

# Conservation Difficulties for *Hylobates lar*: Effects the Illegal Pet Trade has on White-Handed Gibbons' Behavioral Health and Successful Rehabilitation

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## ABSTRACT

White-handed gibbons (*Hylobates lar*) are currently listed as Endangered on the IUCN Red List and wild populations are rapidly declining. In Thailand, the primary threat to this species is hunting for the purpose of capturing infants for the illegal pet trade. During their time in the pet trade, gibbons may be used as a tourist attraction and photographic prop. Some are relatively well cared for while others are reared in abusive conditions with no conspecific contact. In order to determine what effects the illegal pet trade has on white-handed gibbons' behavioral health and rehabilitation prospects, I analyze the behavior of numerous individual gibbons currently housed at the Gibbon Rehabilitation Project (GRP) in Phuket, Thailand. I also analyze the behavior of reintroduced gibbons. Results show that gibbons in the pet trade exhibit a variety of abnormal behaviors that correspond to those of deprived captive and laboratory primates. Some aberrancies cannot be modified later in life and many individuals will never be released. Other aberrancies are more easily alleviated and numerous gibbon groups have been successfully reintroduced into the Khao Phra Theaw Non-Hunting Area. Some important factors to rehabilitation success are age upon arrival and a rearing environment with conspecifics. However, reintroduced gibbon behavior differs from wild gibbon behavior in ways that affect immediate safety. In order for reintroduction programs to be successful, conservation initiatives must address multiple interrelated aspects including education, law enforcement, habitat protection, and economic alternatives.



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## **CHAPTER 1**

### **INTRODUCTION**

Like most primates, the white-handed gibbon (*Hylobates lar*) is a highly social, cognitively complex creature. It thrives among its family group high up in the rainforests of Southeast Asia, swinging between branches with unparalleled agility as its elaborate songs echo through the trees. Unfortunately, this picture is becoming increasingly rare. Wild populations are rapidly disappearing as hunters shoot adults and capture infants for Thailand's flourishing illegal pet trade. Once in captivity, young gibbons are commonly used as photo props and tourist attractions around Thailand's popular beaches, bars and restaurants. The pristine image of an infant clutching its mother's chest as she soars through the canopy is fading. It is more likely for one to catch a glimpse of the infant gibbon clad in baby clothes, scampering through the streets of Phuket for the exploitative tourism market.

This thesis will examine the effects Thailand's illegal pet trade has on white-handed gibbons' behavioral health and rehabilitation prospects. I hypothesize that a large portion of gibbons reared in the pet trade are deprived of their critical developmental period, which may subsequently result in detrimental behaviors that they cannot modify later in life. Therefore, many will never be released into the wild. I first provide background information about the illegal pet trade in order to examine living conditions and assess the degree of deprivation pet gibbons undergo. The basis for my hypothesis lies in previous research regarding primate socialization and development, so I then provide an extensive literature review on these topics. After overviewing the importance of the normal primate juvenile period and the consequences that arise in its absence, I examine the range of pet gibbon behavioral abnormalities via individual case studies at the Gibbon Rehabilitation Project (GRP) in Phuket, Thailand. I also

take a look whether or not reintroduced gibbons' behavior deviates from the normal behavioral repertoire. Finally, I provide a qualitative analysis of the behavioral patterns through the lenses of comparative psychology, socioecology, and neurobiology. Understanding the behavioral changes white-handed gibbons undergo in the pet trade is essential to conservation efforts because it sheds light on specific issues that need to be addressed, aids in the development of successful intervention methods, and educates the public about the complexity of this endangered species.

Gibbons that are fortunate enough to be rescued are likely to be sent to a wildlife rescue sanctuary or rehabilitation center. The steadily rising captive populations at GRP and other sanctuaries such as the Wildlife Friends Foundation of Thailand (WFFT) Release and Research Centre exemplify the immense scale of the problem. Of the sixty-seven gibbons currently housed at GRP, the large majority were once pets kept in cages, homes or temples. The treatment of these animals prior to rescue varied greatly. Some were well cared for and allowed to roam freely through their owners' home; others were chained outside of business establishments amongst busy crowds; a few were virtually isolated from all human and animal contact; and in the worst cases, physical abuse was so severe that individuals suffered irreversible injuries and deformities. Most pet gibbons are abandoned or turned in once they reach sexual maturity and become aggressive and more difficult to care for, while others are confiscated by authorities after receiving complaints about maltreatment or noise. In some cases, well-meaning tourists buy the gibbon from its owner and bring it to the sanctuaries. Unfortunately the large sum of money involved in such transactions only reinforces the trade.

In all cases, the illegal pet trade's negative effects on white-handed gibbons' overall wellbeing rapidly become apparent. The psychological and behavioral changes gibbons undergo

during captivity appear to be a significant obstacle for rehabilitation efforts. While it is no doubt that the pet trade has dire implications for conserving wild populations of white-handed gibbons, it is likely that the very nature of the trade poses even further repercussions for individuals that may or may not have the ability to be reintroduced into the wild.

Obstacles to successful rehabilitation are compounded by the complexity of primate learning mechanisms and behavioral flexibility. Normally, primates in the wild spend an extended period of time— often a number of years— learning from their parents and other group members. When denied this opportunity, young gibbons in their critical developmental period learn to cope in an entirely different environment. Unfortunately, the majority of these coping mechanisms and other learned responses prove to be maladaptive during the socialization, rehabilitation and reintroduction processes. The ease with which white-handed gibbons can be successfully rehabilitated is therefore hindered by the very learning curve that characterizes primate intelligence.

It has long been noted that primates who undergo maternal separation, social isolation and stressful captive conditions often exhibit abnormal and detrimental behavior (Harlow, 1951). As we will see, many gibbons captured for the illegal pet trade experience comparable circumstances. It is thus likely that young gibbons undergo a similar disruption in development that inhibits natural behavior and social adequacy. This may consequently decrease the likelihood of successful rehabilitation and reintroduction to the wild. The question, then, is what effects does the illegal pet trade have on white-handed gibbons' behavioral health? Can they make the necessary social, behavioral and physiological changes that will allow them to lead an independent life in their natural habitat?

### ***Study Site: The Gibbon Rehabilitation Project***

The Gibbon Rehabilitation Project is a non-governmental organization working to rehabilitate unwanted or confiscated gibbons and reintroduce suitable candidates into the wild. The rehabilitation site is located at the Bang Pae Waterfall in the Khao Phra Theaw Royal Wildlife and Forest Reserve, a large area of virgin rain forest in the northeast of Phuket Island, Thailand. The Center for Conservation Education and Fundraising is adjacent to the rehabilitation site while the GRP headquarters is about 2.5 km down the road in the small village of Bangrong. The quarantine site is located within the headquarters, where individuals requiring extra care, nursery reared infants, and new arrivals awaiting blood tests are housed until they can thrive within the rehabilitation site.

Noppadol Preuksawan, the chief of the Phuket Royal Forestry Department at the time, established the project in 1992 with support from the Asian Wildlife Fund and American zoologist Terrence Dillon Morin. The Wild Animal Rescue Foundation of Thailand (WARF) began supporting the project in 1994; shortly after, GRP became a research division of WARF and remains so today.

GRP's objectives are the following: (1) develop a method to successfully rehabilitate white-handed gibbons back into their natural habitat, (2) end the demand for the illegal use of gibbons as tourist attractions and pets, (3) repopulate the last remaining rainforest in Phuket, (4) create awareness of the importance of environmental conservation, and (5) provide volunteers the opportunity to study the white-handed gibbon. In order to meet its goals, GRP hosts several long-term and short-term volunteers. The project is closely affiliated with International Student Volunteers (ISV), a U.S. based non-profit organization that provides educational volunteer and

travel programs to international university students. Volunteers play an integral role in the daily maintenance, education and conservation initiatives.

I resided at GRP for approximately two weeks as part of a small ISV group between June 23 and July 8, 2011. I lived in a small bungalow at the GRP headquarters and assisted in daily volunteer tasks that included trail maintenance, enclosure modification and maintenance, visiting local schools, and collecting observational data on reintroduced gibbons. The project is very education-oriented and, upon arrival, ISV volunteers participated in a day-long trek through Khao Phra Theaw to learn about the local flora and fauna. There were also regular group discussions focusing on sustainable development and community-based conservation as well as introductory Thai language lessons. After my stay at GRP, I spent two weeks visiting other parts of Thailand: Khao Sok National Park, Koh Yao Noi, Railay Beach, and Chiang Mai.

Because my time was dedicated to volunteering, I did not collect observational data for the purpose of this thesis during my stay at GRP. I did, however, spend a good deal of time casually observing both captive and reintroduced gibbons during volunteer tasks and free time. I became familiar with numerous individuals, particularly those in the quarantine site adjacent to my bungalow. I also collected some background information from the GRP headquarters and the Center for Conservation Education and Fundraising. Most material about individual gibbons is derived from GRP's website ([gibbonproject.org](http://gibbonproject.org)), published reports, and e-mail correspondence with Owart Maprang, the Ecological Science Manager and Research and Rehabilitation Coordinator of GRP.

I chose to approach the problem via individual case studies due to frequent gaps in information about each gibbon's history, age, past behavior, and current behavior. Many gibbons have only a brief description of their origin and no description of their behavior. Rather than



assuming that no description equates with normal behavior, I selected individuals with known ages, clearer histories, and more detailed descriptions of past and current behavior. Many subjects I chose are also representative of more widespread patterns seen at the rehabilitation site (See Appendix A). Because GRP's provided descriptions were intended to be brief profiles for the website, the author may have omitted minor stereotypies like repetitive brachiation or digit sucking. There is also a possibility that some individuals displayed aberrancies upon arrival but have since improved and therefore no note of the behavior was published. Finally, some individuals have not been at GRP long enough to accurately assess their behavioral patterns. Furthermore, I believe that the implementation of successful rehabilitation procedures requires acknowledging each gibbon as a distinct individual. Controlled research and literature compilations are deeply valuable to reintroduction efforts, but rescued gibbons are complex, variable creatures with vastly different histories. They thus warrant individual analysis that recognizes each unique situation.

I frame my discussion of gibbon behavioral health primarily within the topics of animal welfare and psychological wellbeing. Because most of the research I reference involves non-hylobatid primates, I acknowledge the close evolutionary relationship gibbons share with monkeys, great apes and humans. These themes provide a basis for understanding how detrimental the pet trade is to a gibbon's behavioral health and overall wellbeing.

### ***A Brief Excursion into Animal Welfare***

Prior to further discussion regarding topics of gibbon wellbeing, it is important to establish the definition and meaning of animal welfare. The process of drawing conclusions about thinking or feeling in nonhuman primates can at times be a challenge due to the simple fact

that they are often not accessible through language. However, an immense range of behavior, visual and vocal signals, and measurable physiological mechanisms may be utilized as the basis for inferences. Animal welfare scientists thus commonly define a creature's wellbeing based on three determinants: the animal's subjective emotional experiences, its physical health and biological functioning, and the extent to which the animal is able to live in ways that are natural for its species (Fraser, 2009; Yeates, 2010). Most contemporary primatologists and biologists embrace the scientific study of animal emotion; for many, understanding whether and how animals experience emotions is viewed as the key to improving animal welfare. Observations of empathy, reconciliation and culture in primates provide striking evidence for subjective emotional experiences (De Waal, 2001), and recent advances in the study of animal emotion and affective neurosciences have not gone unnoticed (Rolls, 2005; Mendl et al., 2010). With valid evidence for each facet of animal welfare, it is according to this definition that I will frame my discussion of gibbon wellbeing.

As a subset of welfare, psychological wellbeing represents a substantial facet of gibbon behavioral health. The assessment of psychological wellbeing is typically based on multiple indexes: the animal's ability to cope effectively with changes in its social and physical environment, the ability to engage in beneficial species-typical activities, the absence of maladaptive or pathological behavior that results in self-injury or other undesirable consequences, the presence of a balanced temperament, and the absence of chronic signs of distress (National Research Council, 1998).

## ***Understanding Gibbon Behavior through an Evolutionary Paradigm***

An understanding of white-handed gibbon behavioral health requires the adoption of an evolutionary framework which acknowledges that all primates are the descendants of a common ancestral species. According to this framework, the more recently two creatures shared a common ancestor, the more similarities there should be. Thus, the evolutionary paradigm is inherently one of comparisons between and within species. Genetic, biochemical and anatomical features, while revealing the differences between nonhuman and human primates, no doubt confirm a view of primate distinctiveness in comparison to other mammalian orders.

In response to this recognition, primates have been widely studied in recent decades due to their close phylogenetic proximity to humankind. Many researchers believe that by studying our closest living relatives, humans can begin to understand our own evolutionary past and current behavior. In fact, Chadwick-Jones (1998) proposed that it is an error to place monkeys' and apes' social actions in a separate category of animal behavior and consequently compartmentalized from human behavior. It is more realistic, he says, to regard the social behavior of nonhuman primates as having many shared attributes with that of humans. Fitzgerald et al. (1982), too, argued that legitimate cross-species comparisons can be made when selective situations correspond. Given the same sets of conditions, a particular strategy will be successful or unsuccessful no matter the taxonomic identity of the performer.

Adhering to this evolutionary paradigm, it can be inferred that similarities amongst the order Primates— and especially within the suborder Haplorrhini and the superfamily Hominoidea— are great enough to examine hylobatid behavior through the lenses of comparative psychology, socioecology and neurobiology. Comparative models of physical or psychological health may aid in identifying causal processes underlying various health issues in

white-handed gibbons. They can also assist in specifying preventative measures or therapies that will produce beneficial outcomes during the rehabilitation process (Sackett, 1991). After examining the social behavior, psychopathologies and brain mechanisms of other anthropoids, this knowledge can be applied to recent observations of white-handed gibbons in comparable conditions, situations and environments. I thus utilize a number of cross-species comparisons in my analysis of white-handed gibbon behavioral health. After discussing research and experiments involving other primate species, I apply this knowledge to some of the white-handed gibbons I casually observed at GRP.

In order to recognize abnormality, it is important to establish a broad definition of normalcy. After widespread research in the last half of the century, white-handed gibbons are quite well studied and their behavior well observed. A brief description of the white-handed gibbon's natural behavior, social structure and ecology provides a helpful overview of the species. Understanding its evolutionary history and normal behavior highlights the importance of a natural life to an individual's psychological and physical wellbeing. Furthermore, developing a picture of wild gibbons provides an essential comparison between the species' natural environment and the conditions in the pet trade. We also see how natural behavior differs from patterns exhibited in rescued and reintroduced gibbons.

### ***A Brief History of Gibbon Research***

Though the earliest scientific account of gibbons appeared in a 1766 publication of *Natural History* (Buffon), detailed knowledge of hylobatids' behavior and ecology remained lacking for well over a century (Bartlett, 2009). In 1929, however, Robert and Ada Yerkes compiled the then current knowledge of apes into a comprehensive publication, *The Great Apes:*

*A Study of Anthropoid Life*, which included extensive coverage of the Hylobatidae. Despite the authors' adamant view that more field observations and data on all of the apes were necessary, they questioned the gibbons' comparative value to humankind and thus focused their subsequent studies on gorillas and chimpanzees instead (Yerkes and Yerkes, 1929). However, the publication nevertheless prompted a series of long-term primate field studies that included both white-handed gibbons and their close hylobatid relatives.

Clarence Ray Carpenter first described much of what we know about gibbon behavior and ecology. After approximately 100 days of intensive and almost continuous observations of 20 gibbon social groups on Mt. Doi Dao in Northern Thailand, Carpenter presented his observations in *A Field Study in Siam of the Behavior and Social Relations of the Gibbon* (*Hylobates lar*). Published in 1940, the monograph covered topics of aggression, grooming, group formation, locomotion, vocalization, sleep behavior, diet, territoriality, and dominance that remain prominent and largely accurate in the field of primatology today.

J.O. Ellefson initiated a second major study of wild gibbons with the goal of uncovering further comparative knowledge that would lead to a better understanding of humankind. From March 1964 to November 1965 Ellefson conducted over 2,000 hours of direct observation on white-handed gibbons at the site of Tanjong Triang in Peninsular Malaysia. In addition to confirming Carpenter's earlier conclusions, Ellefson (1974) quantified the gibbons' activity budget and attempted to reconstruct the evolution of their monogamous social organization.

The following decades marked a proliferation of gibbon field research, including numerous surveys and long-term ecological studies of various gibbon species. David J. Chivers (1974) undertook a long-term field study of siamangs in the Malayan peninsula, noting important similarities and differences between *Symphalangus syndactylus* and *Hylobates lar*. Jeremy and

Patricia Raemaekers (1985) contributed greatly to research on white-handed gibbon vocalizations through the innovative use of playback calls, documenting the response of pair bonds to simulated intrusions by strange gibbons. In addition, Warren Brockelman focused his research on aspects of gibbon conservation (1975), feeding and ranging behavior (1984), and pair formation and social structure (1998).

More recently, research on white-handed gibbons at Khao Yai National Park in Northern Thailand has led to an even greater appreciation of their complex social lives and variable ecology. Reichard (1995) and Brockelman (1998) documented occurrences of variable social organization and affiliative behaviors. Thad Bartlett (2003; 2009) has also done extensive field studies of the gibbons at Khao Yai, focusing primarily on social interactions, behavior and ecology.

Owing thanks to the extensive research of recent decades, we now know a great deal about wild white-handed gibbons' behavior, social organization and ecology in a natural environment. The following information, now widely accepted within the scientific community, can be largely attributed to the work of the previously mentioned researchers.

### ***What is a White-Handed Gibbon?***

The white-handed gibbon (*Hylobates lar*) is a small, highly arboreal ape with close phylogenetic proximity to great apes and humankind. It has been widely accepted in recent years that the gibbon family Hylobatidae constitutes the sister group to great apes and humans within the superfamily Hominoidea (Fleagle, 1999; Israfel et al., 2011). Despite a relatively poor fossil record, numerous attempts have been made to estimate the divergence date between gibbons and great apes. A recent review by Chatterjee (2009) concluded that the most current and widely

accepted estimates postulate that gibbons and great apes diverged approximately 15 million years ago, based on molecular biology and combined biochemical results (Raaum et al., 2005). As a result of this close evolutionary relationship, similarities and differences in hominoid brain structure have been topics of much discussion (Uylings and Von Eden, 1990; Finlay and Darlington, 1995; Schenker et al., 2005). Semendeferi and Damasio (2002) found remarkable homogeneity in the relative size of many large sectors of the hominoid brain. Compared to most other members of the primate order, hominoids have relatively larger, more complex brains and are capable of greater cognitive abilities (Nystrom and Ashmore, 2008). Though gibbons do have a relatively smaller frontal lobe than the great apes, they are highly encephalized primates with a brain larger than predicted by their body size. The gibbon neocortex, the area of the brain involved in higher cognitive functions, is also well developed (Cunningham, 2006).

White-handed gibbons are found throughout the tropical rainforests of South and Southeast Asia. This includes most of Thailand, Laos, Myanmar, Peninsular Malaysia, northern Sumatra, and China's southern Yunnan province. They occupy the upper canopies of deciduous monsoon and evergreen rainforests, spending most of their time foraging for food. Gibbons are primarily frugivorous but also eat immature leaves, flowers, stems, shoots, buds, insects, and birds' eggs (Brockelman and Geissmann, 2008).

Like other hylobatids, white-handed gibbons are relatively small. They typically weigh 4.4-7.6 kg and measure 42.0-58.5 cm in height (Gron, 2010), thus referred to as a lesser or small ape rather than a great ape. They are highly adapted for arboreal locomotion, usually moving through their environment using brachiation and other types of suspensory locomotion. In fact, *Hylobates* actually means "dweller in the trees." Gibbons undoubtedly live up to the name. Their physiology alone exemplifies the specialization they have evolved for life in the trees. They have

the longest forelimb proportion of any living primates, with long, curved digits on their hands and feet as well as a long muscular pollex and hallux (Fleagle, 1999). This allows them to swing through the trees with stunning agility and speed, with the hand acting as a hook to propel the gibbon from branch to branch. Gibbons are even capable of covering three meters in a single swing and can leap over nine meters in distance (Nowak, 1999). While gibbons spend most of their time in a suspensory posture, it is not uncommon for them to walk bipedally atop a large limb with arms held high for balance. They are also the only apes that consistently have ischial callosities, pads of thick leathery skin on the rump that allow them to sit upright on branches while feeding and resting. Furthermore, gibbons have very high size indexes for the cerebellum and striatum, both of which are brain structures that contain important motor centers. This implies a greater complexity of motor patterns than found in other nonhuman primates (Stephan et al., 1988). With such anatomical, physiological and neurobiological specializations, wild gibbons in their natural setting spend the majority of their time high up in the canopy. They rarely, if ever, descend to the forest floor.

Gibbons are usually described as a monogamous ape with exceptionally stable social bonds, but their social behavior is quite complex and highly flexible. Groups are typically composed of a mated adult pair and up to four dependent offspring. It is not uncommon for gibbons to form other types of groups, however. At some sites there are multi-male groups, several of which also incorporate multiple adult females. Extra-pair copulations have been observed on a number of occasions and some females are even considered polyandrous (Bartlett, 2009). This may be an effect of habitat disturbance or ecological constraints that limit dispersal opportunities (Chivers, 2001). Even solitary animals are occasionally seen. They are typically subadults that have separated from the family group and have not yet established a territory of



their own (Nowak, 1999). Despite variations in group organization, monogamy is considered the norm. As we will see, this social structure provides a number of benefits to the rearing, protection and socialization of offspring.

Like other hominoids, gibbons have a longer life expectancy, slower birth rate and longer developmental period than other primates. Their average lifespan in the wild is 25-30 years, with individuals typically reaching sexual maturity between eight and ten years of age (Burnie, 2001). Females will then give birth to a single infant every two to four years. After a long eight months of gestation, they continue to place a heavy investment on caring for young. Mothers carry the infant ventrally for the first several weeks of life, allowing it to nurse on demand until it is weaned at nearly two years of age. Though the mother gives most parental care, the father and elder siblings' involvement is apparent. Bartlett (2009) suggested that males exhibit higher rates of vigilance relative to other group members and appear to take a lead role in investigating perceived threats. In addition to this protective role, males invest heavily in grooming the juveniles and adolescents of their group. Juveniles within the family unit also play a part in the infant's socialization. As the infant becomes more independent from its mother, older siblings focus more attention on it in the form of playing and wrestling. Each group member's behavior highlights the important role the entire family unit plays in the young offspring's protection and development. According to Fleagle (1999), young gibbons spend up to ten years in their family group before leaving to find their own mate and territory. This represents a long period of dependency that is essential to the individual's socialization and learning experiences.

Within-group social behavior varies throughout the year, sometimes taking up only a small percentage of time but occasionally taking up nearly one fifth of the activity budget (Bartlett, 2009). The most common social interactions are grooming, playing and physical

contact. All group members engage in grooming, with some bouts lasting up to one hour. As in many other primates, this is an indispensable behavior in promoting hygiene, maintaining group cohesion and creating social bonds. Play behavior—wrestling, chasing, slapping, and biting—is primarily exhibited in juveniles and adolescents, although adults of both sexes occasionally partake (Bartlett, 2003). It is during this time the young develops social skills and motor coordination. Like most primates, social interaction among gibbons is crucial for normal development, survival and successful reproduction.

Gibbons are strongly territorial and invest a good deal of energy in defending their home range, which averages about 30 hectares. Violent physical confrontations occasionally occur, but it is more likely for a gibbon to chase, display or call at any intruder (Nowak, 1999). Above all, groups tend to range near the edge of their territory and vocalize loudly. Gibbons are well known for these structurally complex song bouts, whether it be a solo great call or the elaborate duets sung between males and females. Brockelman (1984) suggested that duet performance provides a source of pleasurable stimulation and consequently acts as an incentive for breeding pairs to remain together. Thus, the songs are thought to strengthen the pair bond and maintain territorial boundaries (Bartlett, 2009).

It is these facets of gibbon behavior and ecology that best exemplify the importance of a natural existence promoting adequate social skills, a healthy well-functioning body and further species propagation. A gibbon removed from its family unit and natural habitat undergoes changes in physical health, diet, social structure, and environment that alter its behavior, welfare and learning experiences. Understanding a gibbon's needs during and after the rehabilitation process is essential to conservation efforts, for *Hylobates lar* populations are declining rapidly even with legal protection.

## ***Conservation Status***

*Hylobates lar* is currently classified as Endangered on the IUCN Red List. A taxon is considered Endangered when best available evidence indicates a very high risk for extinction in the wild. This is based on an evaluation against a number of quantitative criteria that include but are not limited to a modest population size as well as a reduction in population size or geographic range (IUCN, 2001). While there are a number of criteria, it is important to note that a threatened taxon meets any one of them, not necessarily all.

The white-handed gibbon, last assessed in 2008, has experienced a rapid reduction in population size that justifies its Endangered classification status. It is believed that the white-handed gibbon's population has declined by more than 50% within the past 3 generations or 45 years (Brockelman and Geissmann, 2008). Sadly, the trend is continuing and may not be reversible due to current levels of exploitation as well as a decline in the area and quality of habitat. Furthermore, it should be noted that population size is measured as the number of mature individuals that are known, estimated or inferred to be capable of reproduction. Mature individuals that will never reproduce are not counted, and reintroduced individuals must have produced viable offspring before they are counted as mature individuals (IUCN, 2011). Therefore, infant and juvenile gibbons in the pet trade are not included in population estimates. In addition, many white-handed gibbons housed in rehabilitation centers are incapable of successful reproduction and thus do not contribute to the specie's population size.

According to Brockelman's and Geissmann's Red List assessment (2008), hunting is a major threat to this species and has replaced even habitat destruction as the primary threat. Though the white-handed gibbon is nationally protected in all countries it inhabits, its range is presently confined to protected conservation areas. In Thailand, for example, no significant

populations survive outside of protected areas. Unfortunately, it is common for management to lack the resources to adequately patrol these areas.

*Hylobates lar* is also listed under CITES Appendix I. Species within this appendix are threatened with extinction and fully protected from local and international trade (UNEP-WCMC, 2011). Hunting and selling gibbons has been outlawed in Thailand since 1968 (Berkson et al., 1971), yet their wild populations continue to be decimated and their habitats rapidly destroyed. Despite legal protection, white-handed gibbons are still hunted, captured, traded, and exploited. Existing in plain sight yet simultaneously well hidden from view, Thailand's prolific pet trade poses an especially great risk to the survival of this species.

## *CHAPTER 2*

### **THAILAND'S ILLEGAL PET TRADE**

The trade in illegally captured wildlife is an ongoing threat to conservation efforts worldwide despite the monitoring, confiscations and education efforts of governmental authorities and non-governmental organizations. Primates in particular make appealing pets when young, perhaps as a result of long periods of dependency (Eudey, 1992) or due to humans' attraction to apes' similarity to our own species. Treesucon (1984) reports that gibbons were at one point the “favorite pet for Thais,” a bold claim that may unfairly generalize the country's people but is nonetheless supported by the widespread presence of pet gibbons in both rural and urban parts of Thailand as well as in animal markets and other commercial businesses.

Gibbons in the illegal pet trade are almost always born in the wild. Since infants are preferred, they are captured by killing the mother. The young are taken after the mother has fallen with the infant still clutching to her chest or, in other cases, when the infant comes to the ground to investigate what has happened (Cheyne, 2009). However, it is estimated that only one in three gibbons actually survives the initial fall (Gibbon Rehabilitation Project, 2010b). Because gibbons typically travel with their family unit, it is likely for the other adults within the group—an aggressive and defensive father, for example—to be shot as well. Even if they are not killed, the pattern may severely affect the population dynamics of the species.

The subsequent conditions in captivity and transport in tiny, inadequate cages cause at least half of the infants to die in transport (Bennett, 1992; Cheyne, 2004). Conditions at the market further add to the mortality rates, often the result of grossly inadequate care or in relation to the severe and sometimes fatal stress the infant experiences upon separation from its mother (Cheyne, 2009). Therefore, every individual infant gibbon that actually reaches the market

signifies a much greater loss to the species' wild population. It is estimated that for each gibbon kept as a pet, nine others have died (Gibbon Rehabilitation Project, n.d.).

Infant gibbons are sold between US \$10 and \$500 on the black market (Cheyne, 2009), an amount that represents a significant sum of the wealth of an average Thai family. The large quantity of money offered for the infant itself, in addition to the profits it incurs throughout adolescence, thus perpetuates the trade in endangered white-handed gibbons despite legislation against hunting throughout its range. Once in captivity, young gibbons are often used as a tourist attraction on popular beaches and in bars and restaurants, where a photographer may charge 200 baht (US \$6.34) for one photo with the gibbon (Polo, 2010). However, it is more common now for the gibbon to be in people's arms in the street, allowing the owner to move around more quickly and avoid negative tourist opinions or attention from authorities (Gibbon Rehabilitation Project, 2010b). It is not out of the ordinary for the gibbon to be wearing baby clothes, eating candy or even smoking cigarettes and drinking alcohol. In some cases, it may be sedated during the day and given amphetamines during late hours of the night for cooperative measures and thus maximum profit (Gibbon Rehabilitation Project, 2010a). Most tourists are unaware that gibbons are endangered and illegal to keep as pets. Chris Brooks, a previous long-term volunteer at GRP, lamented that “most people who have their photo taken with gibbons are actually animal lovers, they just don't understand the true situation” (personal communication, February 22, 2012).

Though I did not witness any exploitation of pet gibbons during my stay in Thailand, the practice is far from absent. My lack of personal observations is likely due to my limited one-month long stay, most of which took place outside the larger cities where exploitation is more likely to occur. Since I experienced no personal observations, I turned to public media sharing

websites and contacted other travelers in order to collect evidence of the illegal trade of white-handed gibbons.

### ***Prevalence and Visibility on the Streets and in Social Media***

Despite its illegality, evidence of Thailand's trade and exploitation of white-handed gibbons is rampant throughout the Internet and many social networking websites. A prime example exists on WFFT's official Facebook page: a recently updated photo album titled "Samui Island Gibbon exploitation" that contains 35 photos of 26 different young gibbons being used as photo props<sup>1</sup>. Most of the photos appear to be taken in the evening at bars and restaurants, though one displays a young woman and an adolescent gibbon standing next to one another on a beach. Many of the young gibbons are partaking in highly unnatural behavior: sucking on lollipops, posing with iguanas and cats, wearing diapers and leashes, and chewing on plastic straws and other types of trash. While the majority of the infants appear to be alone, one photo depicts two gibbons together; another photo actually contains three individuals. WFFT had encouraged its Internet followers to send in any photos they found, so it is likely that many of the images came from public websites and photo sharing pages. A written comment by the foundation reads, "I will collect as many pictures as I can so I can hand them over to the authorities who tell me again and again after my complaints that they never see this practice on the streets and therefore can't act." According to WFFT, the album was created with the intention of sending the photos to the governor of Surat Thani Province and the chief of the Samui police as evidence of the continuation of the illegal pet trade.

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<sup>1</sup> <http://www.facebook.com/media/set/?set=a.10150234791012657.316513.28211827656&type=3>



**Figure 2.1.** Jim Johnson took this photo on April 13, 2006 in Koh Paynee in Phang Nga National Park, Thailand. He was unaware at the time that this gibbon was an illegal pet, but later posted the photo on Flickr as a warning to others not to do the same. ©Permission obtained from Jim Johnson (personal communication, Jan. 18, 2012).

A large number of tourists unaware of the illegality of their activities also flaunt their photos on social media websites such as Flickr and Photobucket. Upon searching “Gibbon in Thailand” on both sites, I discovered that it is disturbingly common to find photos of tourists posing with a young gibbon or images of chained gibbons sitting on the ground. In some cases, the tourist later learned of the negative effects this has on gibbon populations and left

the photo up with a warning to others not to do the same (Figure 2.1).

Youtube, too, is a popular website to share vacation videos in Thailand that contain evidence of the country's flourishing illegal wildlife trade. Most importantly, the videos exemplify the highly variable treatment, social experiences and living conditions each gibbon undergoes and provide clues about the behavioral patterns gibbons develop in captivity. Once again, a search of “Gibbon in Thailand” pulls up a troubling amount of pet white-handed gibbons. The video “Monkey vs. Dog,” for example, shows a juvenile white-handed gibbon sitting on the ground with a similar-sized canine<sup>2</sup>. The gibbon calmly grooms the dog during the first portion of the video and then initiates play by gently biting and grappling with the dog on the ground. Though it is likely the gibbon has been reared with no conspecific contact, the individual is not socially isolated. Videos of young gibbons with other animals— dogs, cats and macaques for example— are quite common, suggesting that a portion of pet gibbons are raised in

<sup>2</sup> <http://www.youtube.com/watch?v=Ug4e6DbJGeU>



only a partially deprived environment with some opportunities for engaging in play behavior. There is also a video titled “Rabies monkey” under this search in which an ornery black gibbon runs atop a picnic table and proceeds to brachiate on the rafters of an open bungalow<sup>3</sup>. It then swings down onto a teen tourist's back, much to the amusement of the surrounding large, laughing crowd. The gibbon then runs bipedally, chasing the young man and grabbing onto his legs. Again, it is likely that the gibbon has been raised in the absence of other gibbons but no doubt has plentiful social contact with human counterparts.

A search of “Gibbon in Koh Samui,” however, pulls up a video called “Gibbon Thailand Koh Sumui” that displays less promising conditions for a young primate<sup>4</sup>. Here a young, listless gibbon huddles alone in a small wire cage and turns his back in order to be scratched by the cameraman. It is difficult to determine how often the gibbon is enclosed within this cage or whether it has opportunities for socialization and play behavior. This individual at the time of video recording is clearly less active than the gibbons in the other videos, but it is similar in seeking comfort and physical contact from its human bystander.

However, it is likely that the images seen are hardly representative of overall trends. Tourists are more likely to film gibbons that appear healthy and well cared for, those who are active and interactive, and those who are ranging freely outside of cages. Individuals who appear abused, lethargic and are kept in small cages are not likely to attract the attention that the featured gibbons do. Personal reports outside of social media websites paint a different picture. Bruce Phillips, a biologist who works in Thailand long-term as a conservation education and media officer, shared some of his observations with me via e-mail in November 2011. Phillips reported seeing several baby gibbons being used as photographic props on Phi Phi Island during

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<sup>3</sup> <http://www.youtube.com/watch?v=BuvpbF1enJE>

<sup>4</sup> <http://www.youtube.com/watch?v=0Y4VjpiSPPo>

February of 2011. He believed many of the infants to be sluggish, possibly dehydrated or sedated, or merely tired from the loud background noise of Thailand's bars and busy nightlife. When he asked the owner where the gibbon came from, the man became hostile to questions and was unwilling to give any information. Other travelers report similar scenarios in which the owners, as soon as they see any police, put the gibbon in their jackets and take off on motorbikes (Fraser, personal communication, Jan 19, 2012).

The prevalence of the issue appears obvious, yet it quickly became apparent that uncovering more details about the illegal pet trade would prove difficult. After inquiring to various conservation organizations about whether they had any information about Thailand's commercial business involving white-handed gibbons, I received written responses from both the International Union for Conservation of Nature (IUCN) Thailand and the United Nations Environment Programme World Conservation Monitoring Center (UNEP-WCMC) that they do not hold specific data or information about the local gibbon pet trade within Thailand. However, I did receive an e-mail response from the Wildlife Trade Monitoring Network, known as TRAFFIC Southeast Asia, on October 22, 2011. Chris Shepard, the Deputy Regional Director, confirmed the widespread prevalence of white-handed gibbons in the pet trade but lamented that getting funding for gibbon conservation has proved difficult. "We have managed to squeeze gibbons into our orangutan work in the past, as getting funds for orangutans is easier than for gibbons, and have published a few reports... Unfortunately TRAFFIC's reports only include information about the issue in Indonesia." Though the exact quantity of pet gibbons in Thailand is difficult to estimate, the magnitude of the issue is revealed by the mass of abused individuals that have arrived at GRP in recent years.

### *Conditions Upon Rescue*

Owart Maprang, the Ecological Science Manager and Research and Rehabilitation Coordinator at GRP, described to me typical rescue procedures as well as common conditions the gibbons arrive in (personal communication, January 18, 2012)<sup>5</sup>. Unfortunately, GRP does not have the authority to take gibbons from their owner; only the government—the police or the Forestry Department staff—has the authority to do so. While the police arrest most gibbon owners using their pet as a tourist attraction, some owners who keep pet gibbons do so in a more secretive manner. Many are frightened by the law and would prefer to give their gibbon directly to GRP. Because this is not possible, it is common for an owner to simply abandon their gibbon and stop taking care of it. In these cases, GRP gets a report from police or a neighbor that a gibbon needs to be rescued. Then, together with the Forestry Department, the staff at GRP will take the appropriate rescue measures.

Online news updates from GRP provide a useful historical database of incoming white-handed gibbons and their rehabilitation progress. In order to assess behavioral and historical patterns across gibbon arrivals, I analyzed fifty-five brief descriptions of individuals currently housed at GRP as well as thirteen online issues of regular news updates between December 2009 and October 2011. A more extensive record was not available, but a compilation of GRP's descriptions of each gibbon nevertheless reveals patterns in age, behavior and prior history despite a wide continuum of maltreatment and abuse. Of the fifty-five gibbons described on the GRP website, thirteen (23.6%) arrived prior to one year of age and eighteen (32.7%) arrived between one and two years of age. Taken together, over half of the gibbons arrived at GRP prior to the natural weaning age of two years. Though it is very likely that the majority of gibbons

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<sup>5</sup>Grammar revisions in this e-mail communication credited to GRP volunteer Janet De Vries.

were captured at such a young age, the lucrative nature of the pet trade prevents researchers and volunteers from uncovering a complete detailed history of each individual. Gaps in information are prevalent and I was unable to obtain dates or age at rescue for eleven gibbons with descriptions, in addition to fourteen gibbons that have very recently arrived and do not yet have general information published about them.

According to the information gathered, eighteen gibbons had been used as tourist attractions, caged outside of bars or used as a photographic prop. Four of these individuals were infected with Hepatitis A or B, most likely contracted when the owner injected them with drugs to keep them awake at night (Gibbon Rehabilitation Project, n.d.). Twenty-five were kept as non-commercial pets in homes or temples, four of which were reported to have been very well cared for. On the other hand, seven of the gibbons were described as malnourished, weak or emaciated upon arrival. In fact, most individuals that arrive are quite small and there are few that meet average gibbon height and weight measurements. Six gibbons arrived in other types of distressing physical conditions: filed teeth, missing fingers, matted coats, cuts and scars, and deformed skeletal structure. Most of these descriptions were not exclusive to one another but overlapped; it was not uncommon for a single individual to fit multiple categories.

The harsh reality not seen on the streets is observed daily by the staff and volunteers at GRP. Maprang reported rescuing numerous white-handed gibbons in distressing mental and physical conditions: “most of the gibbons that arrive at the GRP are in a poor to very poor condition. Especially the ones used in the tourist industry are in a very poor condition. In some cases they have a serious disease, like herpes or hepatitis or [malnutrition].” Tam, for example, is now a permanent resident at GRP due to her severe physical disabilities (Figure 2.2). Prior to arrival at GRP, she was beaten so brutally that her subsequent caretakers judged it necessary to



**Figure 2.2** Many rescued gibbons arrive in distressing physical conditions. Tam, for example, was physically abused and arrived with missing fingers and two amputated limbs.

amputate her right hand and left foot. She was then placed in a cage with other gibbons without proper introduction. The group was unsurprisingly aggressive toward the perceived intruder and bit off all but two fingers on Tam's remaining hand. She was eventually brought to GRP, where she receives extra daily care and gibbon companionship. Staff applies daily talcum powder between her two remaining fingers to keep them from becoming raw and cuts her food up into small pieces so that she can pick it up more easily.

Sadly, as we will see later, Tam's distressing story is hardly unique.

Trends in behavioral patterns, too, reveal themselves at the rehabilitation site. Three mothers rejected their infants that were born at the project, forcing the staff to nursery rear the infant gibbons rather than allowing the preferred mother rearing environment. Multiple news updates report gibbons that occasionally ignore food and lose weight; two of the gibbons actually developed enduring eating conditions that are not easily reversed. Numerous exhibit stereotyped behavior such as digit sucking, rocking and self-injury and many are reported to have experienced occasional hair loss known as alopecia. While many gibbons do form strong social bonds with other gibbons, some are incapable due to human attachment or the inability to sing. I later address numerous individual cases in more detail.

## *Implications*

While Thailand's illegal pet trade clearly has a dire effect on wild populations of white-handed gibbons, it also has significant consequences for captive individuals. Conditions in captivity are quite different than those in gibbons' natural existence and long evolutionary history in the high forest canopies with their family unit. Individuals are often kept in unsuitable living conditions, housed individually in small cages with no conspecific contact and no opportunity to find a mate. The early maternal separation, followed by a lack of social experience, disrupts young gibbons' normal development which is further hindered by abuse, unnatural diets, drugs and alcohol. Even in cases where the gibbon is well cared for, allowed to roam freely and engages in play behavior with dogs or humans, learned behavioral patterns are not adaptive to the rehabilitation and reintroduction process.

In order to understand why these unusual behavioral patterns developed and how they may be alleviated, I turn to hylobatids' close primate cousins and examine trends observed in both field and laboratory contexts. After that I return to some of the individuals at the Gibbon Rehabilitation Project, using previously explored knowledge to assess their behavior and rehabilitation prospects.

## **CHAPTER 3**

### **PRIMATE DEVELOPMENT AND SOCIALIZATION**

Here I review research that has established general behavioral patterns among various primate species. These widespread trends allow us to make cross-species comparisons that are indispensable to understanding gibbons' needs and improving rehabilitation procedures. Comprehensive studies have highlighted primates' impressive behavioral flexibility, cognitive abilities and social complexity. Much focus lies on primate development, stressing the importance of having a juvenile period with extensive social contact and plentiful experience with the surrounding environment. Some of the most substantial facets of infancy and adolescence include forming a bond with the mother, receiving sufficient physical contact, playing with peers, and exploring the natural world. Grooming, too, plays a significant role in primate socialization and welfare. In addition to studying the purposes of grooming, many researchers have highlighted physical contact's beneficial physiological and neurobiological effects that promote both good health and closer relationships.

#### ***Juvenile Periods, Learning and Behavioral Flexibility***

In comparison to other mammalian orders, primate life histories are characterized by longer gestation, later weaning, prolonged periods of dependency, slow growth rates, heavy investment in altricial offspring, and large absolute and relative brain sizes. While the mother-infant relationship is fundamentally important to immature primates, development does not end abruptly with weaning. The later stages during the extended juvenile period are especially important to primate development, for prolonged immaturity enhances the amount and complexity of learning possible while the large growing brain facilitates the learning that must

occur. Sherrow and MacKinnon (2011) stated that one of the most important results of primates' increased encephalization and enhanced learning abilities is greater behavioral flexibility. While behavioral flexibility has allowed some species to occupy a wide range of habitats through behavioral modification rather than morphological adaptation, it has also determined that primates are highly dependent on learned behaviors. Dependence on learned behaviors may help explain primates' extended juvenile period, which can account for up to 25-35% of an individual's lifespan. During the long growth period, individuals undergo experiences that shape behavioral patterns to effectively meet local habitat and social conditions. It is during this time the young learn many critical social, behavioral and sexual responses necessary for survival and reproductive success in the wild. This may include learning the species-specific repertoire, sexual behavior, mothering, fighting skills, the establishment of dominance relations, and working out aggression (Baldwin, 1986). Most of all, the juvenile period is crucial to developing social skills and establishing affiliative relationships with peers. The young primate is not merely a passive organism that receives nurture and socialization from its mother and conspecifics. Rather, it is active in seeking out stimulatory experiences that aid in the development of its own skills and social competence (Baldwin, 1986).

In fact, many immature primates use older group-mates as role models. Ottoni et al. (2005) found that in a group of semi-free-ranging capuchins (*Cebus apella*), the younger, less proficient individuals actually observed older, more skilled group members when they used stones to crack open nuts. Furthermore, they preferentially watched the more successful tool users, likely leading to greater payoffs and enhanced learning opportunities. Similarly, young juveniles commonly prefer to affiliate with older group-mates of their own sex, a behavior that is believed to facilitate the development of sex-typical behavior (Pereira 1988; Edwards 1993).



While learning from parents and older group members is one of the most important facets of primate adolescence, interactions with age mates and the surrounding world are equally imperative.

### ***Exploration and Play***

It is well documented that exploration and play are particularly time-consuming behaviors for young primates (Strier, 2007; Bartlett, 2009). In most primates, the infant begins exploration in the first days of life and progressively broadens its sphere until it is familiar with most aspects of its environment (Baldwin, 1986). The adaptive values of exploration and play behavior have thus been the subject of much discussion and dozens of possible functions of play have been proposed (Fagen, 1992; Soderquist and Serena, 2000; Palagi, 2006). A recent review by Burghardt (2005) lists the primary purposes of play: motor development, physiological development, perceptual-motor coordination, adult species-typical behavior, social-communicative skills, learning social roles, information gathering, neural development, enhancing cognitive abilities and creativity, and competence assessment.

Though play behavior includes solitary play and object play, social play remains the focus of many recent tests of adaptive hypotheses. Numerous social benefits to play have been suggested including enhancing social skills, strengthening social bonds, reducing aggression, refining social assessment, and learning cooperative behavior (Fagen, 1981; Lee, 1983; Bekoff, 2001a; Sussman et al., 2005; Bekoff and Pierce, 2009). As the young primate explores the world around it, other group members and interpersonal experiences teach valuable social skills. Play behavior facilitates close contact with conspecifics, helping the infant to learn the appropriate sending and interpreting of visual and auditory signals (Dolhinow, 1971; Fedigan, 1972).

Effective communication skills are heavily intertwined with all aspects of primate socialization and survival. Because stimulus-seeking play behaviors are typically “fun” or “pleasurable,” the infant's early social contacts are usually paired with rewarding experiences that help build positive social bonds (Baldwin, 1986). The subsequent development of cooperative relationships then increases the chances of survival and reproductive success.

Exploration and play also have a significant role in nonsocial learning related to the self and the surrounding environment. Spinka et al. (2001) proposed that mammalian play can be explained in terms of training for unexpected events by allowing an animal to develop flexible kinematic and emotional responses to events that involve stress and sudden loss of control. Specifically, play may function to increase the versatility of movements used to recover from sudden shocks. In the case of primates, this may include breaking or unstable tree branches that cause an individual to lose balance or fall from dangerously high heights. In addition to the development of locomotor versatility in unanticipated situations, Spinka et al. (2001) hypothesized that animals in play learn how to deal with the emotional aspect of being surprised or temporarily disoriented or disabled. This is particularly relevant when fleeing from a predator, for an emotional overreaction may lead to aimless panic and decrease an animal's chances of survival. Since playing involves unexpected, loosely organized elements, it enhances behavioral flexibility and partially frees the individual from tight stimulus-response patterns (Miller, 1973). Learning to improvise behavior during rapid bouts of chasing and grappling may help primates to cope with later situations in which their lives are at stake.

The predominant emphasis on play's adaptive functions has recently been strengthened by increased evaluation of the phylogenetic aspects of play and the healthy development of young primates' physiological mechanisms. While it has long been noted that physical exercise

is indispensable for muscle growth and an overall healthy, well-functioning body (Brownlee, 1954), more recent research has found that sensory input from both the environment and the play behavior itself also enhances neural development and stimulates the central nervous system. In fact, Byers and Walker (1995) suggested that playing during sensitive developmental periods might facilitate the development of appropriate skeletal muscle fiber types and enhance cerebellar synaptogenesis. Furthermore, these specific neurobiological mechanisms can be significantly modified by experience only soon after birth, and changes in this stage appear lifelong in effect. Fairbanks (2000) extended these findings to primates, showing that the peak times of solo, object and social play in vervet monkeys (*Cercopithecus aethiops*) coincide with periods of maximal responsiveness to experience in development of the neocortex. Since schedules for play behavior correlate closely with windows of opportunity in brain development, Fairbanks proposed that play behavior is designed specifically to promote adult competence in coordinated locomotion, food handling and fighting through early, permanent effects on the developing nervous system. An individual with a well-developed and maintained central nervous system will be able to respond to its environment more rapidly and effectively.

Play has long been identified as a potential indicator of the current welfare state of an animal and is commonly linked to the experience of positive emotions in animals (Barnard, 2004; Burgdorf and Panksepp, 2006). Because many animals actively seek out and work for opportunities to play, it has been proposed that it is an emotionally exciting, rewarding and pleasurable experience (Spinka et al., 2001). Neurobiological evidence supports this claim, for it has been found that the subcortical brain areas and opioid neurotransmitter systems that mediate reward properties overlap with those involved in social play (Panksepp, 1998; Vanderschuren, 2010). Thus, Pellis and Pellis (2009) proposed that play may be a way of self-administering

endogenous opioids as a means of self-medication. As we will see, endogenous opiate systems play a significant role in stress and mood regulation and even in immune system functioning.

Furthermore, play may not only result from good welfare but also cause it. Playing is a contagious activity; just seeing animals playing can stimulate play in others (Bekoff, 2001b). Since play behavior seems to be accompanied by a specific emotional state, it can also be viewed as a case of emotional contagion, which enables individuals to experience and understand the same emotions as their social partners (Held and Spinka, 2011). Evidence for emotional contagion in primates includes the presence of cortical mirror neurons in monkeys, which are activated both when an emotionally loaded behavior is being performed and when it is being perceived (Ferrari et al., 2009). It may be plausible, then, that similar scenarios take place during gibbon rehabilitation. This may be good indication that encouraging play behavior in individual gibbons could stimulate similar behavior in others, thus creating a domino effect of positive emotions, healthy brain development and the improvement of locomotive and emotional responses.

### ***Sociobiological Conceptualizations of Primate Development and Behavior***

The close relationship between grooming and social affiliation is widely accepted (Terry, 1970; Di Bitetti MS, 1997; Sussman et al., 2005; Lehmann et al., 2007). Several authors have interpreted grooming as bond forming, while others understand grooming as the expression of a social bond rather than its cause (Cords, 1995). In either case, it is an essential and prominent activity for most primate species. It may function to reduce tension, create long-term alliances, enable social integration, or may even be a form of reciprocal altruism (Chadwick-Jones, 1998). However, many researchers focus instead on the physiological effects of physical

contact and social bonds. Widespread epidemiological evidence reveals that the presence or absence of positive social experiences can have major effects on health and wellbeing (Ryff and Singer, 1998). In addition to establishing social relationships, grooming produces neurobiological mechanisms that improve both physical and psychological welfare.

Social grooming appears to be a relaxing and pleasurable activity for many primates, calming for both the recipient and the groomer. This is likely a result of the soft touches that accompany gentle sweeping movements, which have been shown to activate a class of slow unmyelinated tactile (CT)-afferent fibres that project to both the limbic system and the orbitofrontal cortex (Francis et al., 1999; Olausson et al., 2002). This route differs from conventional somatosensory routes in its unique production of a pleasurable sensation in the emotional somatic center. Other physiological effects include a reduction in heart rate and a lowering of behavioral indices of stress such as scratching (Goosen, 1981).

In addition, Keverne et al. (1989) have demonstrated an association between grooming and endorphin release in talapoin monkeys; similar findings have been reported for rhesus macaques (Graves et al., 2002). Endorphins and other endogenous opioids play a well understood role in alleviating both physical and emotional stress and have also been shown to reinforce social attachment (Dunbar, 2010). Psychologically, the effects are experienced as a mild opiate “high,” a corresponding feeling of wellbeing and light analgesia (Stefano et al., 2000). It appears that these mechanisms are especially important to young primates in their critical development period, for opioid processes within the brain are actually sensitized during this time (Zagon et al., 1982). In fact, Panskepp et al. (1980) proposed that young animals' early formation of social attachment may partially be the result of the opioid comfort derived from

somatosensory contacts. Furthermore, Depue and Morrone-Strupinsky (2005) argued for a crucial role for opioids in not only the initiation, but also the maintenance of social relationships.

Although the exact mechanisms are unknown, it is increasingly evident that evocation of powerful social emotions is capable of modifying physiological processes that modulate susceptibility to disease. Opioids have been shown to facilitate natural immunoresponsive cell activity (Mathews et al., 1983) and animals with higher endogenous opioid levels exhibit reliable resistance to neoplastic disease (Thompson et al., 1983). Furthermore, endogenous opioids may alleviate detrimental psychological states like distress and depression (Panskepp et al., 1985).

Similarly, the neurohormone oxytocin is suggested to play a role in the processes of mammalian social bonding. In females, oxytocin is also linked to maternal behavior and is correlated to greater levels of calmness, sociability and tolerance of monotony (Uvnas-Moberg, 1998). Oxytocin is also known both to increase rates of social contact and to stimulate grooming (Witt et al., 1992; Argiolas and Gessa, 1991). It is possible, then, that oxytocin functions to facilitate the social engagement needed to bring about the endorphin release which is critical to social bonding and a responsive immune system.

Rearing conditions have long-term effects on both social behavior and central oxytocin concentrations. In an experiment comparing mother reared rhesus macaques and nursery reared rhesus macaques, Winslow et al. (2003) found that the nursery reared monkeys had significantly decreased levels of cerebrospinal fluid oxytocin compared to mother reared monkeys. Oxytocin levels were also correlated with time spent engaged in affiliative social behavior. In a similar study, Shannon et al. (1998) found that nursery reared monkeys also have elevated levels of cortisol, a hormone released in response to stress that has been found to weaken the immune system and have persistent negative effects throughout life. These findings suggest that normal

maternal-infant interactions support neural development and physiological health, promote social relationships and positive emotions, and consequently give the youngster a selective advantage a natural living environment. In other words, the maternal bond may be the earliest factor in the presence or absence of primate welfare.

### ***Are Pet Gibbons Deprived of a Normal Juvenile Period?***

A normal juvenile period is characterized by learning, social bonds, skill improvement, and neurobiological development. Conversely, a deprived juvenile period would be devoid of these opportunities and may thus entail stunted cognitive, social and physiological development. It is quite clear that almost all pet gibbons are captured at a young age and thus robbed of the maternal bond. It is also certain that life in captivity removes an individual from its forest habitat and subjects it to extensive human interaction and little conspecific contact. These conditions, then, are a form of both social and environmental deprivation. Unclear, however, is the degree of deprivation among pet gibbon populations as a whole. As we have seen, some are reared alone while others are raised with one or more gibbon counterparts. Similarly, some are caged or chained while others are permitted to roam somewhat freely and play with humans or other animals. Successful rehabilitation likely depends on the form and severity of deprivation the gibbon experienced. The question still remains, then, what actually happens if these needs are not met? Do deprived primates undergo behavioral changes and, if so, can they alter them at a later age?

## **CHAPTER 4**

### **CONSEQUENCES OF A DEPRIVED REARING ENVIRONMENT**

The magnitude of early primate developmental periods is exemplified by consequences that arise in the absence of a normal rearing environment. Primates raised in aberrant settings, particularly those prematurely separated from their mother and raised with little to no conspecific contact, tend to develop severe behavioral abnormalities. Deviations may manifest themselves as observable behavior, social inadequacy or neurobiological deficiencies. Captive primates from laboratories, zoos and private homes also provide insight into the effects of deprived stimulatory experiences or exposure to stressful events. Stereotyped behaviors are common and have been consistently linked to social and environmental contexts during an early age.

The developmental consequences that arise in the absence of socialization and physical contact are well documented (Arling and Harlow, 1967; Harlow, 1969; Harlow, 1974; Anderson and Chamove, 1980). Pioneering research on the issue manifested itself as a series of well-known laboratory experiments in the late 1950's and early 1960's (Harlow, 1958; Harlow et al., 1966) which showed that the development of secure social attachment systems is as much a necessity for normal social development in most primate species as it is in humans. The studies were shrouded with controversy and sparked ethical discussion, debate and activism for decades to come (Roberts, 1967; Singer, 1975; Midgley, 1981; Stephens, 1986; Harraway, 1989; Gluck, 1997; Vicedo, 2009), but the outcomes clearly display the severe outcomes of a deprived or inadequate rearing environment.

The term *deprivation* is often used to describe varying levels of impoverishment, so it is important to define its application within my discussion of white-handed gibbons in the pet trade. According to Kraemer (1985), one aspect of deprivation entails rearing in a less complex



environment than the one in which the organism's genetic basis has evolved. For example, the organism does not receive sufficient social, physiological or cognitive stimulation. Another meaning is that the deprived environment is different, but maybe not less complex, than the environment in which a species would naturally thrive. This may include excessive stimulation from overcrowding but also entails nursery rearing environments, unnatural diet and interaction with interspecies counterparts. Either way, the developing organism adapts itself into the prevailing environment through processes that result in persistent modifications of behavior and brain structure. This may severely impair later encoding of complex stimuli in another environment.

While it is common for effects to endure throughout an individual's lifespan, there is evidence that detrimental behaviors can indeed be modified in subsequent years. In some cases, problems can be alleviated by providing the primate with appropriate companionship and housing. Environmental and feeding enrichment also play an important role in primate behavioral therapy.

### ***Maternal Separation and Social Deprivation***

Psychologist Harry Harlow took social deprivation to unparalleled extremes. In one of his earliest studies, Harlow (1958) separated infant rhesus macaques from their mothers just six to twelve hours after birth. He then placed each infant with two upright, heated surrogate mothers: one was constructed of wire mesh and the other covered with sponge rubber and soft terry cloth. In one experiment, Harlow placed four newborn monkeys with a cloth mother that lactated and a wire mother that did not. To test the relative importance of the variables of contact comfort and nursing comfort, he placed four more newborn monkeys with a wire lactating

mother and a bare cloth mother. Free to contact either mother, the infants in both environments showed an overwhelming responsiveness to the cloth mother. Even when placed with the lactating wire mother, the infants consistently preferred the nonlactating cloth mother over 165 consecutive days of testing. Harlow's data made it obvious that contact comfort is an overwhelmingly important variable in the development of affectional responses, whereas lactation is a variable of negligible importance. Harlow suggested that a primary function of nursing, in addition to the provision of milk, may be to ensure frequent and intimate body contact with the mother.

In a later study, Harlow and Seay et al. (1964) found that “motherless mother” rhesus macaques separated from their mothers at birth and denied any opportunity to interact with other monkeys for the first eighteen months of life were all completely inadequate mothers themselves. Two were violent and abusive towards their infants and two were indifferent and withdrawn. Harlow et al. (1973) repeated a similar study a decade later, with similar results. Furthermore, he found that a certain proportion of infants had extremely severe responses to separation. They did not eat or drink despite having the ability to do so without maternal aid, and would likely have died in the absence of intervention. Interestingly, some died even with intervention. This indicates that social attachment systems are related to core neurobiological functions in the primate brain. The infant monkeys were healthy in every other respect, but the disruption in some underlying brain mechanism resulted in survival failure. This may be related to the link between separation distress and inhibited cellular immune competence. With no physical contact or social bond, the infants may have experienced a drastic decrease in endogenous opioids that hindered their ability to thrive both emotionally and physically.

Hennessy et al. (2001) suggested that the despair stage of maternal separation—characterized by decreased activity, large periods of time curled up in a hunched posture and frequent self-directed activities such as self-clasping of digit sucking— may actually indicate a stress-induced physical illness related to the immunological consequences of separation. In addition to decreased opioid levels, Hennessy et al. believed there to be a connection between the sickness response elicited by separation from an attachment object and consequential increased levels of the stress-responsive neuropeptide cortisol.

This hypothesis is supported by evidence obtained by Feng et al. (2011), who revealed that maternal separation produces lasting changes in both cortisol and behavior in rhesus monkeys. Peer-reared monkeys had significantly lower basal hair cortisol levels than the mother-reared monkeys. Growing evidence also suggests that early adversity has significant long-term effects on the function of the hypothalamus pituitary adrenal (HPA) axis, a major system that mediates neuroendocrine responses to stress (Fries et al., 2008). Compared with nursery-reared monkeys, the peer reared monkeys also demonstrated a significantly decreased duration and frequency of locomotion and affiliative behavior and increased stereotypic behaviors. Even after three years of normal social life, abnormal behavioral patterns were identified in the peer-reared monkeys.

Winslow et al. (2003) also found significant differences between mother-reared and nursery-reared monkeys. Compared to mother-reared subjects, infant rhesus macaques that were removed from their mothers within 48 hours of birth, then housed individually for the first 45-60 days and bottle fed by nursery care staff, exhibited profound and persistent differences in social and emotional behavior. The nursery-reared monkeys showed reduced affiliative social behaviors, increased aggression, more time engaged in solitary behaviors, and high levels of

stereotypy. Furthermore, mother-reared but not nursery-reared infants appeared to benefit from the presence of a familiar companion during a stress-provoking challenge.

There is profound evidence that maternally separated primates undergo harmful changes in social skills, demeanor, psychological wellbeing, and physical health. These changes occurred even in nursery and peer reared primates, not just complete isolates. This evidence was collected in controlled laboratory environments, but within the gibbon pet trade variables are infinite and upbringing is usually unknown. What the gibbons do have in common is some amount of time in captivity.

### ***Unusual Behavior in Captive Conditions***

Since captive conditions frequently entail individual housing in small enclosures unlike any natural habitat, it is no surprise that many primates exhibit deviations from the species-specific repertoire. There has been extensive research on abnormal primate behaviors in captivity, some of which involved animals in controlled environments and some of which focused on rescued gibbons very similar to my own subjects (Lutz et al., 2003; Mallapur and Choudhury, 2003; Cheyne, 2006). Regardless of history, it is common for animals in captivity to develop stereotypic behaviors defined as repetitive, unchanging behaviors with no obvious goals or functions (Cheyne, 2006). They can be categorized as repetitive whole-body movement patterns such as pacing and rocking (Ridley and Baker, 1982) or as fine motor patterns, which include more precise and often self-directed movements like digit-sucking or teeth grinding (Berkson, 1968). Although stereotypies may or may not be harmful, their presence is of concern. They often serve to calm the individual (Wolff and Simmons, 1967) and may also reflect an underlying physiological, psychological or behavioral dysfunction. Of marked alarm is the

development of self-injurious behavior, which poses a greater immediate risk to an individual's health and welfare. This can be defined as a physical attack on or potentially damaging manipulation of one's own body, ranging from self-directed biting and scratching to headbanging (Anderston and Chamove, 1980).

Lutz et al. (2003), upon conducting behavioral assessments of 362 individually housed rhesus macaques at the New England Regional Primate Research Center, found that 321 (89%) exhibited at least one abnormal behavior and on average monkeys performed at least two different kinds of abnormal behavior. The most common stereotypy was pacing though self-grasping, rocking, bouncing, and hair pulling were also prevalent. Many of the macaques also engaged in self-injurious behavior in the form of self-biting and self-inflicted wounding. Analysis of behavioral data confirmed that early environmental experience is strongly associated with the incidence of abnormal behavior. Nursery rearing as opposed to mother rearing was a significant risk factor for digit-sucking. More serious self-directed stereotypies and self-injurious behaviors were closely associated with both the length of time spent and an early age of onset in individual cage housing. Blood sampling was also positively associated with stereotypies and self-injurious behaviors, suggesting that repeated exposure to stressful events may also lead to abnormal behavior.

Similarly, Mallapur and Choudhury (2003) recorded numerous behavioral abnormalities in eleven captive species of primates including langurs, macaques and gibbons across ten Indian zoos. Stereotypic pacing, self-grasping and self-biting were again the most common. Other undesirable behaviors included self-directed sexual activity and begging. Animals confiscated from touring zoos, circuses and animal traders exhibited higher levels of abnormal behaviors than did animals reared in larger, more recognized zoos. Again, this was

again suggested to be the result of a disruption in early rearing experience such as social and environmental deprivation. Furthermore, the study showed that macaques housed in groups were less likely to exhibit abnormal behavior than those housed individually. This supports previous findings that housing in species-specific group compositions tends to play an important role in the development of a naturalistic behavioral repertoire in captive primates.

Directly applicable to my discussion is Cheyne's (2006) study of unusual behaviors seen among wild-born, captive-raised agile and Müllers gibbons at the Kalaweit Gibbon Rehabilitation Project in Indonesia. Of the 75 gibbons observed, 25 demonstrated stereotypic behavior upon arrival at Kalaweit. This included rocking, twitching, repetitive swinging or brachiation, self-harm, and teeth scraping. Other abnormal behaviors, although not as prevalent as stereotypies, included human-directed masturbation and posterior presenting. After 5-8 weeks at the camp, however, many gibbons ceased the stereotypic behavior and most had reduced the amount of time they engaged in it. A few showed no improvement and only one gibbon increased the occurrence. Cheyne attributed the improvement to enclosure changes, environmental enrichment, larger spaces, companionship, some control over their environment, adequate diet, and the opportunity to forage and sing. Again, many of the observed stereotypies were likely the result of deficient enclosures and inadequate social stimulation.

Captivity also entails close proximity with and habituation to humans, which may then lead to dependence on humans. This remains a prominent obstacle for GRP despite efforts to minimize human contact and increase social interactions among gibbons during the rehabilitation process. Research by Tanaka and Uchikoshi (2009) may provide insight into issues of human attachment in captive primates. Tanaka and Uchikoshi raised a male agile gibbon immediately after birth, but he still had daily visual contact with four adult gibbons that were housed in

different cages in the same room. From one year of age, the gibbon was returned to his parents and siblings. Although permanently housed with gibbons from then on, the gibbon continued to have daily contact with humans for husbandry, behavioral observation and enrichment purposes. Between the ages of six and nine, the subject was assessed using a free-choice task in which five or six photographs of different primate species, including humans, were presented on a touch-sensitive screen. The gibbon chose human photographs significantly more frequently than other primate categories; this preference actually grew stronger with age. Previous studies showed that human-reared chimpanzees also show a bias for photographs of humans (Tanaka 2003, 2007). These results suggest that early and extensive postnatal social experience with humans affected the subjects' preference despite a later change in social environment.

Like other behaviors, human attachment appears to be a persistent pattern that originates in infancy or adolescence and endures through adulthood. Though behavioral flexibility is a hallmark of the Primate order, a vast amount of research suggests that cognitive, behavioral and neurobiological plasticity peaks during adolescence and declines with age. More significant to the question of gibbon rehabilitation prospects, however, is whether or not these consequences can be alleviated or even reversed.

### ***Can Abnormal Behaviors be Alleviated or Reversed?***

Though previous investigation has produced mixed results, the majority of research suggests that primates have an impressive ability to adapt in appropriate environments with specific social contexts and enrichment opportunities. For many animals, one of the greatest sources of stimulation is the presence of conspecifics. Social contact appears to be one of the

most powerful variables in primate welfare though environmental, auditory and feeding enrichment may also be beneficial.

Even in the most severe cases of deprivation, introduction to conspecifics had a positive impact. After inducing extreme depressive states in infant rhesus macaques, Harlow (1974) attempted to rehabilitate abnormal monkeys by the administration of other monkeys serving as “therapists.” Socially deprived and motherless mother infants initially showed violent, prolonged aggressive behavior and very low levels of play. However, many of these effects were removed by prolonged group therapy. After six months of daily interaction with younger peers—the therapist monkeys—the deficit in play behavior and the intragroup hyper-aggressiveness were no longer present. The isolate monkeys rapidly overcame any fear that they originally had of the therapist monkeys and began to accept and even reciprocate body contact instead of withdrawing and huddling. After six months of interaction, reciprocal play between isolates and therapists was not uncommon.

When Harlow (1969) raised a pair of 30-day-old rhesus macaques together in a living cage with no mother, the infants rapidly went into a pattern of tight ventral-ventral clinging like that of a normal neonate-mother contact pattern. The response was so strong, Harlow labeled these infants “together-together” monkeys. Compared to solo peer-reared monkeys, the together-together infants in an unfamiliar or stressful situation appeared to obtain some degree of security from the presence of the together-together associate. Unlike the infants raised in the absence of peers, together-together females were also sexually and maternally adequate. Similarly, Wiener et al. (1987) found that the profound stress response in maternally separated squirrel monkeys could be significantly reduced if the infant remained in a familiar environment with familiar companions.



In addition to social therapy, Francis et al. (2002) concluded that environmental enrichment may also help to reverse the effects of maternal separation on stress reactivity. Prolonged periods of maternal separation in early life increase the magnitude of neuroendocrine and fear responses to stress that often endure over the lifespan, thus increasing vulnerability for stress-related illness (Liu et al., 2000; Meaney, 2001). In addition to exaggerated plasma corticosterone responses to stress, maternally separated animals also exhibited decreased exploration. The results of Francis et al.'s research suggested that environmental enrichment actually reversed the effects of maternal separation on HPA function. It also increased exploratory behavior and decreased fearfulness.

Thus, positive events and contexts during later stages in development might have the ability to effectively compensate for the influence of previous adversity. While primates' amplified behavioral flexibility may play a role in the development of abnormal behaviors, it also provides a more promising opportunity for further, more adaptive modifications.

### ***Gibbon Enrichment Opportunities***

Many deprived primate species may later obtain social proficiency under particular circumstances, but what about hylobatids? Gibbons represent an ecologically, behaviorally, socially, and morphologically distinctive taxon and are thus worthy of independent examination. Fortunately, multiple researchers have evaluated various gibbon enrichment opportunities and provided evidence for their varying levels of effectiveness.

Mootnick and Nadler (1997) revealed that most of the captive, maternally separated gibbons they studied were capable of social bonding and reproduction. Sexual proficiency was not related to the age at separation from the mother, but was associated with age at social

isolation and later introduction. Gibbons fared best when introduced within nineteen months of age to a conspecific of less than three years of age and an absolute age difference of less than two years. Furthermore, gibbons that were isolated from conspecifics between six months and two years of age were strongly attached to humans, but this did not prevent sexual proficiency. A smaller proportion of those who lived with conspecifics during this developmental stage showed such attachment. Relatively benign aberrancies—such as thumb-sucking and inappropriate vocalizing, for example— were compatible with sexual proficiency whereas self-abusive behaviors were not.

Rather, inadequate sexual behavior was associated with fearfulness of conspecifics, which interfered with compatible social relationships. The fearful and aggressive animals were separated from their mothers at a somewhat earlier age on average and were introduced to conspecifics at a much later age, thus socially isolated for a longer period of time than the other animals. Sexual behavior also differed in relation to enclosure size both during rearing and in adulthood. Most of the gibbons that were reared in relatively large enclosures were sexually proficient, whereas nearly half of those reared in smaller cages were inadequate.

Mootnick and Nadler (1997) thus suggested that it is not necessary for gibbons to learn sexual and parental behavior by observing experienced adult conspecifics. Like in other primates, the presence of another young conspecific counteracted the adverse effects on sexual and social behavior. In the case of the gibbons, such conspecific companionship was most important prior to two years of age. The results suggest that early separation of gibbons from their mothers results in a spectrum of behavioral deficiencies, similar but not identical to those found in other nonhuman primates. The cross-species similarities in aberrant behaviors reflect a

common primate response to early maternal separation, a behavioral syndrome that is ameliorated or prevented altogether by relatively rapid housing with a conspecific peer.

Shepherdson et al. (1989), upon evaluation of the use of recorded song as a source of environmental enrichment for white-handed gibbons within zoos, suggested that playing recordings of conspecific duets or great calls could be used to stimulate activity and vocalization in captive gibbon groups. This provides the gibbons with a feature of their natural environment that was previously lacking; most then react strongly with natural behavior patterns. Fortunately, gibbons at the rehabilitation site are subjected daily to live auditory enrichment.

Wells and Irwin (2009) also evaluated the effectiveness of feeding enrichment for zoo-housed moloch gibbons. Feeding devices increased the amount of time that the gibbons spent working for their food and encouraged more species-typical patterns of foraging behavior. Gibbons with feeding enrichment devices showed significantly more instances of being outside and foraging. Although the study was relatively short term, the gibbons showed no sign of habituation to the feeding devices. As with other types of enrichment, however, the rotation of feeders or foods presented within may help to reduce rates of habituation, stimulate interest, and promote longer-term enrichment benefits.

Common environmental enrichment involves enclosure design that encourages the gibbon to brachiate and practice balance. The cage can also be provisioned with loose objects such as balls or other toys to encourage exploration (Cheyne et al., 2012). Herbert and Bard (2000) compiled a list of environmental enrichment that has been shown to result in positive behavioral changes in primates including uprooted trees, novel objects, food puzzles, swings, and manipulable objects.

The majority of these enrichment methods are utilized at the Gibbon Rehabilitation Project. Juvenile gibbons are typically housed in groups while adult gibbons are housed adjacent to one another until they express enough interest and tolerance to live in closer contact. Feeding enrichment toys and foraging devices—bamboo containers, for example— are built to provide more cognitive stimulation during feeding. Rope swings and bamboo substrates are altered frequently to enhance interest and encourage physical activity. While enrichment is for the most part effective, some gibbons are unable to improve.

## ***CHAPTER 5***

### **CASE STUDIES FROM THE GIBBON REHABILITATION PROJECT**

Now that I have established the important facets of primate socialization and development and the consequences that arise in the absence of proper rearing conditions, I turn to a variety of cases at the Gibbon Rehabilitation Project where evidence in the literature manifests itself in the reality of the illegal pet trade.

Like WFFT, GRP is undertaking the time consuming, expensive and difficult task of small ape rehabilitation which, across Southeast Asia, has been met with limited success. Though details are scarce, what we know about overall trends and general individual histories suggest that several of the white-handed gibbons at GRP were housed similarly to those that we see in the social media. Others' rearing environments may be more typical of Maprang's descriptions. In either case, many were likely separated from their mothers at an early age and then raised by humans in a socially deprived environment with little or no conspecific contact. It is not surprising, then, that gibbons reared in comparable environments to laboratory or nursery raised primates developed correspondent behaviors. Without a normal juvenile period, many individuals developed behavioral abnormalities consistent with those we have seen in the literature on other primate species.

Because we lack a detailed history of each gibbon's life, it is difficult to determine the causality of the behaviors, reasons for onset or even the potential for alleviation. However, based researched patterns of primate socialization and development, we can infer possible causes of each gibbon's behavior and thus possible solutions. By painting a portrait of some of the individuals and family groups at GRP, I provide exemplary cases that clearly display the illegal pet trade's effects on white-handed gibbons' behavioral health and rehabilitation prospects. The

white-handed gibbons to follow are not merely research subjects presented in scientific journals, but individuals with names, faces, unique personalities, and true life stories.

Not all cases are the same, however. Observable abnormalities exist along a broad continuum and rehabilitation prospects vary greatly. I begin by describing those gibbons with psychopathologies and behavioral abnormalities so severe that it is unlikely they will ever be released into the wild. Then I turn to individuals and family groups with moderate to mild effects and assess the likelihood of future release. Finally, I examine reintroduced gibbon behavior, compare it to natural behavior and analyze whether or not rehabilitation was truly successful.

### *Sam*



Sam (Figure 5.1), a 24-year-old male born wild in 1987, arrived at GRP in 2004 when he was 17 years old. After being captured at only six months of age, he was kept as a pet in Bangkok for six and a half years without ever seeing another gibbon. As an infant he lived freely inside his owner's house, but as in most cases, he became

more aggressive as he grew older. He was consequently locked inside a small cage that was tied to a chair on the balcony. From the age of three, Sam never left that cage except for two escapes. Sadly, Sam's story is not unusual. Pet gibbons may or may not be well treated until they approach maturity. With large canines and exceptional strength, the gibbon becomes increasingly threatening to both the owner and their families. A single bite or aggressive episode often results in tooth filing, heavier sedation or social isolation.

During Sam's second escape, his owner's neighbors came home to find him in the kitchen holding a knife. Both fearful and sympathetic, the neighbor urged Sam's owner to give him a better home. Shortly thereafter his owner traveled from Bangkok by bus and train to voluntarily give Sam to GRP.

After arrival, it became clear that Sam was unable to sing. He was housed individually in an enclosure adjoining two maturing female gibbons, but showed no interest in them nor they in him. Staff then moved Sam to a new, larger cage with plentiful enrichment and conspecific contact in the hopes that it would lift his spirits and encourage more singing. Unfortunately this was unsuccessful; Sam never began to sing and remained socially inept amongst other gibbons.

Since he could not partake in normal gibbon behaviors such as attracting a mate or defending his territory, the staff at GRP determined he could not be released but did their best to ensure he had a happy, healthy life. Though Sam never learned to duet, he was energetic and curious; he often quietly “whooped” while watching humans and gibbons outside his cage.

During March 2010, Sam began displaying signs of alopecia and lost large patches of fur on his arm. On May 24, 2010, volunteers at the rehabilitation site noticed that Sam wasn't his usual self. Sitting motionless in the corner, he had not eaten his lunch from the previous day nor was he showing interest in his breakfast. He was quickly moved to the clinic but continued spiraling into lethargy, his mouth held open as if it were difficult for him to breathe. Sadly, Sam died of pneumonia on the evening of June 27<sup>th</sup>. Pneumonia becomes a significant problem for GRP every year during the wet season.



### *Sumlee*



Sumlee (Figure 5.2), a 27-year-old male born wild in 1984, arrived at GRP in 2002 after being kept as a pet for nearly his entire life. His owner bought him from a poacher in Ranong when he was less than a year old. Sumlee then lived with the man in Bangkok for 18 years until the owner became terminally ill and arranged for him to be collected by GRP. Upon arrival at the owner's house, the Forestry Department and GRP staff found that the owner had already deceased. Sumlee was sitting near the body, lethargic and very weak.

Like Sam, Sumlee exhibits severe social ineptitude. Though he is housed adjacent to younger, gregarious counterparts, he rarely interacts with them and appears incapable of forming a bond. Contrary to typical captive primate behavioral patterns, Sumlee shows no signs of human attachment and shies away from people as well as gibbons. Since he is reaching old age and has never bonded with another gibbon, it is quite unlikely he will be released.

### *Endoo*



Endoo (Figure 5.3), meaning ‘sympathy’ or ‘pity’ in Thai, was born wild in 1998. She was severely mistreated as a pet— both physically and psychologically abused— until her owner’s neighbors managed to acquire her and bring her to GRP when she was just a year old. Upon arrival, Endoo exhibited a disturbing self-harming condition and appeared

incapable of coping with stress or change. Almost every day, she bit and scratched her arms until they bled. She also had occasional bouts of appetite loss.

Fortunately, Endoo has benefited from socialization and environmental enrichment. She has made excellent progress since her arrival; she appears less agitated, her coat is healthier and her appetite has increased likely as the result of daily enrichment puzzles where food is hidden in leaves or coconut shells. Endoo also seems to be forming a bond with Brittany, one of the new infant arrivals. In fact, when Brittany escaped during a routine weight check, she ran straight to Endoo’s enclosure where Endoo held her protectively until staff caught up with her.

Though it is a slow process, Endoo’s behavioral health continues to improve. Her self-injurious behavior, though it has not ceased completely, has decreased. However, her eating patterns remain abnormal and she still has difficulty eating without enrichment activities. Unfortunately Endoo’s mentally prohibitive condition has also prevented her from forming a pair bond, a pattern consistent with Mootnick and Nadler’s (1996) findings that sexual proficiency is incompatible with self-abusive behaviors. Without a mate, Endoo is not a current candidate for release.

### *Rumthai*



Rumthai (Figure 5.4), a female born wild in 2001, arrived at GRP only a year later as one of the most distressing cases the staff had ever seen. As an infant, she was locked inside of a tiny bird cage with virtually no room to move. When she was finally rescued, her spine and arms had grown deformed,

her stature small, and her muscles weak and deteriorated. In addition to her physical disabilities, Rumthai initially displayed numerous symptoms of depression. In August 2009, reports revealed that Rumthai was not showing much of an appetite and often left food behind after feeding. Despite efforts to give her a special diet that included her preferred fruits, rambutan and mango, her appetite did not appear to improve. She was also quite inactive, spending an overwhelming amount of time resting on bamboo substrates instead of interacting with other gibbons.

Rumthai has since improved greatly. Though she still prefers to pick things up with her feet, she can now use her arms for minimal brachiation and swings gently through her enclosure. Over time, her appetite also improved and she began singing more frequently. She has recently formed a bond with Jep; they often groom each other through the enclosure wires. Again, Rumthai typically uses her feet rather than her fingers.

Rumthai is given extra daily vitamins to enhance her physical development and her psychological health appears to be faring reasonably well. Her skeletal deformities are too advanced to be reversed, however, and she still cannot brachiate well. Since a gibbon cannot thrive in the wild without swift movement through the high forest canopies, it is unlikely she will ever be released.

## *Joy*



Joy (Figure 5.5), a female born wild in 1987, was kept as a pet for over a decade in severely distressing conditions. When Joy reached maturity, she became too aggressive for her owner to handle and remained locked in a small cage for long periods of time. For many years, the cage was rarely cleaned and Joy was given little food. Finally, in 2002, neighbors

contacted WARF and Joy arrived at GRP at fifteen years of age. Likely due to undergoing periodic starvation, she had developed a harmful eating condition and becomes very agitated at feeding times. The stress typically leads to repetitive self-directed stereotypies that include self-clasping and teeth grinding. Despite attempts to alter her diet and provide feeding enrichment activities, Joy has not been able to fully overcome this problem. Like Sam, Joy has also undergone occasional fur loss.

In late 2011, however, Joy appeared to benefit from a new, larger enclosure in a quiet corner of the quarantine site. Staff reported a reduction in her stereotypic behaviors, but her eating condition persists. Without natural foraging behavior, Joy is likely to remain dependent on humans within the rehabilitation site.

## *Jep*



Jep (Figure 5.6), a male born wild in 2000, appeared in somebody's kitchen dressed in baby clothes when he was just a year old. It is possible that he was abandoned in this manner due to the owner's fear of legal repercussions. Upon arrival to GRP, he demonstrated distressing behavior at feeding

times very similar to that of Joy. After an adjusted feeding regime and increased social grooming time with Rumthai, he appears to be improving but his abnormal eating habits have not ceased completely.

Though he has now reached maturity, he remains very small for his age as a result of severe malnourishment when he was young. He also seems to be more susceptible to infection and illness than many of the other gibbons. He began to lose fur on his back in August 2010 and, less than a year later, acquired an infection accompanied by severe coughing. In both cases, however, he made a rapid and full recovery.

If Jep's behavioral health continues to improve, he may be a candidate for pairing and release. Like Joy, however, it is essential that he display an adequate ability to forage normally.



## *Bo*



Bo (Figure 5.7), a 24-year-old male born wild in 1987, arrived at GRP in terrible health. He was small, emaciated and had his teeth filed down in order to prevent biting. After many years in rehabilitation, Bo formed a bond with an adult female, Lek, with whom he had two offspring: Dao and

Arun. On August 15, 2003, the family was released into the Khao Phra Theaw forest.

Unfortunately, it rapidly became apparent that Bo was unable to thrive in the wild. He frequently approached observers during post-release data collection and sometimes made physical contact with them. Furthermore, he returned to the rehabilitation site on six separate occasions, leaving his family in the forest for the comfort of familiarity. After several attempts to reintroduce him back to his family in the wild, the staff at GRP decided that he would remain at the rehabilitation site for the foreseeable future. Bo's current enclosure adjoins Tam's, and whilst they cannot share an enclosure due to her physical disabilities, it is clear that they have developed a close bond. The two often sit in close contact and groom one another through the wires; when Tam gets her daily talcum powder to prevent her two remaining fingers from becoming raw, Bo comes as close as possible to investigate.

### *Nuan, Max, Maesa, and Emily*



Nuan, a female born wild in 1986, was kept as a pet in Phang Nga for many years until she bit her owner's daughter. Her owner quickly decided Nuan was too dangerous to keep and brought her to GRP in 1996 when she was ten years old. Nuan was originally paired with Khao and had an infant

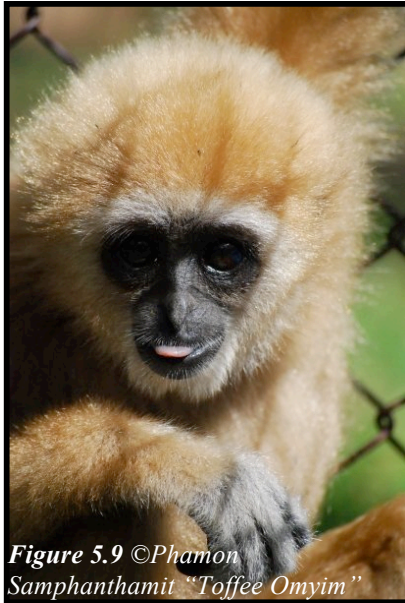
named Payu in 2001. Three years later, she gave birth to a female named Namthip. The family was released successfully in 2007, but unfortunately Khao disappeared in the autumn of 2008. Though the family appeared to be thriving without an adult male, staff found Nuan three months later sitting on the ground and nursing a broken arm. They suspected she had gotten in a fight with Dao, a neighboring female who had recently paired with Payu and likely took Nuan's place in the group. Since she was alone and injured, the staff made the decision to bring her back to the rehabilitation site and attempt a new pairing.

Nuan quickly formed a pair bond with Max and gave birth to Maesa (Figure 5.8) on April 12, 2010. A few days after birth, however, it became apparent that not all was well. Contrary to normal gibbon behavior, Nuan frequently abandoned Maesa by hanging her on the fencing or leaving her lying at the bottom of the cage. Maesa continually cried for attention, but Nuan remained unresponsive. After observing the family for one month, staff decided to remove Maesa from her mother to be nursery reared by the staff and volunteers at GRP.

Since Nuan had successfully reproduced before, she and Max were later given another chance to have an infant that could be raised in the forest. On March 11, 2011, she gave birth to Emily. Once again, Nuan did not display adequate maternal behavior and often left Emily lying on the bottom of the enclosure like she did with Maesa. Emily had to be separated from her parents after only three weeks; she had multiple bruises and the tip of one finger was damaged. Despite her previous reproductive success, Nuan will not be allowed to have another infant at GRP. However, she was still moved to the acclimatization enclosure nearer to the forest in hopes that her behavior will improve.



### *Jane*



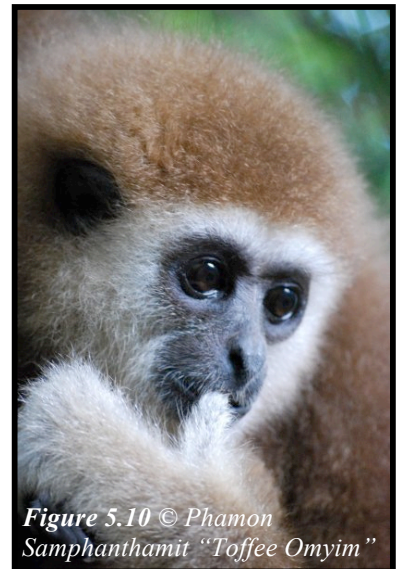
*Figure 5.9 ©Phamon Samphanthamit "Toffee Omyim"*

When Jane (Figure 5.9) was an infant, a resident of Phuket bought her from a beach photographer as a gift for his wife. After only two months, the couple realized they did not have sufficient time to look after Jane and brought her to GRP in February 2008 when she was just a year old. Initially, Jane was very distressed when left alone; she cried loudly, clasped her arms around herself and rocked back and forth. However, her behavior improved significantly and her stereotypies ceased after introduction to playmates. They now share an enclosure

and all appear to be doing very well.

### *O*

O (Figure 5.10), a young male, was kept in a small cage with Mee, a similar-aged female, outside of a Bangkok restaurant until they were confiscated by the Forestry Department when they were both just a year old. They then lived at the Wild Animal Rescue Foundation in Bangkok until they were brought to GRP in 2002 at two years of age. O suffered malnutrition as an infant gibbon and did not develop properly physically or mentally. Like Jane, he occasionally held himself, sucked his thumb and rocked back and forth. However, he is exceptionally social and spends a significant amount of time grooming with an adjacent juvenile named Bobo.



*Figure 5.10 ©Phamon Samphanthamit "Toffee Omyim"*

### *Phi Phi and Crystal*



Phi Phi, a female born wild in December 2008, arrived at GRP in May 2009 at six months of age. She was bought from a photographer on Phi Phi Island as a gift, but her owner quickly decided it would be best to bring her to the project. Phi Phi is a very independent young gibbon and had no problems being separated from human contact. She is currently housed with Crystal, a young female who arrived in July 2009 at roughly nine months of age. As in Phi Phi's case, Crystal was bought off a photographer on

Patong Beach and kept as a pet until the owner's girlfriend brought her to GRP for a better life.

Phi Phi often sucks her index finger and Crystal sucks her thumb. Though both are energetic and agile, they cling to each other ventrally for a significant amount of time (Figure 5.11). In July 2011, however, Phi Phi began losing fur and looked slightly underweight. Staff kept a close eye on her and observed that Crystal was taking most of the food. Phi Phi had a good appetite but was a slow eater. Now they are separated at feeding times and Phi Phi is given extra food and vitamins. Since they are holding one another almost all of the time, volunteers have a great deal of difficulty enticing them into separate enclosures. The two are still quite young but both have social demeanors that may prove advantageous to eventual pair bonding.

### *Jojo and Mee*



Jojo was originally a pet until his owner voluntarily gave him to GRP in 2000 when he was only a year old. He formed an immediate bond with Mee, a two-year-old female who had been kept in a cage outside a Bangkok restaurant, when they became cage mates as juveniles

(Figure 5.12). They have maintained a stable bond ever since, spending a large amount of time grooming and duetting. They are now both sexually matured so the GRP staff has high hopes that they will produce offspring soon. If this is the case, they may be promising candidates for future release.

## *Songkran*



A beach photographer in Patong kept Songkran with another young male, Khunsaul since they were infants. The two gibbons were confiscated by police and brought to GRP in April 2004; Khunsaul was two years old and Songkran was only six months old. Songkran was far too young to be taken from his mother; he was malnourished, weak and needed extra daily care

from GRP staff and volunteers. Today, although small for his age, he is energetic and sociable.

Songkran was initially housed with Bambam, but Bambam was excessively dominant and often stole his food and enrichment toys. He was then moved adjacent to Bobbie and Sylvia, two young females whom he quickly showed interest in. After long time periods of grooming through the wire, staff opened the door separating the enclosures for short periods during the day. The three gibbons got along very well and Songkran was quick to play with or groom the others. Soon they were all housed together aside from feeding times. As Songkran matured, he began showing sexual interest in Sylvia but she did not reciprocate sexual behavior. Bobbie, who had arrived at GRP as a six month old baby in 2006 interacted with Songkran more than Sylvia, often wrestling and grooming with him. The two are now sexually mature and behaving more like a mated pair (Figure 5.13). Though he continues to suck his thumb, forming a pair bond will be a promising step in Songkran's rehabilitation.

### *Thongkum and Lumduan*



Figure 5.14 ©Phamon Samphanthamit "Toffee Omyim"

Thongkum, a male, and Lumduan, a female (Figure 5.14), were both born wild in 2007, poached as infants and sold into the pet trade at a very young age. Prior to rescue, they were both kept chained to a tree to attract tourists into a restaurant. After numerous complaints to the Forestry

Department by tourists and locals, the authorities confiscated them. They arrived to GRP together in May 2010 when they were three years old. They have remained close and spend a lot of time playing together within their enclosure. As is the case with Mee and Jojo, it is possible that they will form a pair bond once they reach sexual maturity.



### *Jorn, Cop and Sherpa*



Jorn, a male born wild in 2004, arrived at GRP in 2006 when he was two years old. He had been released by his owner at the Bang Pae Waterfall, then captured by GRP staff and taken to quarantine to check his disease status. After a clean blood test, he was brought back to the rehabilitation site and introduced to Cop,

a female born wild in 2002. She had been confiscated from a photographer on Patong Beach, but routine blood tests upon arrival tested positive for Hepatitis A. Cop was placed in an enclosure with some other young gibbons that also had the disease until all of them were clear.

Cop and Jorn have since maintained a strong pair bond and gave birth to Sherpa on October 3, 2010. Cop and Jorn appear to be adequate parents and provide Sherpa with sufficient care. Sherpa has developed healthily and began climbing at a young age though he continued to remain within Cop's reach (Figure 5.15). He has not yet been weaned but has begun supplementing his nursing with solid fruits that he takes from his mother's hands. Jorn is responsive to Sherpa's frequent play behavior but is also very protective. He occasionally becomes aggressive when staff and volunteers approach the enclosure.

Jorn, Cop and Sherpa have been selected for reintroduction and are now housed in a training cage to habituate them to life in the forest and encourage a natural behavioral repertoire. Once a group is selected, it typically takes at least one year for release. The acclimatization cage is situated deep within Khao Phra Theaw in an area not yet inhabited by the other reintroduced

gibbon groups. If all goes accordingly, the group is to be released sometime during 2012. They will be the ninth released group and hopefully the sixth to thrive and remain wild. Reintroduced gibbon groups vary widely in success so only time will tell if Jorn, Cop and Sherpa spend the remainder of their lives in the forest.

## **CHAPTER 6**

### **REINTRODUCED GIBBON GROUPS**

In total, eight gibbon groups— 32 individuals either released from GRP or born in the wild— have been reintroduced into Khao Phra Theaw since the first release in 2002. However, three families were unsuccessful as a result of disappearance, physical ailments, death, and poaching. In all cases, most of the remaining individual group members were either accepted by neighboring groups or returned to rehabilitation and later released successfully. Though a total of eight infants have been born in the wild, two disappeared and one died at birth. Today, there are currently five gibbon groups— a total of 20 individuals— living in Khao Phra Theaw. Three families are fully independent and have successfully reproduced in the wild. The two most recently released groups still receive post-release support and have reproduced only in captivity.

All groups were reintroduced using the soft release method, which involves three different stages: quarantine, rehabilitation and reintroduction. In a final report from GRP, Suwit Punnadee (2006) described each phase of the soft release process. When gibbons first arrive, they undergo a full medical examination and all necessary disease tests. New gibbons stay in quarantine for at least three months, where a health and behavioral check is performed daily. If they are healthy and acting more naturally, they are transferred to the rehabilitation site where a series of environments encourages natural behavior and maximum conspecific contact. If a thriving family group forms, they may be selected for release and transferred to the training cage further into the forest. After adjusting to their new environment, a proper release site is selected and they are transferred to the acclimatization cage high up in the canopy. The cage door is opened after at least ten days of monitoring and the gibbons are allowed to move freely. Post-release support, such as supplemental feeding, is provided. Feeding stations are gradually moved



further away and deeper into the forest to encourage natural territory expansion. Eventually, the amount of food and human contact is decreased as the family becomes more capable of foraging for food on their own and exhibits characteristics analogous to wild gibbon populations.

Most of the following information is derived from the Gibbon Rehabilitation Project's online news and forest work reviews, both of which were last updated in September 2011. Activity budget data, further behavioral descriptions, and site information were retrieved from Punnadee and Damiana (2004) as well as Punnadee's final report (2006). I occasionally note personal observations.

After addressing the unsuccessful reintroductions, I turn to the white-handed gibbon groups currently living in Khao Phra Theaw. Finally, I compare behavioral data from reintroduced gibbons in Khao Phra Theaw to that of wild white-handed gibbons in similar environments.

### ***The Reintroduction Site: The Khao Phra Theaw Non-Hunting Area***

The Khao Phra Theaw Non-hunting Area— supervised and maintained by the National Park, Wildlife and Plant Conservation Department— occupies 2,228 hectares of semi-evergreen primary rainforest. Its elevation ranges from 240 to 340 meters above sea level and the terrain is rugged and hilly. The mean annual temperature in the forest is 28°C for the hottest months and 22.8°C for the coolest months (Boulbet and Nophadol, n.d.). Precipitation is seasonal, but the yearly rainfall average ranges from 2,350 to 2,700 mm.

Though wild white-handed gibbons occupied the area in the past, they disappeared from the forest about 20 years ago. Khao Phra Theaw is able to support more than 60 gibbon groups,

allowing GRP to carry on its work for years to come. More importantly, it allows enough area for the reintroduced gibbons to breed and create a wild population.

### ***Unsuccessfully Released Groups***

It is important to acknowledge unsuccessful reintroductions and note the reasons for their failures. Because the majority of the following gibbons are addressed in detail within the later section on successfully released gibbons, I offer a brief summary of trends that contribute to reintroduction failure (Table 6.1).

Group Name	Individuals	Generation	Sex	Age	Age at Release	Release Date	Fate
Yoge	Bird Pompam	A	M	---	16	Dec 10, 2004	Disappeared on Feb 21, 2005 Disappeared on Nov 30, 2005; remains found in poacher camp on March 17, 2006 Rejected by Lek group and brought back to rehabilitation site Survived in reintroduction site and accepted by Lek group
		A	F	---	15		
	Sabai	B	F	13	5		
	Yoge	B	M	9	2		
Nat	Bozo Kushta	A	M	---	17	Mar 10, 2006	Disappeared on Mar 12, 2006 Returned to rehabilitation site; later reintroduced Returned to rehabilitation site; later reintroduced
		A	F	22	16		
	Nat	B	F	8	2		
Nuan	Khao Nuan	A	M	---	Unknown	Jul 7, 2007	Disappeared Nov 5, 2008 Injured and returned to rehabilitation site Paired with Dao and formed new group Accepted by Payu group
		A	F	26	21		
	Payu	B	M	11	6		
	Namthip	B	F	5	1		

**Table 6.1** *Gibbon groups unsuccessfully released into Khao Phra Theaw. A=Rescued gibbons; B=Offspring of rescued gibbons born at GRP*

Of the 32 individuals released or born in Khao Phra Theaw, 12 (37.5%) failed to thrive. The most common reason for reintroduction failure is the disappearance of a prominent group member. A total of six gibbons—two infants and four adults—disappeared within two years of

release<sup>6</sup>. These gibbons may or may not be deceased, but have not been sighted for extended periods of time. In each case of the adults, the father went missing and many of the remaining group members were thus returned to the rehabilitation site. Though two of the individuals remain in rehabilitation, the majority were later reintroduced again. However, remaining group members occasionally thrived despite the loss of a parent. One subadult male, Payu, formed a pair bond with a neighboring female and Namthip, his younger female sibling, remained a group member. Another juvenile named Yoge also integrated into a neighboring group.

In some cases, death contributed to reintroduction failure. Pompam, an adult female, went missing for nearly three months within the first year of her release. Her remains were discovered in a poaching camp shortly thereafter. Unrelated to poaching, one infant born prematurely died shortly after birth. Though five wild born infants have been successfully reared in Khao Phra Theaw, three disappeared or deceased (Table 6.2).

Infant Name	Sex	Birthdate	Age at Release	Group	Release Date	Fate
Redy	M	Sep 25, 2008	*	Lek	*	Disappeared Sep 19, 2010
(Unnamed)	(Unknown)	Nov 20, 2007	*	Lek	*	Disappeared Nov 2007
(Unnamed)	F	Jul 6, 2001	*	Kushta	*	Born premature; died at birth

**Table 6.2** Infant gibbons unsuccessfully reared in Khao Phra Theaw. All were born in the wild (Indicated by \*).

### ***Successfully Released Groups***

In the past ten years, five groups have been successfully released into Khao Phra Theaw (Table 6.3). The first three—the Kip, Lek and Payu groups— thrive independently, have reproduced in the wild, and receive no supplemental feeding. The more recently released groups— the Jita and Kushta groups— have reproduced within the rehabilitation site but not in

<sup>6</sup> An adult female named Jita also disappeared recently. She is discussed in the section on successfully released groups because her family unit still remains wild in Khao Phra Theaw.

the forest. They are now in the process of minimizing human contact and decreasing supplemental feeding.

Group Name	Individuals	Generation	Sex	Age	Age at Release	Release Date
Kip	Joe	A	M	27	17	Oct. 5, 2002
	Kip	A	F	23	13	
	Thong	B	M	13	3	
	Hope	B	F	10	*	
	Toffee	B	F	6	*	
	Omyim	B	M	2	*	
Lek	Lek	A	F	20	11	Aug. 15, 2003
	Bank	A	M	11	5	
	Yoge	B	M	9	2	
	Peanut	B	M	1	*	
Payu	Payu	B	M	11	6	Sep. 26, 2007
	Dao	B	F	11	3	
	Namthip	B	F	5	1	
	Newbe	C	F	2	*	
Jita	Jita	A	F			Dec. 4, 2009
	Tony	A	M			
	Claire	B	F	3	1	
Kushta	Kushta	A	F	22	16	Apr. 27, 2011
	Arun	B	M	10	1	
	Nat	B	M	8	2	
	Muki	A	M	8	7	
	Pee Mai	B	F	2	2	

**Table 6.3.** Gibbons currently living in the Khao Phra Theaw Non-hunting Area<sup>7</sup>. Blanks indicate unknown and asterisks (\*) indicate individuals born in the wild. A=Gibbons rescued from the pet trade; B=Offspring of rescued gibbons;

Eight individuals were initially captive in the pet trade and later rescued by GRP. Nine are offspring born to the rescued gibbons at the rehabilitation site and four are offspring born to the rescued gibbons in the wild. Only one infant thus far was born to the offspring of rescued gibbons. Sex is equally distributed with eleven males and eleven females, though male adolescents and subadults far outnumber females. Age ranges include: four infants, two juveniles, three adolescents, three subadults, and ten adults. For a definition of each growth stage, see Brockelman et al. (1998).

<sup>7</sup> It is unknown whether Jita still resides in Khao Phra Theaw. Pee Mai is temporarily at the rehabilitation site due to injury, but will likely be released quite soon.

Though each current group appears to be thriving, they vary in history, group dynamics, social interactions, and overall behavior. It is important to note that the gibbon groups do not necessarily represent blood-related family units consisting of a mated pair and its offspring. In fact, only the Kip and Jita groups represent this relationship. I will discuss further details about family relationships upon describing each group individually (See Appendix B for a genealogy).

### *Kip Group*

The Kip family was the first group to be released into the Khao Phra Theaw forest and has thrived successfully for nearly a decade. Kip and Joe were both kept as pets since infancy then donated to GRP at the ages of five and nine years. After over a decade in rehabilitation, they were released with their offspring Thong in 2002. Kip gave birth to the first wild-born gibbon, Hope, less than one month after the release. Since then, she has successfully reared two more offspring.

The siblings were reported to play with one another frequently. As the eldest siblings, Thong and Hope, matured they were observed spending an increased amount of time away from the family unit. Thong often leaves his family group and spends a lot of time near the Bang Pae Waterfall. He occasionally returns to his home territory but leaves again when his father Joe returns. In August 2010, Yoge, a maturing male from a neighboring group, was observed in the Kip territory. This continued for the following year; Hope and Yoge in particular spent a significant amount of time together. GRP staff believes they have formed a pair and hopes they may have an infant of their own in the near future.

### *Lek Group*

Lek was released with her mate Bo and two offspring, Dao and Arun, in August 2003.

Bo, the gibbon we met in chapter five, regularly approached observers and frequently abandoned the family unit to return to the rehabilitation site. Since he did not appear to be adapting well to the wild, he now remains in an enclosure within the site. Lek, however, continued to thrive with her offspring. After some time, two neighboring juveniles named Yoge and Sabai joined the group. They had belonged to a subsequent release that failed when the adult male disappeared and the adult female was killed. Yoge successfully integrated into the Lek group but Sabai traveled alone to a far region of the forest so staff brought her back to the rehabilitation site.

On February 7<sup>th</sup>, 2006, GRP released two juvenile males into the Lek group that had been living at a resort in Khao Lak. Khan Ngean became ill soon afterward so he was returned to the clinic, but Bank appeared to be doing well. He gradually took Bo's place in the group and formed a breeding pair with Lek, who gave birth to an infant in November 2007. Unfortunately the infant disappeared only a few days later. On September 25, 2008, Lek gave birth to Redy, the fourth gibbon born wild in Khao Phra Theaw since GRP began releasing gibbons. Redy thrived for two years but, like the previous infant, he disappeared and has not been seen since September 2010. Fortunately, Lek's other offspring Arun survived to adulthood and formed a pair bond with Kushta after her release. He successfully integrated into the group and moved to their territory.

Despite two consecutive non-surviving offspring, Lek gave birth to an infant male named Peanut in June 2011. Peanut is the eighth infant born wild in Khao Phra Theaw. Bank, Lek, Yoge, and Peanut continue to thrive independently with no supplemental feeding and have remained healthy since the birth.

### *Payu Group*

Payu was released with his family—Khao, Nuan and Namthip— in 2007 when he was six years old. Khao disappeared shortly thereafter, but the family continued living in Khao Phra Theaw without an adult male. Dao was released with her family— Bo, Lek and Arun— in 2003 when she was three years old. The two formed a pair bond in 2008 after Dao attacked Nuan and took her place in the group. They appeared to be doing well together so supplemental feeding ceased in June 2009. Both had recently reached sexual maturity and, during a routine check-in, staff discovered that Dao had given birth to an infant male named Newbe on December 20, 2009. After the birth, Payu’s younger female sibling Namthip remained part of the group.

Payu and Dao thus represent the first breeding pair to form a bond and successfully reproduce within Khao Phra Theaw rather than within the rehabilitation site<sup>8</sup>. They are also the first reintroduced pair to consist of both second-generation gibbons that were born in the rehabilitation site<sup>9</sup>. Furthermore, Newbe is the very first infant born in the wild to second-generation offspring. In other words, she is the sole third-generation gibbon currently residing in the forest.

Early observations confirmed that the group was thriving and reported them foraging, traveling, grooming, playing, and singing with one another frequently. Updates in April 2010 were the first of many to reveal difficulties locating and observing the group. After having not seen the family for over a month, staff discovered them again happy and healthy in their territory. The group consistently remains in more protected, very high regions of the forest

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<sup>8</sup> Bank and Lek may be defined as the first breeding pair to form a bond within Khao Phra Theaw rather than within the rehab site. However, they did not successfully reproduce until Peanut’s birth in 2011.

<sup>9</sup> I define first-generation gibbons as those rescued directly from the pet trade; second-generation as those born to the rescued gibbons within the rehabilitation site; and third-generation as those born to second-generation gibbons.

canopy and rarely displays interest in humans. They are difficult to spot but are often heard singing.

### *Jita Group*

Jita, Tony and their female infant Claire were moved into the acclimatization cage on November 29<sup>th</sup>, 2009. However, the group escaped long before GRP's planned release date. Less than a week after transfer, Tony bit through the mesh and the entire family escaped. Concerned that they were not fully prepared for release, staff enticed Jita and Claire back into the cage using food. Tony remained free but continually resided in the trees near his family. On December 10<sup>th</sup>, 2009, the entire family was released to form a territory of their own.

Post-release observation has proven difficult because Tony aggressively defends his territory and protects his family. After several violent attacks on observers and multiple incidents of injury, GRP staff decided that it is too dangerous to spend a full day around the family. Though the group is observed less frequently than others, staff continued to provide supplemental feeding and have spent abbreviated periods of time observing behavior. Between March and April 2010 the group left food in their basket daily, signifying increased self-reliance and the ability to successfully forage independently. Post-release support was gradually decreased but the group still receives 0.5 kg of fruit every two days.

Like many others, Jita disappeared in March 2011 and there has been no record of her since. Tony and Claire are still living together in the area. Hope and Yoge often travel into their territory and the four gibbons appear to be tolerating one another. If Tony and Claire continue to thrive without Jita they will remain wild.



### *Kushta Group*

Kushta, a female born wild in 1990 but soon thereafter captured and used for photographs in a restaurant, arrived at GRP when she was six years old. She paired with Bozo in 1997 and gave birth to a male infant named Nat in 2004. The family was initially released in March 2006, but shortly thereafter Bozo went missing so Kushta and Nat were returned to the rehabilitation site.

Kushta quickly paired with Mai and gave birth to Pee Mai on January 1, 2009. Unfortunately, Mai began losing his eyesight the following May and is thus not an adequate candidate for release. Kushta and Pee Mai remained at the rehabilitation site in an enclosure adjoining Nat and another juvenile named Muki, a male who arrived at GRP in 2006 when he was two years old. Muki was being used as a photographic prop on Koh Samui until a tourist bought him for \$1,000 USD in order to bring him to the project. While this person's intentions were good, paying so much money only reinforces the illegal trade.

Nat grew to be large, healthy and social. He and Muki became close playmates throughout adolescence. The four adjacent gibbons showed interest in each other, often grooming and playing through the corridor between the two enclosures. Staff gradually opened the door for short periods of time and cautiously observed the individuals' behavior. Kushta readily accepted the unrelated juvenile and Muki frequently groomed and played with Pee Mai. Over time, Muki successfully integrated into the family group.

In January 2011 the four gibbons were moved from the rehabilitation site up to a training cage in the Khao Phra Thaew forest. Though Kushta was without a mate, GRP staff hoped she would form a pair bond with one of the many sexually mature males already living in the forest. Arun, a young adult male residing in the forest with his parents and an unrelated male juvenile,

had been observed spending a significant amount of time near the training cage. Thus, Kushta and Pee Mai were released in April and it was not long before Arun and Kushta copulated. Nat and Muki were then released in May.

Two-year-old Pee Mai disappeared on July 16, 2011. Staff had no observational record of her for two months until she suddenly appeared again on September 16<sup>th</sup> at the rehabilitation site. Unfortunately, Mee and Jojo attacked the infant while she was hanging on their cage. Pee Mai had severe injuries on her arm so she was brought to the clinic and given emergency care. GRP staff hopes that she will recover quickly and be able to join her family in the forest again soon.

Staff initially supplemented the group with five kilograms of food everyday but decreased rations to three kilograms over time. However, the group continues to spend excessive time on the ground and near the forest floor. I also witnessed both Muki and Nat sucking their thumbs as they suspended from low branches. Residing in the lower canopy is very unusual for wild gibbons but seems to be a prevalent behavior among recently reintroduced gibbons. Although all of the current groups appear to be thriving, abnormal behaviors are not absent.

### ***Activity Budgets and Habitat Utilization***

How do the reintroduced white-handed gibbons at Khao Phra Theaw compare with wild white-handed gibbons? While there is no doubt that reintroduced gibbons can survive and reproduce in the wild, there remains the possibility of persisting behavioral abnormalities or deviations from the species-specific repertoire.

After a ten month long study of the rehabilitated gibbons released into Khao Phra Theaw, Punnadee and Damiana (2004) evaluated the subjects' general behavior and activity budgets. Though data for wild gibbons is not lacking, the main source of comparison is derived from a

long-term study conducted by Bartlett (2009) in Khao Yai National Park, Thailand. I focus on this study rather than others because the sampling methods and overall habitat are more similar and less likely to influence variation between studies.

	Khao Phra Theaw	Khao Yai
% Feed	38	33
% Rest	28	26
% Travel	22	24
% Vocalization	3	4
% Social	6	11

**Table 6.4** Average yearly activity budgets of reintroduced white-handed gibbons at Khao Phra Theaw (Punnadee and Damiana, 2004) and wild white-handed gibbons at Khao Yai (Bartlett, 2009).

Overall, the gibbons at Khao Phra Theaw have a comparable average activity budget to those at Khao Yai (Table 6.4). The Khao Phra Theaw gibbons engaged in slightly higher rates of feeding and resting whereas the Khao Yai gibbons engaged in higher rates of travel, vocalization and social activity.

However, the two groups have vastly different home range sizes. In ten months, the gibbons at Khao Phra Theaw entered an area of 8.5 hectares. The gibbons at Khao Yai have a significantly larger home range of 24.9 hectares. In addition, recently released gibbons at Khao Phra Theaw regularly utilize lower forest canopy levels than do the Khao Yai gibbons. Within the first year of after release, the Kip group fed on GRP food primarily in the lower canopy, occasionally in the middle canopy and never in the upper canopy. They also approached the ground at times to retrieve dropped fruits (Table 6.5).

Canopy height (m)	% Feeding Time
0	3.5
0-5	2.5
5-10	19
10-15	48
15-25	27
>25	0

**Table 6.5** Canopy heights utilized by the Kip group while feeding on GRP supplemental fruits during the first year after release.

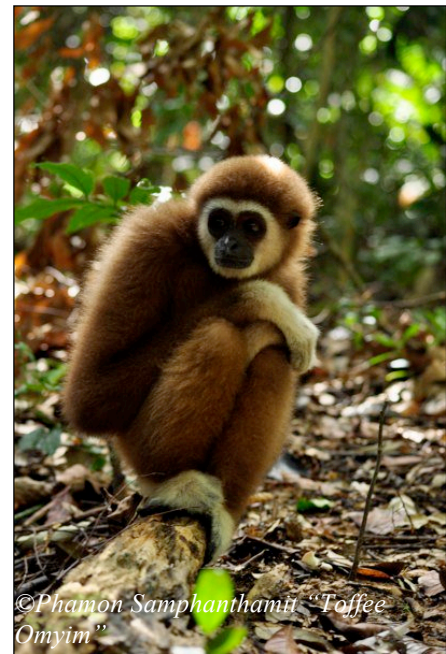
Canopy height (m)	% Feeding Time
0	0.4
0-5	10
5-20	70
20-25	9
25-35	2

**Table 6.6** Canopy heights utilized by the Kip group while feeding on wild resources during the first year after release.

The Kip group fed on wild resources primarily between 5 and 20 m, although they occasionally fed in the lower canopy and rarely in the upper canopies. They almost never approached the ground to feed on wild resources (Table 6.6). Wild hylobatids forage primarily in the middle and high forest canopies, occasionally in the lower and emergent canopies, and virtually never on the ground (Gittins, 1983; Brockelman and Srikosamatara, 1984). Uhde and Sommer (2002) found gibbons at Khao Yai to forage primarily between 20 and 30 meters above ground, although 10-20 m and 30-40 m were also common. They rarely foraged below 10 meters.

During my time in Khao Phra Theaw, I regularly witnessed gibbons in the lower canopy and on the ground even while not foraging. Kip, with Omyim clutching to her chest, approached me and the other observers within one hour of behavioral data collection. She sat within five meters of us on a low substrate, watching for approximately five minutes before moving on. While doing trail maintenance a few days later, Muki approached and watched our group in a similar manner (Figure 6.1). Unlike Kip, however, he descended completely to the forest floor. Shortly thereafter, Kushta and Pee Mai also momentarily came to the ground.

As previously noted, however, not all reintroduced groups occupy lower canopy levels or approach humans—the Payu group, for example. Each group, then, may



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**Figure 6.1** Reintroduced gibbons occupy lower canopy levels and descend to the forest floor more often than wild gibbons. Here, Muki observes his human observers from a grounded log.

represent the variability in behavior as it relates to time since reintroduction as well as differences in group formation and structure. Though the difference in habitat preference is but one aspect of overall behavior, it may have severe implications for the gibbons' safety and could be related to the high rates of disappearance.

## ***CHAPTER 7***

### **DISCUSSION**

Many white-handed gibbons in the illegal pet trade are deprived in a multitude of interconnected manners, most of which are rooted in social deprivation. All deficiencies directly relate to overall welfare which encompasses the gibbon's subjective emotional experiences, physical health, and ability to thrive in a way natural for the species. The first type of deprivation, then, is emotional. This relates largely to the lack of the rich and complex social lives that characterize many primate species. In addition to the absence of the maternal bond and peer relationships, abusive conditions— physical violence or poor housing conditions— have an equally harmful effect on a gibbon's emotional wellbeing. The second type of deprivation is physical. The absence of physical activity or playing opportunities may hinder skeletal musculature growth and CNS development, while social isolation has been shown to decrease cellular immune incompetency. Physical violence, the administration of drugs and alcohol, and unnatural diets of unhealthy human foods are also forms of physical deprivation. Finally, many gibbons undergo cognitive and psychological deprivation. Gibbons in the pet trade lack many of the learning opportunities necessary for survival in a natural habitat. Many have no adult role models and no social experience. Since gibbons are almost always captured as infants, they have no independent experience in the rainforest habitat and likely have never foraged completely on their own. There is also the issue of either a lack of or too much stimulation— isolation versus busy night crowds, for example.

The literature on primate socialization, development and behavior is directly applicable to Thailand's illegal trade of white-handed gibbons. Research within the past five decades consistently and clearly revealed the importance of the maternal bond, social experience and

sufficient learning opportunities during the extended primate juvenile period. Equally evident are the pernicious consequences of deprived rearing environments. White-handed gibbons in the pet trade undergo comparable experiences to other captive primates and, unsurprisingly, develop analogous behaviors. It is possible, then, that causality and intervention methods are linked.

It is quite clear that deprived rearing environments cause a variety of adverse effects on white-handed gibbons' behavioral health. The question then becomes, how severe are the abnormalities and can they be overcome? Can pet gibbons sufficiently modify their behavior during rehabilitation and be successfully reintroduced into a natural habitat? I now address each type of aberrancy in more detail, propose possible causes, and assess the potential for alleviation. I then turn to the released gibbon groups and address whether or not reintroduction was truly successful.

### ***Behavioral Effects Seen at the Rehabilitation Site***

Many of the behavioral patterns revealed within individual case studies overlap with one another and correspond with previous findings. The white-handed gibbons at GRP exhibit numerous behavioral abnormalities: stereotypies, self-injury, social inadequacy, eating conditions, inadequate mothering, and human attachment. There is also evidence that these aberrancies are linked to declining physical health. Similar to the range in severity, the ranges of behavior have differing implications for rehabilitation prospects. Relatively benign stereotypies do not prevent social bonding or even reintroduction and also have a good potential for alleviation. More severe stereotypies such as self-injurious behavior, however, inhibit future release and have marked social consequences. Social inadequacy and eating conditions, if they cannot be alleviated, are completely incompatible with reintroduction.

Furthermore, there appear to be trends related to age upon arrival and degree of conspecific contact throughout infancy. Contrary to my expectations, most gibbons are rescued at an early age and thus have sufficient opportunities for socialization and learning during their critical developmental period. Consistent with the hypothesis, however, is evidence that older gibbons that did undergo most of their lives as pets exhibit more severe aberrancies and a decreased ability to alter maladaptive behaviors.

### *Stereotypic Behavior and Self-Injury*

The behavioral patterns of white-handed gibbons rescued from the pet trade appear to be consistent with Novak (2003) and Cheyne's (2006) findings that nursery-reared primates, particularly those between six months and two years of age, are more susceptible to stereotypies. The range of stereotypies among the gibbons at GRP exists along a continuum of relatively nonthreatening aberrancies to dangerous self-abusive behaviors. Digit sucking is the most prevalent, though self-clasping and rocking are also common.

These behaviors appear frequently in infants and juveniles. Jane, O, Phi Phi, and Crystal—all victims of the pet trade—arrived at GRP prior to two years of age whilst Maesa and Emily were born at the project but abandoned by their mother and nursery-reared by staff. However, stereotypies may be more closely related to rearing experience rather than age. Joy, the eldest female at GRP, retained stereotypic behavior into old age. Multiple individuals—Songkran, Muki and Nat, for example—continued digit sucking into subadulthood and adulthood. Fortunately their behavior does not appear to pose an immediate threat to overall welfare. Digit sucking is not likely to interfere with the formation of social relationships or the ability to thrive after reintroduction.



Fortunately, primate stereotypies tend to decrease with rapid introduction to conspecifics, housing in a large and stimulating enclosure, and frequently changed environmental enrichment. Jane and O benefited significantly from social introduction while Joy benefited slightly from an enclosure change. Patterns of self-injury, on the other hand, are less easily alleviated and represent a concerning threat to a primate's psychological and physical welfare.

Like other primates that develop self-injurious behavior, it is likely that Endoo's increased vulnerability to self-inflicted wounding is associated with early and chronic exposure to a large number of stressful events. Since self-injurious behaviors have been shown to be closely associated with both the length of time spent and an early age of onset in individual cage housing, it is possible that Endoo was separated from her mother earlier than most. In nonhuman primates, three general approaches have been pursued in an attempt to develop effective treatments for self-injurious behavior: altering the physical environment, altering the social environment, or administering drug therapy (Novak, 2003). Contrary to Novak's (2003) findings that environmental enrichment did not reduce the rate of self-directed biting in rhesus macaques, it seems that Endoo has benefited from this approach. Feeding enrichment devices and social companionship may have played a role in her reduced self-injury and increased appetite. Unlike Novak's rhesus macaques that were individually housed for a mean of  $4.6 \pm 0.18$  years, Endoo was housed individually for less than one year. Though her exceptionally young age at maternal separation may have predisposed her to the self-injurious behavior and maladaptive stress coping mechanisms, it may have also played a role in its semi-successful alleviation. As I will soon address in more detail, many gibbons benefit greatly from rescue and social introduction at such a young age.

## *Social Competence*

Issues of social inadequacy were less prevalent than anticipated. The majority of gibbons were capable of forming strong social bonds despite undergoing long periods of time with no conspecific contact. Those gibbons expressing social incompetency were housed alone for significantly longer periods of time and were much older upon rescue. While the behavioral effect does not appear often, cases in which it does arise are quite harmful to the individual's wellbeing. Not only are reintroduction prospects bleak, but the inability to enter into social relationships also appears to have a negative effect on biological functioning.

Sumlee, for example, had difficulties overcoming social inexperience. He lived nearly two decades with his human owner and, though he was relatively well cared for, probably had little to no contact with other gibbons. His social ineptitude is consistent with previous findings that tameness appears to influence gibbons' ability to enter into social relationships with conspecifics (Eudey, 1992). While his behavior toward other gibbons is not surprising, his avoidance of humans is somewhat unexpected. Numerous pet gibbons arriving at GRP exhibit some degree of human attachment, but Sumlee rarely seeks comfort from human staff and volunteers. Perhaps this is the result of an inability to adapt to overall environmental change. There is also the question of the extent or lack of contact Sumlee had with humans other than his primary owner.

Sam, the older gibbon that could not sing, exemplifies the consequences of even more severe social isolation than Sumlee underwent. In fact, his experience encompassed all three types of deprivation: emotional, physical and cognitive. Sam's lack of gibbon parents or role models may be a partial reason for his inability to learn the critical social, behavioral and sexual responses necessary for survival. While most other gibbons undergo similar experiences, Sam

was unique in remaining completely isolated throughout all of adolescence. Though he was allowed to roam and play during his infancy, his exploratory opportunities were ceased entirely as a juvenile and adolescent. In a cage by himself, Sam was unable to move and received no physical contact even from his human counterparts. With no stimulation, play, physical activity or grooming, Sam may have experienced a severe decrease in endogenous opioids and a marked increase in cortisol. Because these effects tend to last throughout a lifetime and are not easily reversed, Sam likely arrived and resided at GRP in the same physiological state. In addition to his overall social inexperience, endogenous opioids' role in the initiation of social relationships may provide a clue regarding Sam's inability to bond with another gibbon.

It is likely that Sam's lack of social bonds at the rehabilitation site further perpetuated the physiological state he initially arrived in. This may have led to a weakened immune system and increased susceptibility to pneumonia. His hair loss, though it is typically a multi-etiological phenomenon involving a combination of many factors, was consistent with and likely related to his deteriorating psychological and physical states. Steinmetz et al. (2006) found levels of faecal cortisol metabolites to be significantly correlated with alopecia, suggesting a relationship between HPA axis activity and hair loss. In addition to stress, alopecia in nonhuman primates has been linked to bacterial and parasitic infections (Novak and Meyer, 2009). Sam was denied nearly every facet of normal primate development and socialization. By the time he was rescued, Sam's juvenile period was over and his neurobiological and behavioral plasticity had decreased. Though he may have been cared for to some extent during infancy, the effects of abuse and deprivation during adolescence were so strong that he was never able to recover socially nor physically. I thus believe that it was a combination of neurobiological and social deficiencies that interacted with one another in a self-perpetuating loop that ultimately led to death.

Sadly, it is not uncommon for gibbons to die shortly after arrival. Numerous gibbons appear to be vulnerable to infection, particularly during the wet season when pneumonia rates increase. Most of them make a full recovery but others like Sam do not survive. The high rates of illness and death may be connected to the link between psychological welfare and cellular immune incompetence. High rates of alopecia—seen in Sam, Joy, Jep and Phi Phi— may also be a result of this relationship. Though the gibbons are no longer pets kept in abusive conditions, neurobiological effects during early development are long lasting. As we have seen, physical and psychological welfare are not synonymous but they are closely interconnected.

Another possibility involves environmental and social contexts that may increase susceptibility to illness. Gibbons normally live in groups no larger than five to six individuals. Exposure to an increased number of conspecifics at the rehabilitation site may increase the risk for disease transmission, for many types of respiratory infections are contagious (Musher, 2003). Likewise, there is a risk of zoonotic disease transmission from human staff and volunteers to gibbons (Wallis and Lee, 1999). Unhealthy diets during infancy and adolescence may also have an effect on the gibbon immune system. Furthermore, it is possible that unnatural dietary patterns have an effect on feeding behavior itself.

### *Feeding Behavior*

The prevalence and severity of eating conditions was unexpected prior to research. Oftentimes the behavior involved intermittent appetite loss but also included persistent distress during feeding times. Endoo and Rumthai exhibited shorter-term appetite loss but benefited from enrichment and social companionship, respectively. Joy and Jep, on the other hand, exhibit enduring eating conditions that have not been successfully eradicated. This may be a result of

early starvation or inadequate, inconsistent diets during infancy and adolescence. Joy's behavior did not positively respond to enrichment, dietary adjustment, or alteration of feeding regime. Jep, however, improved modestly with social companionship and an altered feeding routine.

Normal foraging behavior is a fundamental necessity for survival and the ability to sustain oneself is absolutely essential to leading an independent life in a natural habitat. Eating conditions thus represent an equally powerful impediment to gibbon reintroduction as social inadequacy.

### *Inadequate Mothering*

Nuan's inadequate mothering— characterized primarily by passivity and indifference— is strikingly similar to that of Harry Harlow's “motherless mother” rhesus macaques (1964). Even when the infants were lying on the cage floor, disengaged and screaming, the mothers tended to ignore or withdraw from the infants. Like Maesa and Emily, the infant macaques rarely made ventral contact and had little opportunity to nurse. Without intervention, it is likely they would not have survived. Furthermore, Harlow observed that the infants exhibited persistent oral responsiveness to other monkeys. He believed this behavior to be a compensatory mechanism in response to the restriction of mother mouthing. Interestingly, both Maesa and Emily display frequent digit sucking. In fact, I very rarely witnessed Maesa, who was approximately 1 year and 3 months old when I resided at GRP, without her thumb in her mouth.

What caused Nuan to reject two consecutive infants? The “motherless mother” theory does not hold up to the fact that she successfully reared two offspring in previous years. An alternative explanation is a decrease in oxytocin that led to insufficient maternal behavior, but this hypothesis necessitates a cause for the biochemical change. Is it possible that her increased

age effected parental care? Nuan was 24 years old when she gave birth to Maesa and 25 years old when Emily was born, making her the oldest gibbon at GRP to have given birth. However, we lack evidence that gibbons undergo menopause or hormonal changes in the same manner as humans. Though two others at GRP have behaved similarly, their situations provide no further explanations. Understanding Nuan's behavior will require further inquiry.

### ***How Many Gibbons in the Pet Trade Undergo Deprived Conditions?***

It is quite clear what happens when primates are reared in a deprived environment, and white-handed gibbons are no exception. Fortunately, many gibbons do not undergo conditions as deprived as Sam, Joy, Rumthai, and Endoo's. Some are actually housed with other gibbons during their time as pets and arrive at GRP with the familiar counterpart. Unfortunately this speaks to the magnitude of the illegal trade and represents a mass of wild gibbons that likely died during the capture of multiple infants. However, peer relationships have been shown to somewhat mediate the consequences of maternal separation. Pet gibbons reared with a conspecific appear to benefit from one another's companionship, increasing prospects for future reintroduction. Songkran, for example, was kept as a pet with Khunsaul during infancy. Despite his extremely young age at capture and rescue, Songkran developed normal social relationships and eventually formed a pair bond with Bobbie. Thongkum and Lumduan were also kept as pets together. Now four years old, they remain playmates within a shared enclosure and are both doing very well. In fact, no gibbons that were reared with conspecifics are described as having any type of abnormal behavior aside from digit sucking.

Furthermore, nearly half of the gibbons currently at GRP arrived when they were two years old or less. Though the rehabilitation site is still not the ideal rearing environment, gibbons

rescued at such a young age will have a much less deprived developmental period than those that remain in the pet trade until adulthood. Equally important to conservation efforts is that age also plays a role in a gibbon's ability to later modify any abnormal behaviors.

### ***Can the Behavior be Modified?***

Can gibbons make the necessary social, behavioral and physiological changes that will allow them to lead an independent life in their natural habitat? Like the behaviors themselves, the ability to modify them exists along a highly variable continuum. A gibbon's rehabilitation prospects may depend on the severity of abuse and the extent to which their juvenile period deviated from the norm. Important components include whether or not an individual was raised with a conspecific and had opportunities to engage in play behavior. Perhaps the most fundamental factor, then, is the age at which an individual was rescued.

Though it is concerning that half of the gibbons arrived at GRP prior to the natural weaning age, young individuals may actually be in an advantageous position for future reintroduction. Behavioral plasticity is heightened during infancy and adolescence, increasing the probability that young gibbons can modify any behaviors that developed during their short time in the pet trade. Older adult gibbons, on the other hand, were immersed in an unnatural environment for a much longer period of time and introduced to conspecifics at a much later age. It is no surprise, then, that success rates during the rehabilitation process appear to decrease with age.

Gibbons that exhibit irreversible behavioral abnormalities— Sam, Sumlee and Joy, for example— were captive for a very large portion of their lives. In each case, they could not overcome the problematic behaviors whether it be the inability to sing, social ineptitude or an

inability to forage adequately. Younger gibbons with behavioral abnormalities— Endoo, Rumthai, Jep, Jane, and O— displayed more improvement than did their older counterparts. Joy and Jep in particular provide an interesting comparison due to the similarities of their eating behaviors. Similar methods were utilized to alleviate the behavior, with much different results. While it cannot be proven that Jep's improvement was directly or solely related to his young age, I believe it to play a large role. It is also important to note that, while the behaviors were similar, they were not necessarily caused by the same set of circumstances. Variation in causality may also affect responses to intervention methods. Socialization is essential to successful rehabilitation, but it is difficult to provide a safe and proper social context for matured gibbons that tend to be aggressive towards others and intolerant of cage mates. Adult gibbons are thus usually housed individually, though they have contact with others through the wire of their enclosures. Young gibbons, on the other hand, are less aggressive and can be housed together with multiple age mates. Infants and adolescents may benefit from earlier introduction to conspecifics for a number of reasons. As previously mentioned, behavioral and neurobiological plasticity at this time is highly exaggerated. Rather than missing out on its critical developmental period, the gibbon has sufficient opportunity to alter learned behaviors, acquire the species-specific repertoire, and hone socialization skills. Second, the presence of peers represents increased opportunities for social grooming, physical activity and play behavior. Cagemates may act as “therapist monkeys” that alleviate depression and encourage affiliative relationships. For example, Phi Phi and Crystal's tight ventral clinging is strikingly similar to that of Harlow's “together-together” monkeys. Despite the concerning nature of this behavior, the close physical contact with a familiar companion likely decreases stress levels and improves emotional, psychological and biological welfare. It may also play a role in why Phi Phi, who arrived when



she was only six months of age, is actually a very independent young gibbon and had no problems separating from human contact.

Furthermore, infants that were born at the rehabilitation site have the advantage of being reared by a natural family unit. Sherpa, for example, is mother reared and has minimal contact with GRP staff. Though Maesa and Emily were nursery reared, they have plentiful daily contact



**Figure 7.1** Emily and Arya, another infant born at the rehabilitation site, interact with one another daily on their exercise run, a form of environmental enrichment that promotes healthy physical development. © Phamon Samphanthamit “Toffee Omyim”

with other gibbons and sufficient opportunities to play (Figure 7.1). If it is true for white-handed gibbons that just seeing another individual play can stimulate the activity in others, this is very good news for other gibbons in the quarantine site. Though previous research focused on therapist monkeys that were in close physical contact with the subject monkeys, it is possible that their mere presence may be beneficial.

Though it is advantageous for the individual gibbons, the large number of infants and juveniles at GRP represent a substantial financial drain on the project. A gibbon cannot be released without a mate or group unit, so many of the gibbons will remain at the rehabilitation site for many years before consideration for release. Though multiple young gibbons can share one enclosure, the rising populations being rescued will require even more enclosures, resources, food, volunteers, and time.

### ***Behavioral Patterns After Reintroduction***

Despite numerous obstacles, the Gibbon Rehabilitation Project has successfully released five separate families into Khao Phra Theaw. This alone is striking evidence that pet gibbons can indeed make sufficient behavioral modifications that allow them to thrive independently in the species' natural habitat. Like the gibbons still in rehabilitation, however, the released groups have had varying levels of success.

Prior to further discussion, what defines success? The determinants of animal welfare—subjective emotional experiences, physical health and biological functioning, and the extent to which the animal is able to live in ways that are natural for its species—are equally important in the wild as they are in captivity and rehabilitation. There is also the evolutionary view that survival of a species depends on reproductive success, and that this success in turn depends on the fitness of individual members. The fundamental physiological mechanisms of the individual organism are therefore those that augment individual survivability for the purpose of species survivability. Many zoologists agree upon the four most central survival aspects of motivated animal behavior: feeding, fighting, fleeing, and sexual behavior. Furthermore, these different kinds of behavior must be cohesively interrelated. If a gibbon can successfully perform each critical behavior, it is likely to thrive in the wild.

The majority of gibbons released into Khao Phra Theaw adequately perform these fundamental behaviors and may therefore be described as successful. Most groups also exhibit analogous behavioral patterns to their wild counterparts. First, the activity budget of reintroduced gibbons is similar to that of the gibbons at Khao Yai. Though the reintroduced gibbons fed more frequently and engaged in slightly less social behavior than the wild gibbons, the differences are minimal. The reintroduced gibbons also have complex, flexible social behavior like that of

known wild groups. Bank is a very rare case in which he was released with no family unit but successfully formed a pair bond with a neighboring female. The Payu group consists of a mated pair, their offspring, and a younger adolescent sibling. Kushta, despite the loss of two consecutive mates, paired a third time and adopted an unrelated male juvenile. Though these family units have variable types of group membership, the Kip and Jita groups represent normal monogamous social structure.

The Kip group represents a promising situation that demonstrates that newly wild ex-captive gibbons are capable of forming stable, monogamous relationships. They are also capable of normal sexual behavior and successful reproduction. Kip's average interbirth interval is 3.6 years, well within the normal range. However, Thong and Hope have both reached sexual maturity but remain without a mate. There are a disproportionate number of male subadults in Khao Phra Theaw and there are no subadult females or Thong to pair with. Hopefully this issue will be addressed upon gradually reintroducing more family groups into Khao Phra Theaw.

The Payu group also represents promising patterns in gibbon reintroduction. Payu and Dao were both born at the rehabilitation site to rescued gibbons, then released separate from one another with their respective family groups. The breeding pair formed in the wild and gave birth to the first third-generation infant. Thus, no individual in the Payu group underwent any time in the pet trade. Less habituation to humans may explain their occupation of higher canopy levels and limited interaction with human observers. I suspect that the behavioral repertoire will return closer to normalcy with each passing generation, but this warrants further study.

Newly reintroduced groups, however, display substantial differences in habitat utilization. The gibbons at Khao Phra Theaw have a significantly smaller home range than do the gibbons at Khao Yai. The study group had been released for less than a year, however, and may

not have been familiar with the surrounding environment and resources. Khao Yai National Park also occupies a significantly larger area (2168 sq. km) that could increase areas of territory. In addition, reintroduced gibbons occupy lower canopy levels, occasionally come to the ground, and regularly engage in human watching. This represents a threat to immediate safety because gibbons do not reduce predation risk by living in large groups, which is typical for many other diurnal primate species. Rather, gibbons prevent predation by avoiding the ground and selecting for great heights whenever possible (Uhde and Sommer, 2002). While discussions of predation typically allude to species of large cats, snakes and birds, it also applies to hunting by humans.

Unexpected prior to research is the severity of human habituation and the dire consequences that result from it. Though standard procedure during rehabilitation strictly minimizes human contact, attachment and habituation remain significant obstacles for reintroduction efforts. First, the degree of human attachment a gibbon exhibits may have effects on the stability of social relationships. Bo, the adult male that repeatedly returned to the rehabilitation site, failed to thrive in the wild because he could not maintain a stable pair bond and appeared to prefer humans over his conspecific counterparts. More so, excessive human contact places gibbons at greater risk for hunting and capture. The Payu group's behavior may provide a safer environment while Tony's aggression is of questionable benefit. Although his violent attacks likely deter most, they still place him in close proximity with humans.

The frequency of disappearance within Khao Phra Theaw bears the question of whether or not reintroduction is a viable conservation effort. While it is disheartening for an infant to die or disappear, primate infant mortality is not uncommon. Infant gibbons are at high risk for predation by numerous species of hawks, eagles, pythons, or large cats. They are also vulnerable to illness, falls or accidents. Missing adults, on the other hand, are of significantly more concern.

All GRP staff members are instructed to watch for sign of poaching during trips into the forest. According to Punnadee (2006), there was an average of five signs of poaching per year between 2004 and 2005. These included traps, lost equipment, animal remains, used bullets, and camps. In the worst case, it was Pompam's remains. Although Khao Phra Thaew is a non-hunting area, there are not enough park rangers to patrol the entire forest. The park is easily accessible and many local people continue to hunt wild animals for subsistence as well as the meat and medicinal trades. It is difficult to evaluate whether or not there were significant behavioral abnormalities that resulted in survival or reproductive failure, but it is possible that the occupation of lower canopy levels increased vulnerability to hunting. This represents a behavioral effect of the pet trade that had further repercussions for reintroduced individuals.

### ***Limitations***

It is important to note that analysis of this research is speculative in nature. While most of white-handed gibbons' abnormal behaviors are seen in other primate species within controlled laboratory settings, the history of each gibbon is unknown and causality cannot be determined. Though it can be inferred that most of the gibbons were captured as infants, there is no way of determining the exact age. Maternal separation at three months of age versus nine months of age may represent a profound difference in later behavior and physiology. Furthermore, it is important to determine the etiology of atypical behavioral patterns before recommending a form of intervention. Although it is common to assume that treatment and causation are linked, this is often not the case. For example, although the lack of social interaction early in life may predispose primates to develop severely abnormal behavior, exposure to companions at a later

time does not necessarily reverse the syndrome of abnormality. This is often the case with individuals that are fearful of conspecifics; social introduction may actually increase distress.

Though hylobatids are closely related to other primates, cross species comparisons must be made with caution. Gibbons' social structure is quite distinct and their placement in phylogeny is unique. Gibbon rehabilitation differs from that of other primates because of their monogamous social structure. Thus, the socialization process must be conducted with care.

### ***Future Research***

Though the scope of the illegal trade of primates is immense and research possibilities are vast, there are two areas in particular I believe to warrant further inquiry. First, a study of antipredatory behavior in reintroduced gibbons may shed light on methods that could improve rehabilitation success rates. It is possible that gibbons raised in captivity never experienced the need to flee from predators and had no opportunity to learn essential alarm calls, rendering them vulnerable to novel threats in the wild. Second, it may be valuable to measure fecal cortisol metabolite levels across time in rescued gibbons. If there is hard evidence that rehabilitation centers are successfully reducing stress levels amongst rescued primates, this is likely to bolster funding for the projects. The measurements may also provide clues about the degree to which various enrichment methods are psychologically and physiologically benefiting the gibbons.

## ***CHAPTER 8***

### **CONCLUSIONS**

The scientific understanding of primate socialization and development is relevant to conservation efforts for a number of reasons. First, an awareness of gibbons' complex behavior, learning mechanisms and social lives may promote the significance of their relationship to our own species and consequently bolster public donations and funding. Ecological research—including studies of gibbons' relationship with the surrounding habitat and other rainforest species—may aid in government funding and policymaking. Within the rehabilitation program, scientific knowledge is essential for adequate skill training during preparation for reintroduction. It is also indispensable to the preservation of critical knowledge and competence within primate communities. From a conservationist standpoint, it is crucial that any gaps between academia, policy and public education be bridged.

Thailand's illegal pet trade is a major threat to both wild and captive white-handed gibbons. While wild gibbons are continually hunted and captured, pet gibbons are placed in deprived conditions that have long lasting consequences for behavioral and physical health. Many behavioral effects are consistent with previous research on captive and socially deprived primates: stereotypies, self-injury, social inadequacy, inadequate mothering, and human attachment. Eating conditions are also prevalent. Furthermore, the close link between psychological and physical welfare compounds the difficulties of rehabilitation efforts and may explain the high death and illness rates at primate rehabilitation centers. Detrimental behavioral effects are oftentimes challenging to overcome, particularly in older gibbons or those that have experienced severe abuse.

Fortunately, prospects are not completely bleak. It appears that some abnormal behaviors are more easily modified than others or may still be compatible with reintroduction. Behavioral flexibility and rich social lives—both hallmarks of many primate species—prove advantageous for gibbon rehabilitation efforts. Also beneficial is the very young age at which many gibbons are rescued. They thus undergo their critical developmental period in the rehabilitation environment with sufficient opportunities for play, grooming, learning, and socialization. Furthermore, some gibbons respond positively to rehabilitation and do indeed have the ability to thrive in the wild. While reintroduced gibbons have similar activity budgets to wild gibbons, they differ primarily in habitat utilization and frequency of human contact. Even gibbons that overcome most abnormalities during rehabilitation retain an unfavorable deviation from normal behavior. The occupation of lower canopy levels and close contact with humans renders gibbons vulnerable to hunting, which remains a persistent problem throughout Southeast Asia.

Thailand's illegal pet trade represents a complex mosaic of interrelated elements that must all be considered for successful conservation efforts. While hunting adults and capturing infant gibbons is the most visible aspect of the illegal pet trade, the root of the problem and possible solutions must be researched in more detail. Rehabilitation and reintroduction are viable conservation efforts, but this process necessitates the preservation of forest habitats and the protection of wildlife within them. Insufficient funding for law enforcement remains a significant problem throughout Thailand and most protected areas are not adequately patrolled. Poaching, then, is still a major threat to gibbon populations despite its illegality. If reintroduction is to be successful, these threats must be addressed. GRP strives to reduce the threat of poaching through community education programs for local villages as well as educational leaflet drops in tourist areas. Local education is an indispensable piece of conservation efforts, but it is also important



for international travellers to be aware of the effects of their actions and spending behaviors. In turn, local populations must be provided with sustainable economic alternatives and opportunities for livelihoods that don't involve the exploitation of wildlife. Though it is a difficult, time-consuming process, all issues must be addressed in order to ensure the conservation of white-handed gibbons. If we are successful, Thailand's forests may sing again.

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## APPENDIX A

The following information is derived largely from the Gibbon Rehabilitation Project's Adoption Programme which allows visitors, affiliates, friends, and supporters to help fund the project by selecting a gibbon to "adopt." Brief profiles of each gibbon are listed both on the website and at the Center for Conservation and Education and Fundraising. Much of the information is also derived from the regular news updates. Finally, some was obtained during my stay at GRP and through e-mail correspondence with Owart Maprang.

Due to the lucrative nature of the pet trade, GRP staff does not have a complete history of most gibbons. Confiscated gibbons are rescued with little information; other gibbons are merely abandoned in a box. Even gibbons given up voluntarily by their owner lack historical details since many people are unwilling to discuss their activities. Many ages are thus estimated based on skeletal and dental anatomy. It must also be noted that certain information may have been purposely omitted due to issues of relevancy or even funding. Because the rehabilitation program is focused on gibbon welfare, a simple limitation on time likely prevented the dissemination of information to the public and researchers like myself.

**TABLE A.1 BRIEF DESCRIPTIONS OF GRP GIBBONS**

Name	Sex	Birthdate	Wild vs. Captive Born	Date Acquired by GRP	Age at Rescue	Brief History	Notable Behaviors and Features	Current Status
Maesa	F	Apr. 12 2010	Captive	Apr. 2010	Newborn	Born to Nuan and Max at rehab site  Rejected by mother  Nursery reared	Digit sucking  Shy and nervous	Rehabilitation site  Housed with other adolescents
Nat	M	Sep. 19 2004	Captive	Sep. 2004	Newborn	Born to Kushta and Bozo at rehab site	Digit sucking	Reintroduced with Kushta group
Santi	M	Dec. 24 1999	Captive	Dec. 1999	Newborn	Born at rehabilitation site  Rejected by mother  Nursery reared		Rehabilitation site  Housed with other adolescents
Mary	F	Oct. 1 2002	Captive	Oct. 2002	Newborn	Delivered via caesarean section because her mother Pompam was having problems in the late stages of her pregnancy  Rejected by mother  Nursery reared	Epilepsy  “Energetic and a strong will to survive”	Death from epilepsy
Pee Mai	M	Jan. 2009	Captive	Jan. 2009	Newborn	Born to Kushta in rehab		Reintroduced  Disappeared and injured, now at rehabilitation site
Arya	F	Jul. 15 2011	Captive	Jul. 2011	Newborn	Born to Jonus and Santi at the rehabilitation site		Rehabilitation site with parents
Sherpa	M	Oct. 3 2010	Captive	Oct. 2010	Newborn	Born to Jorn and Cop		To be released in 2012
Tunda	M	Dec. 2009	Wild	Jun. 2010	6 mo.	Pet  Sold into the pet trade at 2 mo. of age  Donated voluntarily to GRP		Rehabilitation site
Songkran	M	2003	Wild	April 2004	6 mo.	Photographic prop  Confiscated from a beach photographer in Patong.	Malnourished  Arrived with conspecific  Energetic and sociable  Pair bond	Rehabilitation site  Bonded with Bobbie

Bobbie	F	2006	Wild	2006	6 mo.		Pair bond	Rehabilitation site Bonded with Songkran
Phi Phi	F	Dec 2008		May 2009	6 mo.	Photographic prop Bought from a photographer on the Phi Phi islands as a gift. Given to GRP voluntarily	Ventral clinging Digit sucking Alopecia Independent; no problems being separated from human contact	Rehabilitation site
Crystal	F	2008		July 2009	8-10 mo	Photographic prop Bought off a photographer on Patong Beach Given to GRP voluntarily	Ventral clinging Digit sucking	Rehabilitation site
BamBam	F	2003	Wild	2004	9 mo.	Abandoned in a cardboard box by the side of the rode		Rehabilitation site
Flick	F	2007	Wild	Oct. 2008	1 yr	Photographic prop Bought from a photographer in Patong to give to GRP	Malnourished	Rehabilitation site
Brittany	F	2009		Feb 2011	1 ½ yrs	Tourist attraction Confiscated from a tour office and handed to the Forestry Department, who then brought her to GRP.	Malnourished	Rehabilitation site
Jane	F	2007		2008	1 yr	Photographic prop A resident of Phuket bought Jane from a beach photographer as a gift for their partner. Given to GRP voluntarily	“Cried a lot and rocked back and forth” when left alone Stereotypic behavior Benefited from introduction to playmates	Rehabilitation site
JoJo	M	1999	Wild	2000	1 yr	Pet Given to GRP voluntarily	Pair bond	Rehabilitation site Paired with Mee
Mee	F	2000		2002	2 yrs	Tourist attraction Kept in a cage outside a restaurant in Bangkok. Confiscated	Pair bond Arrived with conspecific	Rehabilitation site Paired with Jojo

O	M	2000		Sep. 2002	2 yrs	Tourist attraction  O arrived at GRP with Mee. They were kept in a small cage in a Bangkok restaurant.  Confiscated by the Forestry Department, then lived at WARF in Bangkok before arrival to GRP.	Malnourished  Stereotypic behavior (self-grasping)  Digit sucking  Arrived with conspecific	Rehabilitation site
Muki	M	2004		2006	2 yrs	Photographic prop  Bought off a beach photographer by a well-meaning tourist.	Digit sucking  Descends to forest floor  Strong social bonds	Reintroduced with Kushta family
George	M	2002	Wild	2004	2 yrs	Tourist attraction and photographic prop	Hepatitis A	Rehabilitatoin site  Recovered  Friendly
Champ	M	2002	Wild	2004	2 yrs	Tourist attraction and photographic prop	Hepatitis A	Quarantine site
Khunsaul	M	2002		April 2004	2 yrs	Photographic prop  Confiscated from a beach photographer in Patong.  Kept by the same owner as Songkran, and they came to GRP at the same time.	Arrived with conspecific	Rehabilitation site
Jonus	F	2000		2002	2 yrs	Pet  Jonus was kept as a pet in Phuket until her owner, who had taken very good care of her, realized that it is illegal to keep gibbons as pets.		Rehabilitation site
Jorn	M	2004	Wild	2006	2 yrs	Pet  Released by his owner at Bang Pae Waterfall. He was captured and taken to the Quarantine site to check his disease status. When given the all clear he was brought back to our rehabilitation site and introduced to Cop in June 2008.	Pair bond	Acclimatization cage  To be released in 2012
Cop	F	2002		2004	2 yrs	Photographic prop  Confiscated from a photographer on Patong Beach.	Hepatitis A (Treated)  Pair bond	Acclimatization cage  To be released in 2012

Epson	M	2006	Wild	Feb 2008	2 yrs	Pet  Mistreated by his owner in Phuket, which resulted him biting their children.  Brought to GRP by neighbor	Mistreated  Hepatitis B	Quarantine site
Seagame	F	2006		Apr. 2008	2 yrs	Pet trade in the Prachuap Khiri Khan province.  Bought in the Sing Kon market. The people who bought her from the market kept her for one month.  Given to GRP voluntarily		Rehabilitation site
Beauty	F	2006		April 2008	2 yrs	Tourist attraction and photo prop  Collected from Patong police after being confiscated from her owner.		Rehabilitation site
Max	M	2000	Wild	2002	2 yrs	Tourist attraction at the Dumnern-sa-doeek floating market in Ratchaburi  Confiscated  Spent 2 years at the WARF animal shelter before arriving at GRP.		Rehabilitation site
Lumduan	F	2007	Wild	May 2010	3 yrs	Tourist attraction  Chained to a tree to attract tourists into a restaurant.  After numerous complaints to the forestry department by tourists and locals, she was confiscated by the authorities. Her owners were going to try to fight in court to get her back, but once they realized that owning her was illegal and that they did not have the proper permits, they dropped the case.  Lumduan came to GRP with Thongkum.	Arrived with conspecific  Strong social bond	Rehabilitation site

Thongkum	M	2007	Wild	May 2010	3 yrs	Tourist attraction  Chained to a tree to attract tourists into a restaurant.  Confiscated by the authorities.	Arrived with conspecific  Strong social bond	Rehabilitation site
Bobo	M	2001		Jan 2005	4 yrs	Pet in Phuket Town  Grew more aggressive with age  Given to GRP voluntarily  Paired with Endoo and they got on very well, but her self-injurious behavior resulted in them having to be separated. He is now housed by himself and GRP is awaiting a suitable female gibbon for Bobo so he can be released back into the forest in the future.	Occasional appetite loss and weight loss  Alopecia	Rehabilitation site
Kushta	F	1990		1996	6 yrs	Pet  She has experienced the loss of her mate and offspring. She had two infants in captivity that became sick and died, and lost her mate Bozo when released into the wild with her third baby, Nat.  Kushta has had another baby in captivity, Pee Mai (♀), born in January 2009. Unfortunately Mai lost his sight in May 2009, and had to be relocated to Quarantine away from his family to observe his condition.  Paired with Arun upon reintroduction	Released without mate; paired in the wild	Reintroduced  Pair bond with Arun
Pook	M	2002		2010	7 yrs	Pet  Previously kept as a pet at Kong Ka temple in Phang Nga Province  Given voluntarily to GRP		Rehabilitation site

Nuan	F	1986	Wild	1996	10 yrs	<p>Pet</p> <p>Kept as a pet in Phang Nga but was brought to GRP after biting her owner's daughter.</p> <p>Nuan was originally paired with Khao and had a baby named Payu in 2001. The family unit was released in 2007 but Khao disappeared in autumn of 2008.</p> <p>Nuan was later found nursing a broken arm so GRP staff returned her to the rehabilitation site to attempt a new pairing. She lived adjacent to Max while her arm was healing.</p>	Inadequate mothering	<p>Rehabilitation site</p> <p>Training cage</p>
Sylvia	F	2006	Wild			<p>Photographic prop</p> <p>Her owner filed down all her teeth so she couldn't hurt him.</p> <p>Confiscated from a beach photographer in Patong.</p>	Mistreated	Rehabilitation site
Annie	F	2005	Wild			<p>Kept as a pet</p> <p>Injured: finger missing on one hand and a very matted coat with dreadlocked fur</p>	<p>Mistreated</p> <p>Pair bond</p>	<p>Rehabilitation site</p> <p>Paired with Aye Aye</p>
Aye Aye	M	2008				Kept in a cage in a temple, when a married couple took pity on him and brought him to GRP.	Pair bond	<p>Rehabilitation site</p> <p>Paired with Annie</p>
Tom	F	1986	Wild			Pet	Pair bond	<p>Rehabilitation site</p> <p>Pair bond with Ollie</p>
Ollie	M	1989	Wild				Pair bond	<p>Rehabilitation site</p> <p>Pair bond with Tom</p>
Nong	F			Dec 15 2009		<p>Pet in Ranong</p> <p>Given voluntarily to the Forestry Department</p>		Rehabilitation site
Pompam	F						Inadequate mothering	<p>Reintroduced</p> <p>Death by poacher</p>



UNABLE TO BE RELEASED								
Guinness	M	1987	Wild	2001	14 yrs	<p>Pet</p> <p>Kept in a temple with monks for 14 years.</p> <p>He is different species from the other gibbons at the GRP: a Pileated Gibbon.</p> <p>Guinness loves to sing and it is noticeably a different call to the other gibbons here at the GRP. He will not be able to be released back into the wild and will live out the rest of his life here at the project.</p>		Rehabilitation site
Gibby	F			2008	6 yrs	<p>Pet</p> <p>Her owner looked after her very well, but neighbors complained about the loud singing</p> <p>Given to GRP voluntarily</p> <p>Gibby is a Golden-Cheeked gibbon, which are native to Indo-China.</p> <p>She will remain at GRP as her species is not endemic to Phuket so she cannot be released to the forest.</p>	Digit sucking	Rehabilitation site
Honey	F			Mar. 2007	2 yrs	Honey is an Agile Gibbon	Digit sucking	Rehabilitation site
Sumlee	M	1984	Wild	2008	18 yrs	<p>Bough from a poacher in Ranong</p> <p>Pet</p> <p>Lived with his owner in Bangkok for 18 years until he became terminally ill and arranged for him to be collected by GRP. Upon arrival at the owner's house we found him close to his owner's dead body. He was very weak.</p> <p>Sumlee is housed on</p>	Social inadequacy	Rehabilitation site

						his own as he has never bonded with any other human or gibbon, and can therefore never be released.		
Joy	F	1987	Wild	2002	15 yrs	<p>Pet</p> <p>Periodically starved by her owners</p> <p>Developed an eating condition and becomes very agitated at feeding times.</p> <p>Due to her advanced years, it unlikely that she will ever overcome this problem and will probably never be a candidate for release into the wild.</p> <p>Joy has a very distinctive call and is usually the first female to initiate the great call in the mornings.</p>	<p>Eating condition</p> <p>Mistreated</p> <p>Alopecia</p>	Quarantine site
Mai	M	1997	Captive		Newborn	<p>Born at the rehabilitation site</p> <p>Mai stayed with his family until he was a juvenile and was then released with three other juveniles. The release was unsuccessful and Mai had to be returned to the project.</p> <p>Attempts were made to reintroduce him to his parents, but he was rejected by his father.</p> <p>Paired with a female for 3 years, but this also was unsuccessful.</p> <p>In 2006 he was successfully paired with another female, Shirley. Soon after they had an infant and were close to release. In September 2007 a Python attacked the family, killing the baby and leaving Shirley with serious injuries that she never recovered from.</p> <p>Mai was paired with another female soon</p>		<p>Quarantine site</p> <p>Blind</p>

						after this, Kushta. All was well and a baby Pee Mai was born in January 2009. Again, Mai was very close to release when tragedy struck again. In May 2009 Mai lost his eyesight and had to be brought to our Quarantine site for observations. His condition does not appear to be improving. It is very unlikely he will ever be released		
Endoo	F	1998	Wild	1999	1 yr	<p>Pet</p> <p>Endoo, meaning 'sympathy' or 'pity' in Thai, was being mistreated as a pet.</p> <p>Neighbors brought her to GRP</p> <p>Endoo had a self-harming condition, which involved her biting and scratching herself, but she has since made excellent progress.</p> <p>Due to this mentally prohibitive condition, we cannot pair her with another gibbon and it is therefore unlikely that she will ever be released.</p> <p>Endoo especially enjoys her enrichment games when food is hidden in leaves or coconut shells and she shows her cleverness by retrieving it quickly.</p>	<p>Self-injury</p> <p>Appetite loss</p> <p>Benefited from feeding enrichment games</p> <p>Improvement</p>	Rehabilitation site
Bo	M	1987	Wild			<p>Arrived at GRP emaciated, having had his milk teeth filed down and generally in bad condition.</p> <p>Bo had a family with a gibbon called Lek and was released into the wild in 2003. However, he returned to the project six times, leaving his family in the forest.</p> <p>Bo's cage adjoins Tam's, and whilst they</p>	<p>Malnourished</p> <p>Mistreated</p> <p>Social bond with Tam</p> <p>Human attachment</p>	Rehabilitation site

						cannot cage share due to her disabilities, it is clear that they are firm friends and groom each other through the wire.		
Tam	F	1994	Wild	Dec. 2002	8 yrs	<p>Tam is a permanent resident at GRP due to her physical disabilities of only having one hand and one foot. Beaten so brutally by her owner that amputations were necessary, she was then put in a cage with other gibbons without introduction and they bit off all but two fingers on her remaining hand.</p> <p>Despite all this, Tam is gentle and friendly and is still able to play and move around in her cage. She is best friends with Bo in the cage next door and likes to be groomed by him through the wire.</p>	Physical disabilities	<p>Rehabilitation site</p> <p>Permanent physical disability</p>
Rumthai	F	2001	Wild	2002	1 yr	<p>When Rumthai was brought into the GRP, she was one of the most distressing cases GRP had ever seen. Kept inside a tiny birdcage with v no room to move, her spine and arms had grown deformed and she was extremely small and weak.</p> <p>She has since improved greatly and can now use her arms to brachiate a little, although she still prefers to pick things up with her feet. Her deformities are too advanced to be reversed and therefore she cannot be released into the wild.</p>	<p>Appetite loss</p> <p>Inactive</p> <p>Alopecia</p> <p>Improvement</p>	Rehabilitation site
Jep	M	2000	Wild	2001	1 yr	<p>Appeared in somebody's kitchen dressed in baby clothes.</p> <p>Demonstrated distressing behavior at feeding times, but we have adjusted his feeding regime accordingly and he is</p>	<p>Malnourished</p> <p>Eating condition-distressing behavior at feeding times</p> <p>Alopecia</p>	Quarantine site

						<p>starting to settle down.</p> <p>Having been extremely malnourished, he is very small for his age.</p> <p>GRP staff will be closely monitoring him for a while and hope for him to have a cage mate in the near future.</p>		
Sam	M	1987	Wild	1994	7 yrs	<p>Pet</p> <p>Kept in Bangkok as a pet for 6 ½ years, from the age of 6 mo. to 7 yrs. As an infant he lived freely inside his owner's house, but as he grew older and became more aggressive, he was tied to a chair and then kept in a cage on a balcony. From the age of 3, he never left that cage, except for 2 escapes.</p> <p>Upon arrival, Sam was unable to sing. Therefore he could not partake in normal gibbon behaviors such as attracting a mate or defending his territory, so he was unable to be released.</p> <p>At GRP he was housed by himself, but he had previously been housed with 2 female gibbons. Unfortunately, he showed no interest in them, nor them in him, which might be because he could not sing.</p> <p>Sam was moved to a new, larger cage which we hoped would lift his spirits and encourage more singing, which would have enabled us to find him a suitable mate. Unfortunately this was unsuccessful and Sam stayed alone and never started to sing.</p>	<p>Inability to sing</p> <p>Socially inept</p> <p>Alopecia</p>	Death from pneumonia

## APPENDIX B

