

New
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内 容 简 介

本书是国内外第一部蟒蛇专著，包含丰富的蟒蛇科学研究成果和精彩纷呈的蟒蛇图片，既有蟒蛇的一般常识，又有蟒蛇鲜为人知的奥秘；既有野生蟒蛇生物学新的发现，也有人工养殖蟒蛇研究的新进展；既有蟒蛇保护的理论和技術，也有科学养殖蟒蛇的方法。总之，无论读者出于对蟒蛇的好奇，还是为了求得新知，都能从本书得到很多的收获。

本书可供动物学专家、大中专院校的教学科研人员、野生动物管理部门和野生动物保护工作者、爬行类爱好者和饲养者、动物园蟒蛇饲养管理人员和兽医、蛇类科普工作者、热爱大自然和动物的青少年等查阅参考。

Summary

This book is the first book of the research on the Burmese python (*Python bivittatus*) and Hainan python (*Python bivittatus hainannus*) in China. The book takes a contemporary look at the Burmese python and its subspecies, the Hainan python, the only python species in China. The book also provides more essential information and some new discoveries on the biology of Burmese python and Hainan python including embryonic, anatomic, development, conservation, distributions and densities of the natural population, captive bred, care of injured pythons and the achievements of the conservation of this species in China.

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序

蟒蛇是濒危的爬行动物，分布于东南亚和中国南部，特别是海南岛的数量较多，密度较大。由于蟒蛇皮和活体在国际市场上需求量巨大，供不应求，每年都有大量的野生蟒蛇被捕杀，导致这个物种的生存面临巨大的威胁，我国已经把这个物种列为极危物种。有关蟒蛇的中外文科学著作十分罕见，更没有出版过像该书这样系统、深入的蟒蛇研究著作，民众对蟒蛇的科学知识知之甚少，网络和视听媒体上存在许多对蟒蛇的误解和偏见。目前，国内外尚未见一部专门研究和论述蟒蛇的专著。该书作者研究蟒蛇多年，对蟒蛇的生物学特性有许多新的发现和新的观点，特别是对海南岛野生蟒蛇的习性、历史和现状、胚胎发育、骨骼肌肉系统、如何保护和利用，以及人工养殖问题等，都有详细论述。

该书的出版对于全面客观地学习蟒蛇的基本常识和生活习性，了解蟒蛇的最新研究成果、海南蟒与东南亚缅甸蟒的异同、海南蟒的历史和现状，加强中国极危的蟒蛇资源的依法保护，指导蟒蛇的科学养殖，普及蟒蛇科学知识，培养更多的新一代蟒蛇保护工作者，都有重要的价值。

在20世纪，我曾经多次到海南岛考察野生蟒蛇。在21世纪，我也多次到海南岛考察蟒蛇的人工养殖情况，并且与该书作者及其研究生有过多次的学术交流。他们大胆探索、谦虚好学、治学严谨、吃苦耐劳、坚持多年，令人



钦佩。根据我的观察了解，海南的野生蟒蛇资源保护和人工养殖技术在国内
外都处于领先水平。该书作者虽然不是专门从事爬行动物研究领域的专家学
者，但是在蟒蛇的生物学研究，野生蟒蛇与养殖蟒蛇习性等方面，都有许多
新的探索和发现，也培养了许多研究蟒蛇的研究生；在野生蟒蛇的调查研究
与保护和救助，蟒蛇人工养殖技术开发方面，也有许多新的探索和建树，并
得到应用。


我愿意向广大读者推荐这部蟒蛇新著，并希望有更多更好的蟒蛇著作
问世。

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2013年9月10日

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前言

蟒蛇研究一直是一个冷门，有关蟒蛇的科学著作较少，即使是相关的科普书籍也不多。本书作者所领导的蟒蛇研究团队从21世纪初开始研究蟒蛇。10多年来积累了许多蟒蛇研究成果，其中包含许多新的发现，澄清了许多蟒蛇的错误看法与传说，使人们对其生物学特性有了更客观全面的认识。这些研究进展说明蟒蛇研究还有许多未知领域，需要更多的有识之士加入进来。

许多年来，有关蟒蛇的各种新老版本的简介，道听途说、毫无根据的蟒蛇传闻时常见诸于各种媒体，真假难辨，哗众取宠，以讹传讹，极大地妖魔化了蟒蛇，让很多不明就里的普通民众信以为真。这种现象本身就说明大部分人缺少对蟒蛇常识的了解。本书的目的就是用多年积累的第一手观察研究成果，客观全面地介绍蟒蛇的基本知识、蟒蛇的胚胎发育、蟒蛇的遗传特征、野生蟒蛇目前的生存状态和人工养殖技术、蟒蛇的研究进展、蟒蛇资源的保护与养殖的理论和技术等，答疑解惑，为蟒蛇正视听。例如，都是岩蟒，而且外观也相似，亚洲岩蟒与非洲岩蟒有何区别？虽然都是亚洲岩蟒，缅甸岩蟒和印度岩蟒又有什么差异？缅甸蟒和海南蟒是不是也存在一些不同的地方？此外，诸如最长的蟒蛇有多长、最重的蟒蛇有多重、最大蟒蛇皮有多大、蟒蛇有多少鳞片、蟒蛇有多少椎骨和牙齿等，本书中都有解答。

古今中外关于缅甸蟒基本知识方面的书籍非常少，或者文字记述都极其



简单，而这方面系统的科学专著则至今尚未见到。虽然世界各地也有一些有关蟒蛇和蚺的著作，以及有关蟒蛇的逸闻游记和野外考察记述等，但是绝大部分只是某个物种的一般描述，没有深入细致的观察研究，用于研究的蟒蛇遗传背景不明，而且既没有足够大的蟒蛇群体用来观察比较，也没有多个世代、不同地域蟒蛇种群的长期和系统的研究。关于缅甸蟒的著作或者论文，大多是对某一国家或者地区的个别标本的物种分类特征描述，生理生化指标的测试和分析，以及宠物蟒养殖的入门水平的小册子而已。

本书的主要特色在于，既有对野外蟒蛇种群多个栖息地（中国海南岛、东南亚地区）历经10多年的长期观察研究，包括数千条不同性别和年龄的个体，多个世代的连续跟踪，也有在人工养殖条件下，对多个世代，整个生命周期，数万条蟒蛇的生物学特性连续多年的研究。通过观察比较数千条东南亚和海南蟒蛇的解剖结果，发现许多过去从未提及的蟒蛇的解剖特征、胚胎发育规律、骨骼肌肉系统。在蟒蛇线粒体DNA的序列特征方面，积累了大量基础数据，发现了许多从个别样本中无法发现的种群差异，特别是海南蟒与东南亚缅甸蟒的不同之处。本书作者通过长期的观察研究纠正了过去对蟒蛇的一些错误看法，补充和丰富了蟒蛇的基本常识。因此可以说，本书的内容与国内外已经出版的蟒蛇著作相比，除了物种不同以外，更加注重蟒蛇鲜为人知的细节，特别是有许多第一次发现的蟒蛇的生物学特征；用大量的观察记录和事实，尤其是大量的照片来澄清和纠正过去对缅甸蟒的一些误解，甚至错误的看法。关于蟒蛇的生活特性、解剖特征、胚胎发育、繁殖规律、线粒体基因组等方面，本书也有许多新的细节描述和新的研究发现，其中很多结果与结论都与至今广为流传的论断和说法完全不同。虽然本书介绍了关于



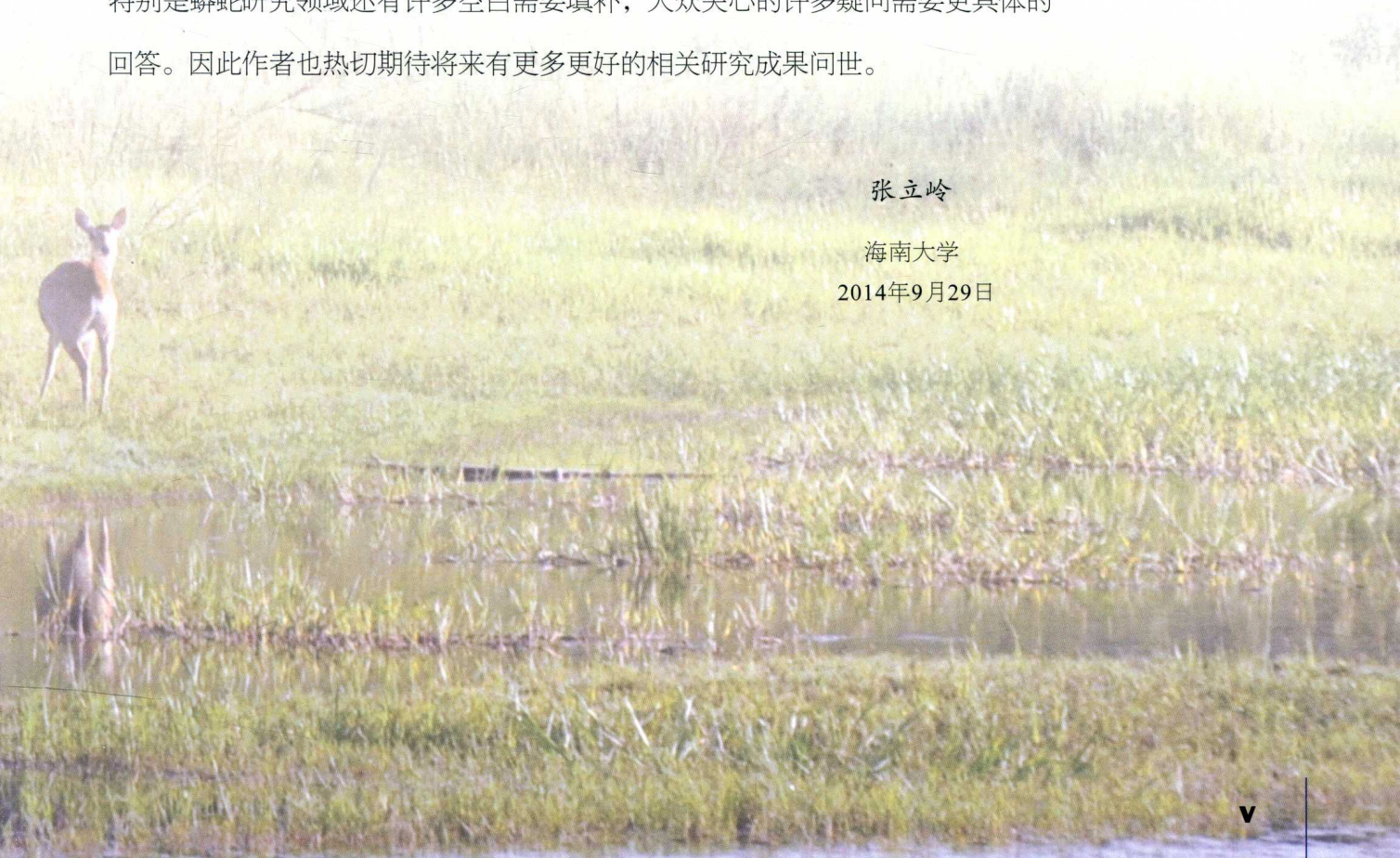
蟒蛇生物学的许多新发现，但是关于蟒蛇，特别是海南蟒，还有许多未知的秘密等待揭开。例如，蟒蛇的内分泌系统、神经系统，以及许多器官组织的细胞水平、超微结构、分子水平等微观内容等，还属于空白，需要更多的专家学者和更多的后起之秀做进一步研究。

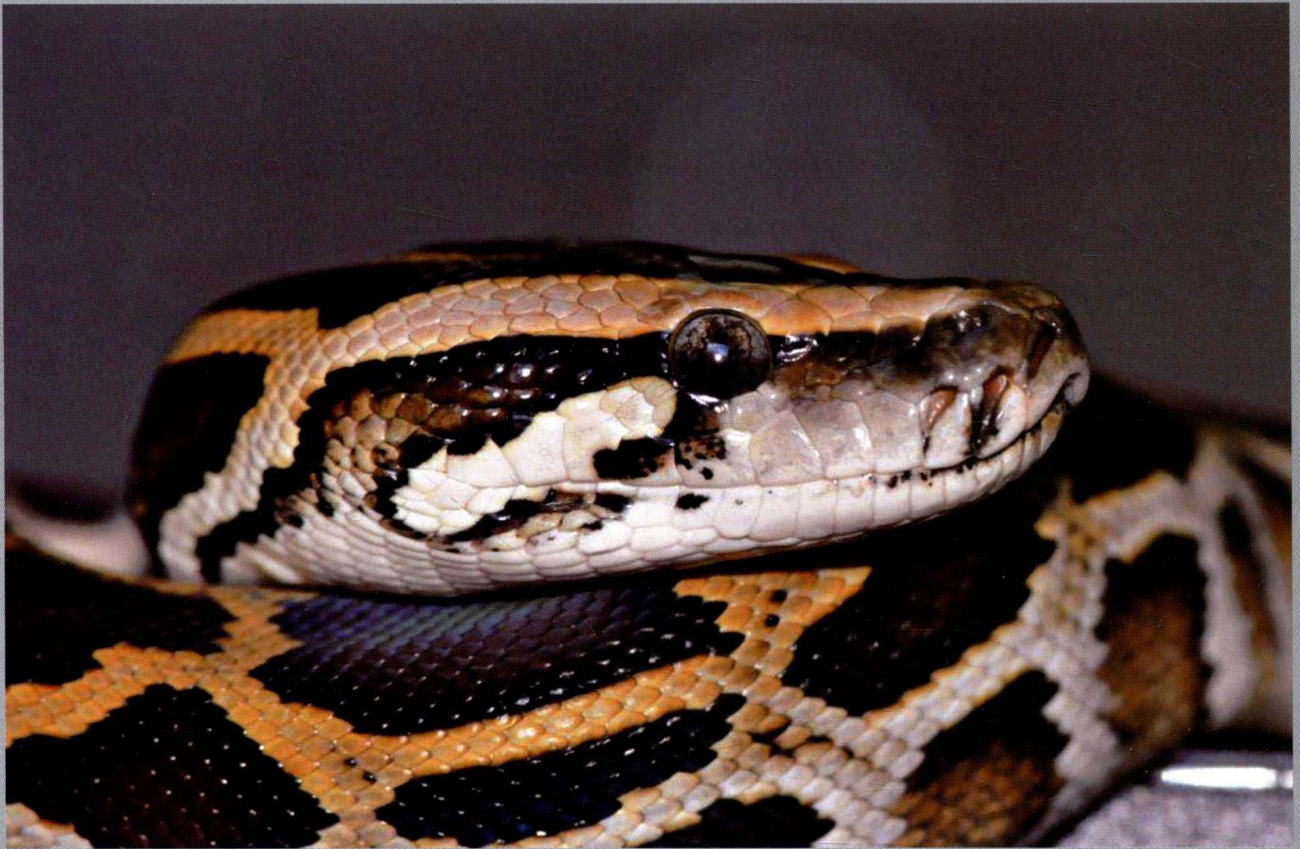
本书的另一个特色是读者对象广泛，阅读本书不要求读者有生物学和动物学背景，书中也没有枯燥抽象的理论和冗长乏味的文字描述，而是通过实验室工作与野外调查相结合，用大量独特视角的高清晰度照片与观察分析数据来说明和解释蟒蛇的生物学特性。因此作者相信本书会有众多的读者。这里还要重申的是，本书是关于蟒蛇基础研究的第一部中文著作，也是蟒蛇研究领域迄今为止内容最为丰富的著作。虽然本书的观点和论断都有长期的、大量的观察记录和实验分析数据支持，还有大量的照片佐证和文字说明，但是还不够全面，仍然有许多没有回答的问题，有待于今后新的研究数据提供更多更有说服力的验证和支持。特别是蟒蛇研究领域还有许多空白需要填补，大众关心的许多疑问需要更具体的回答。因此作者也热切期待将来有更多更好的相关研究成果问世。

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2014年9月29日





小小海南蟒



Python in Hainan Island of China

The natural territory of Burmese python extends among south of China, Burma, Thailand, Vietnam, Indonesia, and Cambodia, Lao, *etc.* On the taxonomy, the scientific name of Burmese python has changed from the first *Python molurus* (Linnaeus, 1758) into the later *Python molurus bivittatus* (Kuhl, 1820) and the last *Python bivittatus*. Burmese python has been an endangered species and can be easily harmed or hurt because it is no way to escape the hunting from people for making money.

The main characteristics of Burmese python and Hainan python are with light-colored skin, and its scales have many brown blotches with black borders. The total numbers of scales of the body surface are 25 500~27 500 pieces, and total numbers of the bones are 978~990 for Burmese python and 970~986 for Hainan python.

The Burmese Python is not only one of the 6 biggest snakes, but also a most popular pet snake in the world. Because of these reasons, these pythons are all threatened by the international trade for pets, leathers, and the native musical instruments, native medicines in Asian.

1. Brief Geography of Hainan Island

Hainan Island is the second largest island in China, which located on the South China Sea and distance to the main land of China by about 20.0km across



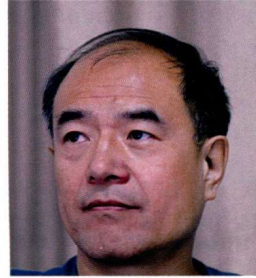
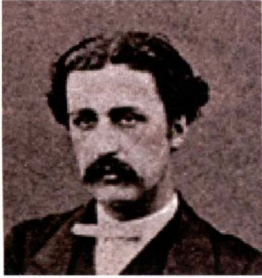
Qiongzhou Strait. Hainan Island located at east longitude $108^{\circ}37' \sim 111^{\circ}05'$, north latitude from $18^{\circ}10' \sim 20^{\circ}10'$, the average temperature is $16 \sim 20^{\circ}\text{C}$ on February, $25 \sim 29^{\circ}\text{C}$ on August, and the annual mean temperature is from $22 \sim 27^{\circ}\text{C}$. Hainan Island has a tropic monsoon climate. It is hot in summer and rainy in cold season. The annual precipitation is $1500.0 \sim 2600.0\text{mm}$.

2. Python in Hainan Island

According to the government report from the State Forestry Administration of China in 2009, the population of Burmese python (*Python molurus*) in mainland (including Guangdong, Guangxi, Yunnan, Fujian, and Tibet) of China was totally 62 000. This statistic result was not including the population in Hainan Island. In fact, the numbers of Burmese python in Hainan Island is more than the mainland of China.

The python in Hainan Island was also called “Mangshe” in Chinese, its meaning giant snake. At the beginning, the species name of Hainan python was *Python molurus* (Swinhoe, 1870), and then, was changed into *Python molurus bivittatus* (Zhao, 1998), and at the 21th century, a new species name is *Python bivittatus* has been given to Burmese python and Hainan python. It should be notice that more and more evidences from Hainan python indicate that there are some differences between Hainan python and Burmese python. For example, about 15%~20% in the population of Hainan python, just like as Indian rock python, an important characteristic in the scales of the head is the absence of any subocular scales, thereby permitting contact between the 6th and/or 7th supralabials and the eye itself. On the other hand, same as Burmese python, the brown arrow-head on the top of the head is distinct and extends fully to the snout of Hainan python. Moreover, there are some obvious differences in the mitochondrion of genome between Hainan python and Burmese python. So, it is suggested that the Hainan python should be as a subspecies of *Python bivittatus*, and renamed as *Python bivittatus hainannus*.

In China, the major part of Burmese python population was distributed in Hainan Island. This species prefers bush habitats, particularly scrub forest and



From left to right: Specialists of Hainan python were R. Swinhoe (British, 19th century), C. H. Pope (US, 20th century) and Zhang Liling (China, 21th century) since 1868~2014

often rest tree and cavities. Hainan pythons are active at night, searching for food or mates or moving to new resting sites. The main prey are rats, birds, small deer, rabbits etc. Hainan python is different from the population of Southeast Asia with some special characters. The first class of conservative species has been affirmed by China government on 14th December 1988. The dominant feature of the research on the python in Hainan University has been the direct observation of wild pythons in their natural haunts. Another purpose of Burmese python and Hainan python research is to develop a new and effective way to artificial breeding this species for commercial utilization. The total number of Hainan python is about 15 000 in the wild fields and 30 000 in the capture bred in Hainan Dongshenghong Python Production Technical Company (DOSHO) for more than 10 years.

As one of the largest snakes, the Burmese python grows to an average length about 5.0~7.0m, 50.0~100.0kg. Burmese python continue to grow all throughout its life, with the females growing considerably faster and bigger than the males of the species by 20.0~50.0kg. As one of the biggest specimens of the Burmese Python was found in Hainan Island, the weighs of them was over 200.0kg, and the body length was 7.36m. The Hainan pythons are good at climb trees to warm from sunshine and keep away dangerous from other hunters. Burmese python can be found usual grassland, marsh, hills and forestry in Hainan Island.

Although the wild Burmese pythons have been considered an endangered species by State forestry Administration, and a critically endangered species and been listed on Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), it has been seen as a source of leather for the world luxury market, especially European countries, which has led



to the slaying of many of this endangered species among the countries in Southeast Asia every year. On the other hand, as a famous natural resource of the folk medicine materials and native music instruments in Asian and Africa, this species is also captured for long time. The more serious situation is this endangered species as one of popular pets, has been sold as in many countries for many years. In Hainan Island, many Hainan native people including Li and Miao, are more scared than hurt by this creature. Therefore, almost no native people capture the pythons for pets, skins or food. The people who hunt the python in Hainan Island for the trade are all come from the main land of China.

The age of the first time mating is 2~3 years old for Burmese python and 4~5 years old for Hainan python. The mating season of each year is from September to October for Burmese python and from October to November for Hainan python. By observation more than 2000 females individuals for 10 years including Burmese python and Hainan python, it confirmed that if no mating, then no ovarian developing, therefore no egg follicle maturation and no egg-laying for the Burmese python and Hainan python. After 5 months of pregnancy period, before the gravid females are laid, they often move and find concealed site for egg hatching. Under the normal condition, all the eggs are adherent together. Most first clutches contain 20~50 eggs but the eggs are often small (50.0~70.0g) and no embryonic development inside, and most eggs are separated each other. Generally, from second clutching, the average weight of egg is 80.0~150.0g, generally, the success rate of clutching is 50%~80%. During the first month of incubation, the females coil around the eggs and brood the eggs like a bird with regular vibration of body muscular contractions to avoid embryo adhere to the shell. The period of incubation lasts about 50~70 days depending upon the environmental temperature. The length of the baby pythons are 50.0~70.0cm and the average weight of them is 70.0~100.0g. The young pythons grow rapidly and the body length can reach 1.5~2.0m and the body weight can reach 2.0~3.0kg for Burmese python in first year. For the Hainan python, the length and weight is lower than that of the Burmese python.



3. The Conservation of the Pythons in Hainan Island

The Burmese pythons have handsome patterning and are usually docile, therefore, this species is the most popular giant snake of the pet trade and the skins for fashion styles. Burmese python is one of the largest and a powerful representative among all the snakes of the world. The pets and skins trade have depleted many wild populations of this species, although the big snake species is legally protected in Southeast Asia and China.

According to the Law of the People's Republic of China on the Protection of Wildlife and the Administer rule of the People's Republic of China on the Protection of Wildlife, and in order to effectively protect, monitor the pythons in their haunts, and develop artificial raising the pythons appropriately and legally to utilize Hainan python resources, in 2001, the Department of Wildlife Conservation and Nature Reserve Management, the State Forestry Administration of China, has approved the python protection in their natural haunts and its commercial utilization program of the native 2 stringed musical instruments - Erhu to the DOSHO, which is the only one license of python raising in China granted by the State Forestry Administration of China. From this time, the program of the Hainan python protection entered a rapid development period. By artificial breeding the rarer species in captivity, more and more pythons are reproduced for the commercial purposes and the endangered wild population is conserved and recovered effectively. The Institute of Hainan Python is also founded. From this time, the efforts of the Hainan python protection entered a rapid development period.

From 2006 to 2014, more than 20 projects of Hainan python scientific research, artificial breeding and large scale production have been granted from State Forestry Administration, the Ministry of Science and Technology of China, and 5 key projects of Hainan Province (2007~2011) have been granted to Hainan University and DOSHO. These python protection projects were approved with 20 million RMB from China government and DOSHO funds. Many farms for domestication and breeding of python have been established and one wildlife

rescue and deliver center (Hainan Python Institute) managed by DOSHO. In 2011, the number of delivered wild and artificial breeding pythons to the Hainan national nature reserves was 100 and 400 separately. A 10 years plan for wild python protection and captured breeding pythons of sustainable utilization have been designed and implemented.

These python projects covered not only the wild native species for protection, monitor and rescues, but also the Hainan python seed source (breeding) bases have been established by DOSHO, with implantation microchips and miniature radio-transmitter surgical implantation for tracking or locating and recognizing these pythons in wild fields. And a computer monitor network system has set in the major farms to protect the python production normally and sustainably.

The population of pythons in Hainan has expanded from less than 10 000 individuals in the wild fields estimated by Hainan University and Hainan Python Institute in 2010~2013. The population of artificially breeding pythons (captive bred and ranched), has reached more than 30 000~40 000 among 2009~2013. By means of above scientific programs, Hainan pythons have been spread a few fields among Hainan Mountains, and some of captured individuals have been successfully reintroduced into the nature.

Hainan Python institute for wildlife protection and nature reserve development was established in DOSHO for research and monitoring Hainan python. There are more than 20 persons including professors, researchers, doctor and master degree graduates, college students leaded by chief scientist, Professor Zhang Liling. 3 master degree graduates on the python study have graduated. Many achievements have been obtained in both basic and applied studies in python reservation and scientific utilization. Many well-known wild life experts and scholars appreciated and supported the studies on China python reserve and utilization. A management information platform has been established by computer networks, including a pedigree databases, ID system based microchips to obtained complete information for standardized and scientific management of the python foods, breeding, egg production, hatching by nature and artificial incubation, disease control, animal



welfare, *etc.*

The Burmese python in the wild has been considered a threatened species by the government of China, and listed on Appendix II of CITES more than 10 years. Burmese python has been seen as a source of high quality and special leather for the world luxury goods market, which has led to the slaying of many of its numbers in southern Asia. They are also hunted for Asian native medicine materials and the folk music instruments, and some of them are caught in order to be sold as pets and distributed in the world.

4. The Advances in on Burmese python Studies in China

The anatomy and microsection of the main organs and the tissues of Burmese python and Hainan python have been made and some new discoveries have been detected, including the detail structures of the heart, the brain, the skull, the reproduction organs, the bones and the scales, *etc.*

The ways to prevent the common diseases of Burmese python have been studied for 10 years. Some preventive measures against the common diseases have been used to the artificial raising population of the Burmese python for more than 5 years and saved thousands of the pythons.

The growing regulation of the Burmese python and Hainan python have been studied for 5 years, including growth coefficient, growth curve of the weight and length from birth to 3 years old.

The biology and the technology of the reproduction and breeding of Burmese python and Hainan python, including estrus and mating, diagnosis of pregnancy, length of pregnancy period, laying cycle, laying performance, hatchability, litter weight, livability, feeding trial, feed conversion efficiency and feed formula, environment control, management, *etc.*

In order to locate the pythons in wild fields, the radio transmitter was used to the Burmese python and Hainan python. The method was allowed maximum transmission range are 1.0~2.0km for open fields or 0.5~1.0km among some obstacles. By this method, people can find again the pythons after released 1~3 days.



The complete mitochondrial genome sequence of Burmese Python has been sequenced by my group, Hainan University in 2014. The structural features of the mitochondrial genome and the phylogenetic trees based on 12 kinds of protein-coding gene sequences were analyzed and constructed to explore the evolutionary status of Burmese python species.

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