Review on the Development Course of Shijiazhuang Zoo

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Abstract The paper summarized the development course of Shijiazhuang Zoo from the aspects of origin, animal feeding and management and venue construction, and showed the achievements of Shijiazhuang Zoo in feeding and reproduction, scientific research and communication, venue renovation and expansion in different periods. The problems existing in the development of Shijiazhuang Zoo were put forward, and the future development was prospected.

Keywords Shijiazhuang Zoo; Development course; Achievement; Problem; Prospect

Shijiazhuang Zoo is located in the southwest of the intersection of Guanjing Street and Shanqian Avenue in Luquan District, which is a low hilly land in the junction zone between the stretching branch of the Taihang Mountains and the North China Plain, 17.5 km away from the downtown center of Shijiazhuang. Since the liberation of Shijiazhuang in 1947, the zoo has been moved and rebuilt twice, and now is developed into a large modern zoo with an area of 267 hm^2 and 4 696 animals of 246 species, integrating animal exhibition, ex-situ conservation, science popularization education, scientific research, leisure and entertainment. It has won many honorary titles such as National Science Popularization Education Base, Excellent Demonstration Exhibition Area of Chinese Association of Zoological Gardens, Science Popularization Education Base of Hebei Province, Five-star Park of Hebei Province, Top Ten Park of Shijiazhuang City, *etc.*, becoming a bright visiting card of Shijiazhuang City and even Hebei Province.

1 Development Course of the Zoo

1.1 People's Park period

1.1.1 The origin of the zoo. It can be traced back to 1940 (formerly known as the "Japanese Puppet Regime"), when the Japanese army set 2.7 hm^2 of farmland in Dongjiao Village and Yuanying Village as a park, called "Ping'an Park". There was a wooden pavilion and a fountain in the park, as well as 3 monkeys, 2 deer and several trees. As Japan surrendered in August 1945, the park was taken over by the national government and renamed "Zhongshan Park". Shijiazhuang was liberated on November 12, 1947, and the park was taken over by the municipal people's government and belonged to the construction bureau of the municipal government. In 1948, a park office was established for park restoration and expansion. In 1951, "Zhongshan Park" was renamed "People's Park", and the area of People's Park reached 7.7 hm^2 by 1957. In 1983, there were 2 000 animals of 150 species and more than 100 animal exhibition rooms. Besides, monkey mountains and waterfowl lakes were built, making it a comprehensive park integrating animal exhibition, recreation and science popularization.

1.1.2 Animal feeding and management. After establishment for more than 10 years, various management systems of the park had been constantly improved, and *Safe Operation Rules for Feeding and Management* was revised in 1961. In 1963, the *Rules for Animal Feeding and Management in People's Park* were established, involving feeding and management requirements of feed houses, wild animal houses (including monkey hills and pig exhibition houses), herbivores and bird houses. Animal archives were established in 1965 to register the number, economic value, health status and age of animals. The *Operating Instructions of Animal Feeding Technology* was initially formulated in 1973, which improved the feeding technology of employees and strengthened the sense of responsibility of employees.

1.1.3 Venue construction. After the liberation of Shijiazhuang in 1947, the state invested heavily in the construction of parks, facilities and buildings. Fountain, flower room, bird room, animal room, greenhouse, flower cellar and other infrastructure had been successively built or maintained, while lotus pond and fish

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pond were excavated, and more than 100 animal exhibition rooms with advanced equipments, such as deer park, lion and tiger room, monkey hill, *etc*. were built. The animal houses covered an area of 3 372 m^2, and the outdoor cinema, land skating rink and other recreation projects covered an area of 2 800 m^2.

1.2 Western Suburb Zoo period

1.2.1 Park profile. The park was officially opened on October 1, 1983, commonly known as Xijiao Zoo, covering a total area of 53.33 hm^2. It was located at No.286 Zhongshan West Road, adjacent to Yuandong Street in the east, Yuanxi Street and Datan Village in the west, Xiaotan Village in the south, and Zhongshan Road in the north, which was close to Xiwang public transport hub, with convenient transportation. The whole park was composed of three scenic spots; the first was the entrance activity area, and the park gate was facing north, close to Zhongshan West Road; the second was the animal exhibition area, which was arranged clockwise according to the order of animal evolution, with a total of 17 buildings along the U-shaped cloister to the east and south; the third was the scenic area with Chenlv lake as the main body and Dicuifeng as a foil, and there were a variety of service facilities around.

1.2.2 Feeding management. In 1986, after the zoo was relocated and opened for the first time, Shijiazhuang Landscaping Department issued the *Interim Provisions on Rewards for animal Breeding* and *Trial Provisions on Animal Management Request and Report System*. In 1990, the *Regulations on Animal Management* was formulated for the zoo, which made specific provisions on the establishment of animal archives, request report system, animal feeding and management, environmental health management and veterinary work. In 1998, the *Regulations on Daily Management of Animal Feeding Department* was revised. The total number of employees in 1985 was 333 (including 280 permanent employees) and that in 2004 was 247, more than 100 of which were engaged in animal feeding, maintaining a relative stability. By constantly strengthening the professional and technical training of feeders, the level of animal breeding had been improved.

1.2.3 Venue construction. According to animal habits, venue enrichment, landscape environment transformation and other factors, the animal welfare in the captive environment had been constantly improved, and the level of animal house construction and animal living environment had been constantly improved. There were 6 912 m^2 of panda house, monkey house, songbird house, rhinoceros house, hippopotamus house, waterfowl house and chimpanzee house with relatively complete facilities, 9 825 m^2 of bird house, elephant house, bear house, ostrich house, yellow deer house, small animal house, alpine animal house, carnivore house, herbivore house, feed house and lion and tiger house, and 547 m^2 of monkey hill in the park. Hence, the park became a place for close-up look at various animals.

1.3 Shijiazhuang Zoo period

1.3.1 Feeding and management. Since the zoo moved to Luquan District in 2005, the mode of animal rearing and exhibition has changed, and the transformation process from traditional cage rearing to free rearing has been smoothly completed. After more than 10 years of development, there were 196 employees in 2017, including 10 managers, 60 professionals and 126 workers. There were 87 feeders on the job, accounting for 44.39% of the total number of employees. The feed purchase system and feed distribution system are established and perfected; the management of animal logs is standardized, and animal logs are absolutely necessary for single key rare animals (head); the behavior, habits and feeding of animals are comprehensively recorded in details, to provide first-hand information for feeding management and animal disease control; in terms of safety management, a full-time safety officer system is set up to conduct regular inspection of animal houses, improve the intercom communication network, and grasp the situation of animals in time; new breakthroughs have been made in the enrichment work of animal house and animal behavior training has been carried out; Che Junguo Innovation Studio has been established to give full play to the demonstration and leading role of model workers and highly skilled talents.

1.3.2 Venue construction. The zoo attaches much attention to the creation of animal environment, and there are 33 animal exhibition areas opened to the public, covering a total area of 187 hm^2. The animal houses are connected with the sports ground. The flamingo house, herpetofauna house, precious monkey house, lemurs house, deer house, red panda house, elephant and rhinoceros house, hippo house, aquarium, tropical parrot house, alpaca house, chimpanzee house and mandrill house cover a total area of 63 900 m^2; the children's zoo, bird's twitter forest, central wild animal area, lion and tiger valley, Asian herbivore area, Australian herbivore area, African herbivore area, Alpine fauna area and bear valley cover a total area of 143 000 m^2; the black swan pool, swan lake and wetland wading bird area cover a total area of 67 000 m^2; the monkey mountain and lemur island cover a total area of 18 000 m^2; the chick garden, waterfowl garden, ibis garden, songbird garden, peacock garden, and animal exhibition area of amusement park cover a total area of 18 000 m^2. There are 14 goldfish gallery tanks along the main park road, and 8 animal exhibition areas are set up in the amusement park to exhibit snow monkeys, squirrels, birds of prey and other animals. A large green corridor is made on the road of the central square leading to the alpine animal and bird's twitter

forest, 27 groups of parrot cages are displayed above the corridor, and climbing plants such as *Campsis grandiflora*, *Wisteria sinensis* and *Parthenocissus quinquefolia* are planted on both sides of the corridor. At present, the polar aquarium project is under construction, and various security measures, enrichment of animal houses, roads and landscape greening have been gradually improved.

2 Achievements Made in Zoo Development

2.1 Animal stock, breeding and exchange

2.1.1 People's Park period. There were only 3 animals in the zoo in 1940; the park was preliminarily expanded in 1950, with an area of nearly 6.67 hm^2, and over 20 animals of 10 more species were added; in 1954, Changsha Shuangshi Zoo donated 110 animals of 30 species to the People's Park, and the number of animals in the park increased to over 400 animals of 70 more species; in 1959, there were over 1 000 animals of 100 more species in the park; in 1983, there were 2 000 animals of 150 species, and the park was developed into a comprehensive park dominated by animals.

2.1.2 Western Suburb Zoo period. After the animals in People's Park were moved to Xijiao Zoo in 1983, the zoo had undergone a period of stable development from 1984 to 1992, and a period of rapid development from 1993 to 2004. In 1994, 1996, 2001 and 2004, there were over 100 national first-class protected animals of 20 more species and over 100 national second-class protected animals of 20–40 species on hand, respectively. In 1988, the breeding of chimpanzees reached the domestic advanced level and it was the first case in China; the first case of artificially feeding leopard was successfully obtained; golden cat was bred and survived for the first time in 1991; red-crowned cranes first laid eggs and reproduced in the Western Suburb Zoo in 1992; francois langur was reproduced and survived for the first time in 1998; ostrich was successfully reproduced for the first time in 2000. In 2005, Swinhoe's blue pheasant and manchurian tiger, which are first-class protected animals, were propagated for the first time, breaking the history that there was no large tiger bred in the park. Two Asian elephants were introduced in 1984, and one giant panda in 1988. In 1994, a red-crowned crane was exchanged for 2 female jaguars from Germany. Giant pandas were borrowed from Beijing Zoo in 1996–1997. In 1998, the zoo exchanged a pair of red pandas for a pair of chimpanzees from Chausuyama Zoo in Nagano, Japan.

2.1.3 Shijiazhuang Zoo period. Since the zoo moved from Xijiao Zoo to Shijiazhuang Zoo in 2005, it has passed the stage of animal adaptation smoothly. Afterwards, the number and species of animals have gradually increased, and jackal and squirrel monkey had formed their populations. In 2009, zebra, jackal, meerkat, ring-tailed lemur, squirrel monkey and black swan had bred massively and formed populations. In 2010, the pregnancy care and postpartum care of the first giraffe twins were performed, and the experience of healthy growth of twin cubs was accumulated. In 2013, one *Budorcas taxicolor*, a first-class protected animal, was successfully raised. In 2017, the first case of artificially rearing young squirrel monkey was successful in China, and the first case of young *Cercopithecus neglectus* successfully survived, marking a new level of artificial rearing in the zoo. In 2019, Asian elephants delivered smoothly, which was the first time in the history of the zoo that an Asian elephant was bred. In 2007, a pair of white rhinoceros was introduced, ending the 20-year-long history of no rhinoceros in the zoo. In 2008, 2 African elephants of the same species were introduced from home and abroad, which filled the gap in the history of our zoo. In 2012, 2 giant pandas "Duoduo" and "Yaxiang" were introduced to the zoo. In 2015, black-backed jackal and southern coati were introduced for the first time, and the giant panda lease renewal procedures were completed; the giant panda "Duoduo" was sent back to the Sichuan panda base without a hitch, and the giant panda "Yunzi" was welcomed back smoothly.

2.2 Scientific research, scientific popularization and exchange work

2.2.1 Scientific research.

2.2.1.1 People's Park period. In 1981, the People's Park applied for a scientific research project to artificially raise cubs of lions, tigers and leopards. In 1982, the project of phenological observation and meteorological research was completed, and it was the basis for scientific research and teaching of urban landscaping, which not only filled the gap in Hebei Province, but also provided a scientific basis for urban planning, landscaping design and construction, and urban landscaping management.

2.2.1.2 Western Suburb Zoo period. In 1986, the zoo cooperated with the green team and Chang'an Park and other units on the subject of phenology observation and meteorological research, and compiled the *Summary Table of Common Flowers and Trees Phenology in Shijiazhuang from 1982 to 1985*, which was awarded the third-class prize for scientific and technological progress in Shijiazhuang. *A Report of Experimental Studies on Expelling Internal Parasites in Asian Elephants*, jointly completed with Department of Biology, Hebei Normal University, found the ideal drug to expel parasites in Asian elephants, albendazole (the best dose 20–30 mg/d), which won the first-class prize for municipal science and technology progress. In 1988, the chimpanzee breeding declared the project of the municipal construction committee, and chimpanzees were bred successfully. In 2000, the project of

"breeding of manchurian tiger" was successfully completed and accepted after 6 years of experiments, which won the second-class prize of Hebei provincial construction science and technology progress.

2.2.1.3 Shijiazhuang Zoo period. Since 2009, many scientific research projects, such as study on the application of probiotics in wild animal feeding, ecological environment improvement of urban water system, study on conservation, domestication and proliferation of wild pheasant resources in Hebei Province, research on construction technology of mountain afforestation landscape in Shijiazhuang Zoo, investigation of germplasm resources and construction technology of symbiotic landscape of animals and plants in Shijiazhuang, cultivation and efficient utilization of high quality and high yield forage for wild herbivores in captivity, effects of *Bacillus natto* preparation on stress response of precious swimming birds in the initial stage of stocking, had been successively completed, which had won 1 first-class prize and 4 third-class prizes of provincial construction science and technology. In March 2017, the first science and technology conference of the zoo was held, marking that the zoo's scientific research had entered a new stage of development.

2.2.2 Scientific popularization.

2.2.2.1 Western Suburb Zoo period. In 1995, an animal knowledge field was set up in the zoo, which consisted of 4 sections themed "amazing animal world", "protected animals in the motherland", "interesting stories about animals" and "knowledge of wildlife protection law". In 1999, the zoo launched a publicity campaign of "building a green home: bird-loving week", and Shijiazhuang University set up a "young volunteer" activity station in the zoo.

2.2.2.2 Shijiazhuang Zoo period. In 2010, the zoo was awarded the title of "Hebei science popularization education base" by Hebei Association of Science and Technology, and became a provincial and municipal base for science popularization education. In 2011, 10 popular science activities were carried out, including naming and adopting twin giraffes and popularizing science in the community. In 2012, 8 popular science activities were held, such as panda meeting and "I accompany pandas on June 1". In 2015, the Association of Zoo Volunteers was officially established, and the science popularization museum was successfully opened. It was awarded the title of "national science popularization education base" by China Association for Science and Technology. In 2017, the zoo established the science popularization and explanation post jointly with the volunteers of Hebei University of Science and Technology, which was carried out for 13 phases, with a total of 25 volunteers participating and a total of 45 people explaining.

2.2.3 Cultural exchange with foreign countries.

2.2.3.1 Western Suburb Zoo period. In 1985, the Chausuyama Zoo in Nagano City, Japan, presented a pair of chimpanzees to Shijiazhuang City, and Western Suburb Zoo presented a pair of red pandas to Nagano City. Nagano hot-air balloon visiting-China delegation donated some Yoshino cherry saplings to Western Suburb Zoo, which were planted in the north side of the rhinoceros house. In 1986, a pair of nordic blue foxes was presented by Hopeh and Shantung Natives (Hongkong) Association. On the 5th anniversary of the friendship between Shijiazhuang City and Nagano City, Western Suburb Zoo received 100 Yoshino cherry saplings from Nagano City, Japan, which were planted in the north side of the rhinoceros house. In 1989, Asian Elephant attended itinerant exhibition in nonlocal places. In 1994, a pair of red-crowned cranes was exchanged for 2 female jaguars from Germany, and the first experience sharing meeting for animal feeding and management was held. In 1997, 4 *Cacatua moluccensis* were donated by sister cities in the United States.

2.2.3.2 Shijiazhuang Zoo period. In 2010, the science and technology annual meeting of the Chinese Association of Zoological Gardens was held in Shijiazhuang. In 2013, the launching ceremony of the campaign to protect African crowned crane in Chinese zoos was successfully held in Shijiazhuang Zoo. The 2016 annual meeting of the Chinese Association of Zoological Gardens was held in Shijiazhuang Zoo. In 2018, the training course for backbone keepers from Northeast and North China cooperative areas of China Zoo Industry Vocational Re-Education and Training Center was held in Shijiazhuang Zoo.

2.3 Key reconstruction and expansion projects

2.3.1 Lotus charm wetland. The project began in April 2015, and the southern ecological wetland landscape project was successfully completed in October. The project is adjacent to the south side of the main road of the park, and is close to approach channel in the west, covering an area of 88 500 m^2. The straight-line distance from east to west is about 380 m; the widest place from north to south is 210 m and the narrowest is only 20 m; the level difference between the east and west is 11 m, and the average level difference with the main road is about 7.5 m. According to the nature of the land, the project deals with the relationship of mountains and waters in a coordinated manner, integrating dam, water body, embankment, beach, wetland, plants and organisms into an organic whole. Plants such as Chinese ash, willow, lotus and pampasgrass are planted to form a good natural ecological wetland landscape, providing a breeding place for wild birds and aquatic organisms such as swans, egrets, kingfishers and wild ducks.

2.3.2 Flood-damaged project. After a heavy rain on July 19, 2016, many of the park's infrastructures were damaged. Im-

mediately after the disaster occurred, the emergency plan for fighting floods and providing relief was launched, and self-help production and garden appearance restoration work was carried out. The basic restoration and construction of 14 severely flood-damaged areas including crane island wetland, north wall, mandarin duck pond, east of chicken farm, south slope of bear valley, region near the line of approach channel, around swan lake and mid-lake island were completed, and swan lake and its surrounding colorful terraces, waterfowl garden, waterside scenery and other characteristic scenic spots were created, which added new scenery to the zoo.

2.3.3 Panda house. In 2016, it was planned to build a panda house in the east part of approach channel on the land of chicken breeding farm, and the construction work of panda house was officially started. The project covered an area of 10 023.22 m^2, including 2 479.18 m^2 of building area and 41.44% of greening rate, and the total investment was nearly 15 million yuan. The construction unit stared construction in March 2018, and the new panda house was officially completed and opened to the public in September 2019, with 4 pandas on display.

2.3.4 Marine polar world. After taking over the Feilong breeding chicken farm in 2016, the marine polar world project composed of white whale exhibition hall, dolphin exhibition hall, sea lion and fur seal exhibition hall and large aquarium was launched. The project construction procedures were officially started in August 2017. The expert discussion meeting of the marine polar world project was organized and held in June 2018, and the polar aquarium entered the construction period in 2019.

3 Problems in the Development of the Zoo and Prospects for the Future Development

3.1 Problems in the development of the zoo So far, the construction of the zoo has experienced three stages: the initial development stage of People's Park, the middle development stage of Western Suburb Zoo and the late development stage of Shijiazhuang Zoo. After two moves, great changes have taken place in the animal welfare and environment of the zoo, and the zoo has now entered a period of fast development. At the same time, there are some factors restricting the development of the zoo. First, there is a serious shortage of frontline breeders due to the system and mechanism of public institutions and other multiple reasons. Second, it is difficult to introduce professional and technical personnel. The treatment of animal diseases mainly focuses on prevention. Wild animals are highly resistant to diseases and it is very difficult to diagnose correctly. The professional and technical personnel needs long-term knowledge accumulation. Third, insufficient funds constrain development. Animal development needs a large amount of funds, such as infrastructure construction, environmental improvement, animal welfare improvement, animal medical equipment, *etc*., and limited funds constrain the development to a certain extent. Fourth, the nature of the land constrains the development of the zoo. As a public welfare cause, most of the lands in the zoo are rented, which seriously restricts the future development of the zoo.

3.2 Prospect of future development of the zoo As a place for collecting and raising various kinds of animals, conducting scientific research and ex situ protection, and for public viewing, scientific popularization and protection education, Shijiazhuang Zoo is one of the indispensable elements in the urban garden green system. In the future, we should continue to set up new development concepts and ? implement the relevant national biodiversity protection requirements focusing on popular science education, animal research work, zoo environment construction, animal environment enrichment and other functions, and promote the development of the zoo by innovating working mechanism, actively striving for money, absorbing technology talent, strengthening scientific management and continuously explore new methods and ways, in order to better serve society and the public.

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