmer, & Lehnhardt, 1995), stress associated with blood-collection during animal handling could potentially generate a glucocorticoid response and complicates the results. Therefore, non-invasive methods of measuring the concentration of FGM were also developed and validated because there is no need to capture and handle the animal. Additionally, a study has shown that FGM concentration can remain stable for up to eight hours in a tropical environment, emphasizing the reliability of using FGM as a welfare indicator (Wong et al., 2016). Positive

associations have been discovered between FGM and heterophil/lymphocyte ratio in semi-captive elephants in Myanmar (Seltmann, 2020), between FGM and triglycerides, and between FGM and testosterone (Norkaew, 2019), suggesting some potential stress indicator alternatives. However, in addition to stressful conditions, glucocorticoids in elephants also increase in response to normal physiological changes. They can be beneficial during pregnancy, parturition, and musth (Brown & Lehnhardt, 1995; Brown et al., 2007; Kajaysri & Nokkaew, 2014). Excitement can cause the elevation of glucocorticoid level, while HPA function can be depressed in chronic conditions (Veasey, 2006). Additionally, the monitoring of glucocorticoid can be time-consuming, expensive, and have delayed results due to the time spent on laboratory analysis procedures (Webb et al., 2020). Therefore, although monitoring glucocorticoid level can be useful to assess elephant welfare, it can be inaccurate and does not unequivocally equate to welfare. It is recommended to combine glucocorticoid measurement with other welfare measures, such as biological and behavioral measures (Bansiddhi et al., 2019; 2020).

Additionally, salivary immunoglobulin A (sIgA) has been suggested to be another promising physiological welfare indicator. Immunoglobulin A is one kind of natural immune proteins in mammals. It is naturally abundant in secretory fluids such as saliva and breast milk, and in respiratory, urogenital, and gastrointestinal secretions (Tsujita & Morimoto, 1999). Studies in mammals have shown a correlation between stress and sIgA, but the relation can vary among different species. For example, decreased sIgA level is detected in dogs during defense training and under the influence of noise stressors (Kikawa et al., 2003; Svobodova et al., 2014), while increased sIgA level is detected in pigs during isolation (Escribano et al., 2015) and restraining (Muneta et al., 2010). Although studies of other species have found the relation between salivary IgA and cortisol, including humans (Hucklebridge, Clow, & Evans, 1998) and dogs (Skandakumar, Stodulski, & Hau, 1995), no significant correlation between them in Asian elephants have been seen (Edwards et al., 2019; Plangsangmas et al., 2020). Just like glucocorticoids, IgA level increases in response to acute stressors, and decreases under chronic stressors. Therefore, it is suggested to interpret both IgA and glucocorticoids levels according to the context, and incorporate sIgA with other welfare assessment measures (Plangsangmas et al., 2020).

Behavioral:

Behavioral observation is a rapid and non-invasive way of recognizing stress (Webb et al., 2020). Preference testing of behavioral choices can aid in discovering the needs of captive animals based on their preferences (Blom et al., 1992; Dawkins, 1976). For intelligent animals like elephants, preference testing can provide insight in what elephants prefer in a captive environment between several options. Although there has not been a lot of preference testing carried out in elephants, previous preference testing of flooring substrate choices in Asian elephants shed lights on this methodology (Meller, Croney, & Shepherdson, 2007). Limitations of preference testing exist such as when animals have to pick an option among several undesired choices (Webber, 2017).

Stereotypies, together with hormones, are suggested to be the most common and best validated tools as indicators of suboptimal captive elephant welfare (Elzanowski & Sergiel, 2006; Laws et al., 2007; Mason & Latham, 2004; Mason & Veasey, 2010; Rees, 2004). Stereotypies are defined as repetitive unvarying behaviors with no clear goal or function (Mason, 1991). They are sometimes referred to as Abnormal Repetitive Behaviors (ARBs). Studies have shown that constant frustration can lead to the development of ARBs such as object sucking in

bull calves (Kooijman, Wierenga & Wiepkema, 1991), feather plucking in chickens (Dixon, Duncan & Mason, 2008), and bar-mouthing in pigs (Cronin, 1985; Mason & Mendl, 2017). Parental deprivation for animals at a young age can also cause ARBs later in their life as has been shown in infant rhesus monkeys (*Macaca mulatta*) (Polanco, 2016), horses (*Equus ferus caballus*) (Parker, Goodwin & Redhead, 2008), and chimpanzees (*Pan troglodytes*) (Warniment & Brent, 1997). In captive Asian elephants, stereotypies often include swaying, rocking, or head bobbing. They have been suggested to be related to prolonged chaining (De Mel, Weerakoon, & Ratnasooriya, 2013; Friend & Parker, 1999; Gruber et al., 2000; Schmid, 1995; Varadharajan et al., 2016), limited moving space (Greco et al., 2017; Elzanowski & Sergiel, 2006), and social isolation from other elephants (Greco et al., 2016; Kurt & Garai, 2007; Kurt & Garai, 2001; Yon et al., 2019). However, there have been debates on whether stereotypic behaviors have no benefits whatsoever to the individuals. Performing stereotypies is suggested to have some physiological and psychological enhancement functions in a sub-optimal environment (Carlstead, 1998). Study has also shown that some animals perform stereotypies as a coping mechanism such as self-soothing to deal with challenges caused by the environment, and stereotypies can reflect a historical welfare state due to a persistent past stressor (Mason & Latham, 2004). Additionally, it is worth mentioning that no clear relationship has been found between stereotypic behaviors and cortisol concentrations as there are conflicting findings in literature regarding that (Wilson, Bloomsmith, & Maple, 2004). While some past studies showed the highest cortisol concentration in elephants (Schmid et al., 2001) as well as in cattle (Redbo, 1993) with the greatest amount of stereotypies, others proposed the opposite (Bildsoe et al 1991; Mason 1991; Bettinger et al 1997). A recent study in Thailand also discovered lower levels of FGM concentration in elephants exhibiting stereotypic behaviors than others that did not (Bansiddhi et al. 2019). For all that, the prevalence and frequency of stereotypies generally reflect a welfare-compromised environment because ARBs as welfare indicators most certainly indicate a problem (Webber, 2017), and research aiming for identifying the mitigation measures is recommended to be carried out regardless of the cause (Bansiddhi et al., 2020). It is also suggested that high prevalence of ARBs indicates a chronically poor past and present wellbeing but not a reliable indicator for identifying temporarily poor welfare condition (Mason & Mendl, 2017).

Demeanor could also serve as a potential welfare indicator as identified by elephant stakeholders (Chadwick et al., 2017). Based on the quality of an animal's demeanor, Qualitative Behavioral Assessment (QBA) has been designed for animal welfare assessment in both domestic animals (Whitham & Wielebnowski, 2009; Blokhuis et al., 2003; Brscic et al., 2010; Wemelsfelder et al., 2000, 2001; Wemelsfelder & Lawrence, 2001) and wild African elephants (Wemelsfelder, 2010). Commonly QBA/demeanor terms include 'tense,' 'relaxed,' 'depressed,' 'content,' 'attentive,' 'distressed,' etc. One study of captive zoo elephants proposed the development of an elephant behavioral welfare monitoring tool which includes QBA, day-time behavior observation, and night-time observation, providing insight on potential rapid and simple welfare assessment tool for routine use by zoo elephant keepers (Yon et al., 2019). Similar to demeanor, behavioral ethograms, which are catalogues of behaviors specific for one species, are also commonly used for captive animals because they are simple, fast, and non-invasive (Wells, 2005; Watters, Margulis, & Atsali, 2009; Hall & Heleski, 2017). Although there is not one simple type of ethograms used for assessing Asian elephant welfare though, as they range from basic behavioral description such as 'walk' and 'sway' (Whilde & Marples, 2012) to

demeanor description as listed above, study has shown that elephant behavioral welfare monitoring requires little previous experience to be reliable (Webb et al. 2020).

Play is suggested to be another behavioral indicator for the wellbeing of captive elephants, especially for calves. Six criteria have been suggested to use simultaneously when defining play which includes lacking functionality, being pleasant and voluntary, exaggerated, repeated, occurring without stress, and requiring communication and exchange (Burghardt, 2006; Graham & Burghardt, 2010; Byosiere, Espinosa, & Smuts, 2016; Bekoff, 1972, 2001). For elephants, play occurs throughout their lives in various forms, which has been observed even within the oldest ages (Lee & Moss, 2014). Studies have shown that play in elephant calves is beneficial to their long-term survival as high play rates are related to faster growth speed and lower mortality rate (Lee et al., 2013; Lee & Moss, 2014). Because play is metabolically costly and risky (Harcourt, 1991; Kuehl et al., 2008), it generally occurs when animals meet their physiological needs (Cordoni, 2009; Lee, 1984). It is also believed that play is associated with positive mental states and pleasure (Cooke, 2011; Descovich et al., 2017; Fraser & Duncan, 1998; Held & Špinka, 2011; Panksepp & Burgdorf, 2003) and therefore, a potential indicator of positive animal welfare (Webber, 2017). However, the utility and validity of using play as a positive welfare indicator is controversial (Ahloy-Dallaire, Espinosa, & Mason, 2018; Blois-Heulin et al., 2015). Like stereotypic behaviors, it is proposed that play might also act as a coping mechanism in a suboptimal environment (Burghardt, 2006), which is supported by the discovery of horses playing under extremely stressful conditions (Hausberger, Fureix, & Bourjade, 2012). A recent study of captive elephants showed no significant difference in playing activities between captive elephant calves and wild ones, proposing that play may not be a reliable tool for elephant welfare assessment (Webber & Lee, 2020).

Psychological:

Although the behavioral and physiological/biological assessments for captive elephant welfare are addressed and validated in existing studies and guidelines most commonly, physical wellbeing of an animal alone might not equate animal welfare. Mental state has been suggested to be another crucial part of captive elephant welfare. However, because objectively assessing mental state of an animal is quite challenging, many animal welfare assessment and management plans overly focus on physical health examination alone (Veasey, 2017; Duncan & Petherick, 1991; Rushen, 2003). Study of captive Asian elephants in Thailand has revealed that mental state assessment for captive elephants is not universally valued and is only used in some elephant camps (Bansiddhi et al., 2020). In addition, there is suggested to be a conflict between physical and psychological priorities when assessing captive animal welfare because prioritizing captive elephant physical wellbeing often leads to compromised psychological needs of the animals (Veasey, 2017). Playing, Walking (Williams et al., 2018), management (Meehan et al., 2016), and Socialization (Meehan et al.,2016; Greco et al., 2016) have all been suggested as potential factors associated with elephant welfare. It is believed that balanced diets, proper exercises, natural environments, and freedom of movements enhance both physical and psychological wellbeing (Brown et al., 2020). Elephant keepers are also said to be important as the welfare of elephants is closely related to their experiences with mahouts (Crawley et al., 2019; Mumby, 2019). However, no assessment tools or guidelines have been provided in corresponding studies. In a recent study, the psychological priorities for assessing captive elephant welfare was evaluated using an Animal Welfare Priority Identification System[©] (APWIS[©]) (Veasey, 2020). This pioneer study demonstrated the reliability of using APWIS to identify welfare priorities and

the importance of foraging and socialization to the welfare of captive elephants. The need to reconsider the established priorities in current husbandry guidelines such as the Association of Zoos and Aquariums (AZA) and the British and Irish Association of Zoos and Aquariums (BIAZA) was also emphasized as they fail to accurately reflect captive elephants' psychological needs.

Chapter Four: Policies

Today, there are many accrediting associations around the world with the aim of improving zoo animal welfare with standardized guidelines for zoo animal management. Well-known ones include the World Association of Zoos and Aquariums (WAZA), AZA, the Zoo and Aquarium Association of Australia, and BIAZA in western countries, as well as the South East Asia Zoo Association and the Zoological Park Organization in Asia. Each organization has its own guideline for elephant management and guideline developing procedure. For example, BIAZA has its own elephant welfare group (EWG), working through welfare concerns relating to health, nutrition, reproduction, and behavior. However, it is worth mentioning that there is consensus of what should be included in the guideline for elephant management. Standards for elephant management and care often include all the resources that should be provided to animals such as access to food, water, shelter, and medical care. In addition, factors such as sociality for captive elephants are also commonly valued in guidelines, but the standards could be different. For example, BIAZA recommends that all institutions with captive elephants keep at least four female elephants over two years old together (BIAZA, 2006). On the other hand, for AZA, the number of cows that are recommended to be managed together is three (AZA, 2003).

In available and implemented guidelines of organizations for zoo elephant management, the welfare effort of elephants is mostly based on the externalities (environment) around animal care. The affective states of animals, however, are not assessed or included, which is concerning for achieving good animal welfare. Accordingly, the Detroit Zoological Society (DZS) has proposed a framework that brings together science, common sense, and compassion to evaluate zoo animal welfare, providing a foundation for zoos to follow in the future (Kagan, Carter, &Allard, 2015). One challenge of making changes in management of zoo elephants for improved welfare is that, according to BIAZA, due to the long lifespan of elephants, the positive welfare change brought by some of the changes in management might take more than a decade to show, emphasizing the importance of elephant welfare monitoring.

In elephant range countries, evidence-based standards and guidelines for tourist elephants are often lacking (Bansiddhi et al., 2010). Studies on the effects of tourist activities on elephants are in urgent need for the development of implementable guidelines. In Thailand, captive elephants are considered livestock according to Draught Animal Act of 1939, in which animal welfare is not addressed (Baker & Rebecca, 2020). The Wild Elephant Protection Act prohibits any killing or capturing of wild elephants since 1921, but illegal capture of wild elephants from neighboring elephant range countries such as Myanmar has been reported, likely due to the lucrative elephant tourism industry as well as the undesirable birth rate of captive elephants (Godfrey & Kongmuang, 2009; Nijman, 2014). In order to prevent such wild elephant trafficking, a system that requires microchipping and DNA fingerprinting was established in 2016 through the collaboration of several organizations, and registration of an elephant within 90 days of birth is required today (Bansiddhi, Brown, & Thitaram, 2020). There are two laws in

Thailand today to protect captive elephant welfare, including the 1956 Criminal Code B.E. 2499 as well as the 2014 Prevention of Cruelty and Animal Welfare Provision Act B.E. 2557. However, problems exist as there are no detailed welfare assessing criteria provided, coupled with poor enforcement from the government (Bansiddhi, Brown, & Thitaram, 2020). Additionally, the Asian Elephant Captive Working Group (ACEWG) was formed in 2015 in Thailand involving a group of elephant experts around the globe with the aim of improving the welfare of captive elephants in Southeast Asia (Thitaram, Brown, & Luz, 2015). However, government's involvement in implementation, enforcement, and regulation of elephant welfare standards is required to make a transformational change there (Bansiddhi et al., 2020). In India, different types of captive elephants are managed by different parties under different regulations. The Forest Department department of each state has managed captive elephants for logging purposes for a long time. Like Thailand, after the ban on timber logging, many logging elephants went into tourism industry and offer rides to tourists (Vanitha, Thiyagesan, & Baskaran, 2011). For temple elephants such as Hindu temple captive elephants, they belong to the Hindu Religious and Charitable Endowments Board as well as the local government, and are used for religious practices such as participating in ceremonies to deity and temple festival processions (Vanitha, Thiyagesan, & Baskaran, 2016). Although these elephants are worshiped in India, they are mostly isolated, kept in small indoor enclosures (Vanitha, 2007), and prohibited from breeding (Krishnamurthy, 1998). Private owned elephants can belong to institutions, charities, or mahouts, and the majority of them (66%) are individually owned and managed by the elephant keeper (Vanitha, Thiyagesan, & Baskaran, 2016). Being commercially rented out regularly, individually owned elephants are very mobile with frequent changing in ownership (Vanitha, 2007; Vanitha, Thiyagesan, & Baskaran, 2010a). Breeding is usually absent too due to the high maintenance cost or the lack of opportunity to meet other elephants (Krishnamurthy, 1998; Vanitha, 2007; Vanitha, Thiyagesan, & Baskaran, 2010b).

Conclusions

On a global scale, we have made great progress on improving captive elephant welfare, but it is an ongoing battle. Knowing that there are no universal guidelines or standards for captive elephant welfare assessment of all captive elephants around the world, agreements exist, however, on what are considered beneficial to captive elephant welfare and what are not. As a controversial topic that continues to bring about emotional discussions, empirical studies are especially important in contributing to the development of evidence-based standard or guidelines for the management of captive elephants, and the education to the public. We need to continue working on solving existing problems that are detrimental to captive elephant welfare, identifying new welfare measures, integrating study results to policy making, aiding the public to make informed decisions, and seeking for the involvement of the governments. It should be our ultimate goal to provide captive Asian elephants, a long-lived species, an ideal environment to the best degree that would satisfy individual animals physiologically, behaviorally, and psychologically.

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Reference for pictures:
Figure 1: https://elephant-family.org/what-we-do/about-asian-elephants
Figure 2: https://elephant-family.org/what-we-do/about-asian-elephants