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Mary Renwick Anderson March 22, 2016

Slow and Steady – Losing the Race? Chinese Culture and the Survival of the Turtle

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Abstract

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This is a study exploring unsustainable Chinese cultural practices evolving around the turtle. The analysis of the history of the three main aspects in Chinese culture rooted in the turtle—traditional Chinese medicine, the Chinese pet industry, and Chinese food consumption—highlight the significance of the turtle in Chinese cultural tradition and reasons for the increased demand today. The consequences of turtle consumption in the three areas above, in both the environment and the health sector, are examined through study of turtle aquaculture. The discussion of the impacts turtle farming has had on the environment, communities, and native turtle populations due to demand from Chinese culture practices is followed by analysis of the current efforts by Asian countries to make turtle consumption sustainable, particularly through policy and innovative turtle farming techniques. This study also identifies the reasons for the shrinking turtle populations, zooming in on the unsustainable, unregulated practices in turtle aquaculture resultant from Chinese culture pressures. The study points out that turtle consumption and its impact on the environment are a complicated issue involving cultural traditions, folk practices, government policies, social developmental goals, and individual preferences and desires. The study argues that turtles have had a long tradition in Chinese culture and have been integrated into Chinese daily life. If turtles are to continue to live outside myth, history books, and grandma's stories, concerted efforts between the government, turtle farmers, traders, and individual consumers are indispensable for developing policies, guidelines, and practices to sustain the turtle population.

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INTRODUCTION

"The living chelonians of the world are in perilous decline. Today, there is no more serious turtle crisis than that which is taking place in Southeast Asia and southern China. Southeast Asia is being vacuumed of its turtles for China's markets."

--John L. Behler, Wildlife Conservation Society[1]

In the middle of the eastern edge of Asia lies the world's third largest country by land, approximately 9.6 million square kilometers of agricultural country, and by population, 1.357 billion people.[2] As the world's most populous country and easily accessible resources from the land, China has become the second largest economy with rapid urbanization and an annual GDP growth rate of over ten percent for two decades leading up to 2014. Chinese cities are among the fastest growing in the world, and China currently has over 160 cities with populations over one million.[3] As the Chinese economy developed and the rate of consumption climbed, the concerns for the impact of the consequences resultant from China's astonishing economic growth on the environment intensified.

The Chinese refer to China as *Zhongguo*, translated to Middle Kingdom. The majority of ancient settlements in China developed from the Yellow River to the Pearl River during the Paleolithic age.[4] Findings from this prehistoric period have revealed the hunting, gathering, fishing, planting, and growing techniques of early Chinese civilization, methods that have been influential in the evolution of Chinese food culture.

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[1] "The Asian Turtle Crisis." The Asian Turtle Crisis. http://nytts.org/asianturtlecrisis.html.
[2] "U.S. and World Population Clock." Population Clock. http://www.census.gov/popclock/.
[2] "U.S. and World Population Clock." Population Clock. http://www.census.gov/popclock/.
[3] "China City Information,Chinese Cities, China Province Information, China's Administrative Divisions, China Population." China City Information,Chinese Cities, China Province Information, China's Administrative Divisions, China Population. http://www.chinatoday.com/city/chinese-city-province-information.htm.
[4] Newman, Jacqueline M. *Food culture in China*. Greenwood Publishing Group, 2004.

The study of food culture has emerged around the world, from students and foodies to general readers, all interested in learning about the role food has had in shaping human culture and contemporary society.[5] The connection between food and culture is adopted in this paper to better interpret the importance of previous and existing cultural practices in traditional and the development of contemporary China. In China, like in many other countries, eating practices from ancient records dating back thousands of years ago reveal that food was not just consumed for nurturing the body; it was used for molding social interactions and influencing the exchanges between different ethnic groups and classes.[6] Globalization literally and metaphorically expanded the boundaries of countries' food culture and the ramifications of food consumption. In the now globalized world where countries, economies, and the environment of different countries interconnect, the idea of food is no longer limited to consumption and pleasure within national borders. In Jacqueline Newman's *Food Culture in China*, the contemporary study of eating habits and food culture is connected to key global issues, including economy, war, and sustainability. This global perspective informs this study. My exploration will focus on the foundation of Chinese culture and how the sustainability of this culture and one of the most beloved animals living in the waterways, the turtle, are now imperiled.

China is the object of this study because of its complex economy and its status of being the world's largest food consumer in regards to volume.[7] China's extraordinary economic growth at an annual rate of over ten percent from 2000 to 2014 has greatly increased consumer income, giving rise to important changes in Chinese culture and

[5] Ibid., 1.
[6] Ibid., 4.
[7] Dahlman, Carl, and J. Aubert. *China's development strategy: the knowledge and innovation perspective*. Mimeo, the World Bank Institute, Washington DC, 2000.

consumption. Its demand for an increase in domestic production, however, is constrained by the country's limited and unsustainable agricultural resources.[8] To deal with the stress on domestic production and growing consumerism, China has increased food imports from all around the world and is changing production methods to meet the high demands.

Aquaculture, defined by the National Oceanic and Atmospheric Administration as the "breeding, rearing, and harvesting of plants and animals in all types of water environments including ponds, rivers, lakes, and the ocean" can be broken down into two main categories, marine aquaculture, culturing species native to the ocean, and freshwater aquaculture, producing species from rivers, lakes, and streams.[9] The practice of aquaculture is one of the fastest growing sectors of the world food economy; it has doubled in both volume and worth during the past decade and is now providing one-third of the world's seafood consumption.[10] China is no stranger to aquaculture. The country's inland aquaculture dates back 2400 years, and the farming of fish 1700 years.[11] "Fan Li on Pisciculture," the earliest written work known on fish farming in China from the fifth century B.C., discusses the experience of raising carp in ponds.[12]

The sector of aquaculture in contemporary China has grown exponentially. In 1970, aquaculture production in China measured less than 1.3 million tons, and by 2010 it had grown to 47.8 million, accounting for 61.2 percent of the world's aquaculture

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[8] Zhou, Zhangyue, Weiming Tian, Jimin Wang, Hongbo Liu, and Lijuan Cao. 2012. "Food Consumption Trends in China." *Report Submitted to the Australian Government Department of Agriculture, Fisheries and Forestry. Http://www. Daff. Gov. Au/market-access-trade/food-consumption-trends-in-china*. Accessed December 10 (April): 2012.
[9] "What Is Aquaculture?" Office of Aquaculture. http://www.nmfs.noaa.gov/aquaculture/what_is_aquaculture.html.
[10] Act, Aquaculture. "Aquaculture—a gateway for exotic species." (2001).
[11] "FAO National Aquaculture Sector (NASO)." FAO National Aquaculture Sector (NASO). http://www.fao.org/fishery/countrysector/naso_china/en#tcN70044.
[12] Ibid., 1.

production in weight.[13] China's growth of aquaculture can be attributed to the country's vast land mass and its diverse climates that allow access to a plethora of various species. China has a coastline of approximately 18,400 km, making it easy to transfer a wide range of species to ponds and facilities for farming. China's land mass and the diversity of species have played an integral role in making the country the largest producer of aquaculture in the world in terms of production quantity.[14] In fact, the aquaculture sector of China has transformed food consumption globally. People are no longer limited to eating fish they can catch but can eat fish farmed for mass consumption. In theory, aquaculture has prevented many people from protein malnutrition and has reduced over-hunting of aquatic animals in the wild. This study will prove that this is not the case for one highly demanded animal, the turtle.

Turtles and tortoises have existed for almost 300 million years before the Triassic Era and have endured remarkable changes on Earth. They have outlived preexisting dinosaurs through natural selection pressures that have forced extinction of other animals and reptiles. Taking habitat to every continent except Antarctica, turtles are key to the balance and biodiversity of almost all of the world's ecosystems. Due to their distinctive body structure and effective survival adaptations, turtles have survived and thrived for the last 100 millions of years.[15] The average life span varies from species to species, but the average age of a tortoise is longer than 150 years, and turtles average 70 years.[16] However, those successful survival adaptations—"delayed sexual maturity, high juvenile

[13] Xie, Biao, Jun Qin, Hao Yang, Xia Wang, Yan-Hua Wang, and Ting-You Li. "Organic aquaculture in China: A review from a global perspective." *Aquaculture* 414 (2013): 243-253.
[14] Ibid., 244.
[15] Fund, Turtle Conservation. "A global action plan for conservation of tortoises and freshwater turtles." *Strategy and funding prospectus* 2007 (2002): 30.
[16] "Sea Turtles." NOAA Fisheries. http://www.nmfs.noaa.gov/pr/species/turtles/index.htm.

mortality, and a long adult life-span with low natural mortality"—are failing as the turtle faces pressures from human exploitation.[17] The populations of turtles are shrinking at a devastating rate. Many are seriously endangered, some almost extinct, and a few known only through history and fossil findings.

Turtles play an integral role in the balance of the ecosystem they inhabit, six out of seven of the world continents. Sea turtles are on of the few animals that eat sea grass, fast growing grass that many popular fish and shellfish use as breeding grounds.[18] The decline in sea turtle populations has led to a noticeable decline in sea grass, and without this grass many other marine populations may decline and the food web is jeopardized for marine life, and human life.[19] Sea turtles also play a key role in the formation of dunes, which are important for protecting many communities. Sea turtle eggs supply the nutrients that create stability of shorelines and species distribution. Dunes are limited in nutrients, and the sea turtle eggs that do not hatch act as nutrients, as well as attract predators that can bring nutrients in their feces. Without sea turtles, shorelines may disappear into established cities. The main source of food for leatherback turtles is jellyfish.[20] The number of jellyfish in the ocean have increased in recent years because of the decline in leatherback turtles, that can be found in China's turtle market. The increase in jellyfish does not only make swimmers more jellyfish sting prone, but also impacts the

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[17] Ibid., 4.
[18] "Information about Sea Turtles: Why Care?" Sea Turtle Conservancy. Accessed February 08, 2016. http://www.conserveturtles.org/seaturtleinformation.php?page=whycareaboutseaturtles.
[19] Ibid., 1.
[20] "Biological, Cultural and Economic Significance." World Wildlife Fund. Accessed January 11, 2016. http://wwf.panda.org/what_we_do/endangered_species/marine_turtles/asian_marine_turtles/background/.

amount of fish in the ocean.[21] Jellyfish eat larval fish, and with an increase in populations less fish are reaching adulthood. The decline in turtle populations have already been impacting the ecological balance in waterways. Sea turtles graze against coral reefs, and this grazing has been scientifically proven to improve the growth rate of coral reefs. Scientists believe that the decline in turtle populations can be attributed to the decline in coral reefs globally.[22] Unfortunately, the demand from Chinese culture has significantly decrease turtle populations, and the ecosystem is already seeing devastating consequences that if continue, could but the entire ecosystem at risk .[23]

Of all the dangers turtle populations in China are facing, the most pressing is the uncontrollable and devastating harvesting and commercialization to meet the growing demand of Chinese culture, more specifically traditional medicinal, food customs, and pet trade.[24] The aquaculture sector is one of the main threats to freshwater waterways where turtles reside. The United Nations has reported 11 percent of the world unable to access drinking water.[25] The UN is specifically focused on sustainable development of delicate freshwater systems, which it states are under increasing stress largely due to population increase and the the demands of agricultural use.[26] Turtle farming in China is one of the dirtiest aquaculture practice and action needs to be taken.[27] Currently, Asia is the largest consumer and supplier in the turtle market which is having devastating impacts on the

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[21] Ibid., 1.
[22] Ibid. 1.
[23] Ibid., 6.
[24] Turtle Conservation Fund, 7.
[25] Water, U. N. "The United Nations World Water Development Report 3–Water in a Changing World." (2009).
[26] "Global Issues at the United Nations." UN News Center. Accessed February 29, 2016. http://www.un.org/en/globalissues/water/.
[27] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China.", 795.

native populations.[28] Phrases such as 'Asia's Turtle Tragedy' and 'The Terrible Turtle Trade' are being used to convey the gravity and urgency of this issue.[29] Measured in tons of live turtles per day, southern China imports more than 10 million individuals per year from the Southeast Asian region.[30] The intercontinental turtle trade has impacted turtle populations in not only Southeast Asia, but the entire world. To meet the demand for turtles in China, turtles are being farmed in the United States and then exported to China to be sold in the turtle market. [31] Not isolated to China, Chinese food culture spans across Asia. Worldwide countries have invested in turtle aquaculture through construction of turtle farms. However, the hopes of increasing the rate of turtle reproduction on turtle farms has failed, and the decline in turtles persists even as the aquaculture industry expands.

The situation is dire and urgent. This study explores the driving forces behind turtle endangerment that will be followed back through the history of Chinese culture to the establishment of Chinese society. The turtle has traveled through centuries of diverse Chinese generations, but through the differing dynasties and country revolutions, the meaning and significance of the turtle has remained. Although the Chinese have continued to value the turtle and sustain its worth, the turtle can no longer sustain itself. Now, the Chinese culture around the turtle is threatening the very foundation of its practices.

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[28] Cheung, Sze Man, and Alex T. Chow, 3.
[29] "Asia's Turtle Tragedy - National Wildlife Federation." Asia's Turtle Tragedy - National Wildlife Federation. https://www.nwf.org/News-and-Magazines/National-Wildlife/Animals/Archives/2006/Asias-Turtle-Tragedy.aspx.
[30] van Dijk, Peter Paul, Bryan L. Stuart, and Anders GJ Rhodin. *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia--Phnom Penh, Cambodia, 1-4 December 1999*. Lunenburg, Mass.: Chelonian Research Foundation, 2000.
[31] Turtle Conservation Fund, 6.

Chapter One addresses the history of three main aspects of Chinese culture rooted in the turtle: traditional Chinese medicine, the Chinese pet industry, and Chinese food culture. By highlighting the influence of the turtles throughout China's journey to present day, the chapter seeks to understand the development of Chinese cultural practice involving the turtle. Chapter One reaches into the contemporary era and discusses the changes in China's food consumption patterns as the result of economic development in the past three decades. Focusing on the negative impacts from the three sectors of Chinese turtle culture laid out in Chapter One, Chapter Two evaluates the consequences caused by cultural practices turtle consumption, food consumption. By examining international organizations involved in regulating wildlife trade, the current government action will be addressed and the failure to combat turtle population decline in Asia will be better understood. Chapter Three explores the possibility of sustainable turtle farming and the benefits the industry could generate, leading to improved environmental law enforcement and knowledge about the decline in turtle populations from within the Chinese community. Turtle consumption and its impact on the environment are a complicated issue involving cultural traditions, folk practices, government policies, social developmental goals, and individual preferences and desires. Through analysis of Chinese culture and an understanding of its roots in Chinese society and turtle consumption trends, efforts are proposed to resolve the turtle crisis and sustain Chinese culture. However, to successfully engage in the aforementioned initiatives towards resolving the turtle crisis, a thorough understanding of the turtle in Chinese culture must be established. To adapt a famous appeal by Lu Xun, the father of modern Chinese

fiction, who called for the society to wake up and create a modern China in the 1910s, "save the turtles."

CHAPTER ONE: History of Chinese Culture and Turtle Demand

There are three sectors of turtle trade in China: traditional Chinese medicine, pet trade, and food consumption. Each of these sectors has had a long history in Chinese culture going back thousands of years, in which turtles acquired symbolic meanings and practical use. This longstanding tradition has influenced the expansion of turtle trade in contemporary China and led to one of the largest unsustainable markets. Besides cultural factors, changes in China's economy, population, and governance have also played an important role in the largest turtle trade ever in the country's history.[32] To understand the turtle trade in China, we therefore must also consider how changes in national economy and individual consumption patterns also impact food culture. For example, the main reasons for turtle consumption as food, particularly turtle meat, must be conjoined with an understanding of the development of the country that contributes to changes in people's eating habits and food preferences. In the last thirty years in both the urban and rural populations of China, consumption of aquatic products increased due in part to the exponential population growth and Chinese economic reforms.[33] This chapter will lay out the cultural and economic influences on the three leading sectors of turtle trade that see the highest demand for turtles in China—medicine, pet use, and consumption—to map out the history of each sector and the reasons of the increasing demand for turtles in China.

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[32] "Organic aquaculture in China: A review from a global perspective.", 243-253.
[33] Liu, Jianguo, and Jared Diamond. "China's environment in a globalizing world." *Nature* 435, no. 7046 (2005): 1179-1186.

A. Chinese Divination and Writing System

The turtle is commended in China as one of the four spiritually-endowed creatures, and is highly regarded in the Confucian Classics, particularly in the Book of Rites.[34] It is said to possess several different powers, including the power of foresight. As a result, in the early establishment of Chinese civilization, the turtle became key to rituals involving ancestor worship and divination. The practice of divination stems from the Chinese belief that the ancestors who passed away possessed great power and influence over the living, which gave rise to the practice of propitiatory sacrifice as a form of ancestor worship.[35] Oracle bones were used to read future outcomes in divination practices. Holes were punctured into each half of the shell. Once heated with an inflamed stick, the bone developed cracks. Diviners read and interpreted these cracks. First, the diviner would state one positive statement and one negative for the two halves of the oracle bone.[36] Then, depending on where the cracks formed, the answers would be read foreseeing a positive or negative outcome. Finally, these outcomes were carved into the bone for documentation.

Divination from the cracks in the oracle bone "was a method of predicting the future and ensuring a favourable outcome for the enquirer by identifying the correct target of appeasement."[37] The oracle bones (甲骨), more than three thousand years old inscribed with Chinese characters kept in the Hopkins Collection at the Cambridge

[34] Allan, Sarah. *Shape of the Turtle, The: Myth, Art, and Cosmos in Early China*. SUNY Press, 1991.
[35] Ibid., 1.
[36] Chang, Kwang-chih. "Archeology of ancient China." *Science* 162, no. 3853 (1968): 519-526.
[37] Ibid., 1.

University Library, are the oldest written material in history.[38] As described by the Cambridge University Library, the "oracle bone texts are the oldest extant documents written in the Chinese language" used to "record questions to which answers were sought by divination at the court of royal house of Shang 商, which ruled central China between the 16th and 11th centuries B.C."[39] During the Shang period, it was believed that the royal family had premonitions of upcoming events, and they were able to manipulate the outcome. The practice of divination to examine cracks formed from heating is not isolated to specific time periods and can be seen in many different cultures throughout Chinese history, and outside China, too.

Archeologists believe that oracle bones used in divination represent the beginning of the Chinese writing system.[40] It is uncertain when and where the Chinese writing system began, but the first verification of it was found in Henan Province at Wuyang in central China.[41] The excavation found symbols scripted on turtle plastrons, the ventral part of the turtle shell, that were estimated to be from between 8500-7500 B.P.[42] The symbols strongly resembled Chinese characters and are believed to have represented a form of protowriting. Before this was realized in the late 1800s, turtle shells were thought to be solely a medicinal ingredient in traditional Chinese medicine,. When oracle bones were excavated in China during the 1880s, archeologists had little understanding of the

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[38] Li, Xueqin, Garman Harbottle, Juzhong Zhang, and Changsui Wang. "The earliest writing? Sign use in the seventh millennium BC at Jiahu, Henan Province, China." *Antiquity* 77, no. 295 (2003): 31-44.
[39] "Oracle Bone." Cambridge University Library. http://www.lib.cam.ac.uk/mulu/oracle.html.
[40] Guo Moruo, ed., *Jiaguwen heji* (Beijing: Zhonghua zhuju, 1978-83) [FB.285.174-186]
[41] "The earliest writing? Sign use in the seventh millennium BC at Jiahu, Henan Province, China.", 44.
[42] *Shape of the Turtle, The: Myth, Art, and Cosmos in Early China*., 15.

meaning and importance of the symbols inscribed on the bones.[43] It was not until almost 20 years later at the turn of the century that scholars realized the value of these artifacts.

B. Traditional Chinese Medicine

In order to examine the use of turtles as an ingredient in medicine, first an understanding of the connection between traditional Chinese medicine and Chinese food culture must be established. The author of *The Food of China*, E.N. Anderson, points out that the boundary between medicine and food during the Han period was almost nonexistent.[44] While the Chinese used turtle as an ingredient in medicine, they also used it for household recipes. In the herbal Chinese medicine, Materia Medica, the turtle shell is still being used as a medicinal agent in the rehmannia-based formulas to nourish the *yin* and settle the *yang*. *Yin* and yang describes a complex opposing energies that cannot exist without each other, represented on a half-black, half-white medallion.[45] Each half has a dot of the other color, signifying dependence on the other to be whole. The elements of balance have been one of the core foundations in traditional Chinese medicine, acting as the source of diagnosis and healing methods. *Yin* is the black half of a medallion, containing a white dot to represent the seed of yang. At a basic level of traditional Chinese medicine, the treatments seek to balance the yin and yang. The turtle was one of the treatments for this rooted idea in traditional Chinese medicine, one that was both spiritual and holistic. It is most often included in pills, with about 2 grams of shell in the daily dose.

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[43] Loewe, Michael, and Edward L. Shaughnessy. *The Cambridge history of ancient China: From the origins of civilization to 221 BC*. Cambridge University Press, 1999.
[44] Anderson, E. N. *The Food of China*. New Haven: Yale University Press, 1988.
[45] Patwardhan, Bhushan, Dnyaneshwar Warude, Palpu Pushpangadan, and Narendra Bhatt. "Ayurveda and traditional Chinese medicine: a comparative overview." *Evidence-Based Complementary and Alternative Medicine* 2, no. 4 (2005): 465-473.

Traditional Chinese medicinal practice uses primarily soft shell turtles, leading to their high demand in the Chinese medicinal market. Different parts of the turtle are adopted for different uses. Chinese traditional healers believe that the shell from a soft shell turtle can treat a low-grade fever, chronic hepatitis, and hepatosplenomegaly (swollen spleen and liver often caused by mononucleosis or viral hepatitis); the head of the soft shell turtle can help cure proctoptosis (prolapse of the rectum) and hysteroptosis (displacement of a viscus); the meat reduces hot flashes in menopause and Bell's palsy; and the eggs can be used for *yin* deficiency.[46] Turtle jelly, in Chinese referred to as *Gui-ling-gao (*龟苓膏), is another traditional herbal remedy for clearing toxins in the blood and nourishing the *yin*. People also believe that it can improve skin disorders and minimize effects from damp-heat on the body, hepatoprotective.[47] *Gui-ling-gao* has two main ingredients: turtle shell and Rhizoma Smilacis Glabrae. It is made by boiling the turtle shell for almost an entire day and then adding many different herbs until the broth becomes black goo.[48] One of the highest recommendations for treatment within traditional Chinese medicine is turtle soup, believed to revive failing kidneys. Although it began as a treatment, turtle soup has also become a food delicacy. Chinese still consume the recipe for the famed health benefits, but it has become common for making dinner and the demand has exceeded that which is request for the sick.

Chinese medicine is not only widely practiced in mainland China but also throughout Taiwan. An island off the coast of Southeast China, Taiwan and the mainland

[46]"Soft Turtle Shell (Bie Jia)." Chinese Herbs Healing. http://www.chineseherbshealing.com/soft-turtle-shell-bie-jia/.
[47] Zhang, Qing-Feng, and Hon-Yeung Cheung. "The content of astilbin and taxifolin in concentrated extracts of Rhizoma Smilacis Glabrae and turtle jelly vary significantly." *Food chemistry* 119, no. 3 (2010): 907-912.
[48] Ibid., 910.

share many different cultural practices, especially in regards to ancient traditions that existed in China before the formation of Taiwan due to their common ethnic and cultural origins. If the culture in Taiwan and the mainland had already had close ties, the migration of more than a million people from the mainland to Taiwan around 1949 when the Nationalist government relocated to the island after its defeat by the Communist forces in the civil war further strengthened the practice of Chinese culture among the local population. For this reason and for the reason that all turtles used in Taiwan medicinal market are almost entirely imported, data of turtle-shell products in the traditional Chinese medicine market from Taiwan will give us an approximation of the scale of both the market as a whole and turtle use within the market in the region, of which mainland China is the largest market.[49] Analysis of turtles imported into Taiwan for medicinal purposes has shown over 20 non-marine chelonian species used in the market. Twenty-five percent of these species were listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora and are commonly used in the traditional Chinese medicine recipes.[50]

The annual import of Taiwan's trade volume of hard-shelled turtle shells increased drastically in the turn of the century. In 1993-1998, 136 metric tons/year were reported, but in the following nine years, 1999-2008, the trade volume exceeded 198 metric tons/year.[51] The increase happened around the time mainland China and Taiwan faced enormous economic growth and population increase, possibly impacting the

[49] Chen, Tien-Hsi, Hsien-Cheh Chang, and Kuang-Yang Lue. "Unregulated trade in turtle shells for Chinese traditional medicine in East and Southeast Asia: the case of Taiwan." *Chelonian Conservation and Biology* 8, no. 1 (2009): 11-18.
[50] Ibid., 12.
[51] Ibid., 13.

traditional Chinese medicine trade. The amount reported now suggests that the shells of millions of turtles and tortoises are being consumed annually in Taiwan alone.[52] Taiwan is only a fraction of turtle trade in the traditional Chinese medicine market. The large trade volume reported in Taiwan suggest the total trade volume worldwide is exponentially higher.

When the nutritional value of turtles was tested by experts outside of the traditional Chinese medicine industry, the levels did not match those that were being claimed by market professionals. A recent study concluded that turtle jelly, made from the shell of endangered turtle species and sold at high prices because of the acclaimed health benefits, could be substituted by cheaper, local ingredients, including mineral supplements or other less threatened animals.[53] Furthermore, the levels of fatty acids in turtles claimed by in the traditional Chinese medicine market were found to be actually significantly lower than levels in crab and shellfish, and the amino acids in turtle shells were actually the most difficult for the human body to digest.[54]

C. Pet Trade and *Fangsheng*

Ted Williams of the National Audubon Society coined the term "the Terrible Turtle Trade" in 1999 when he first assessed the harmful consequences the turtle pet trade was having on the environment and turtle species.[55] Ten years after his research, the

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[52] Ibid., 16.
[53] Meiling, Hong, Shi Haitao, Fu Lirong, Gong Shiping, Jonathan J. Fong, and James F. Parham. "Scientific refutation of traditional Chinese medicine claims about turtles." *Applied Herpetology* 5, no. 2 (2008): 173-187.
[54] Ibid., 185.
[55] Williams, Ted. "The Terrible Turtle Trade." New York Turtle and Tortoise Society. March 1, 1999. http://nytts.org/asia/twilliams.htm.

turtle pet trade was estimated to be worth over $20 million annually.[56] China is home to the largest turtle pet market in the world, Yuehe Pet Market in Guangzhou.[57] The market sells live chelonians and other animals, and led to surveys of the region in August 2006 to March 2008 to find out just how extensive the market was. There were over 39,000 individual chelonians, spanning 61 species, adding up to 19.1 percent of the global total of 319 species.[58] TRAFFIC, the wildlife trade monitoring network, has difficulty monitoring turtle pet trade because many turtles are caught and sold illegally.[59] Not only is it difficult to identify the growth of the turtle pet trade over the years, but it is also a more complex animal to trade than others sold as pets. Turtles are highly susceptible to extracting salmonella, and the size of certain turtles, for example the baby red-eared slider that is can be as small as a dollar coin, make them fun to play with but highly infectious. In 1975, the Food and Drug Administration placed a ban on selling baby red-eared turtles within the United States due to the number of salmonella cases from turtle owners.[60] The red-eared slider turtles are more hardy, making them popular choice for pet stores. The red-eared slider species spreads disease quickly, and there have been devastating cases for households. The adults are no less infectious, but because they are larger in size, they are seen as less likely to be handled.

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[56] Gong, Shi-Ping, Alex T. Chow, Jonathan J. Fong, and Hai-Tao Shi. "The chelonian trade in the largest pet market in China: scale, scope and impact on turtle conservation." *Oryx* 43, no. 02 (2009): 213-216.
[57] Ibid., 215.
[58] "The chelonian trade in the largest pet market in China: scale, scope and impact on turtle conservation.", 213-216.
[59] "TRAFFIC - Wildlife Trade News - Illegal Pet Trade Threatens Freshwater Turtles And tortoises." TRAFFIC. Accessed January 29, 2016. http://www.traffic.org/home/2008/1/8/illegal-pet-trade-threatens-freshwater-turtles-and-tortoises.html.
[60] Hardy, Tad. "The tortoise and the scare." *Bioscience* 38, no. 2 (1988): 76-79.

Ironically, turtles are also bought from the pet trade market for the sole purpose of being released back into the wild. *Fangsheng*, meaning releasing lives in Chinese, is a ritual regularly practiced by Buddhist monks. The ceremonial act of freeing the captive animal into its rightful habitat is meant to express compassion for the heart and soul of the animal. It first appeared in literature during the fifth century in Book of Brahma's Net, Fanwang jing.[61] The Buddhist school of Tiantai was formed in the sixth century of the common era and had monumental impact on the spread of *fangsheng* across China. One of the Tiantai Buddhist masters, Master Zhiyi (538-597) built the first pond solely for the practice of releasing living things, *fangsheng chi*.[62] The Buddhist Masrer Zhiyi continually observed fisherman killing their catches, and he believed negative karma was building in the community due to this constant harm to the animals. He saw the *fangsheng chi* as a place for fishermen to release their caught fish.[63] Zhiyi purchased over 60 ponds for fishing and reclaimed them as ponds for animal release. The master preached Dharam of the Lotus Sutra to those released in the pond, and the practice became a major part of the Tianti school.[64] During the Tang dynasty (618-907) when Buddhism became widespread, the practice saw a rise, and ponds were increasingly built for the specific purpose of animal freedom.[65] The practice also received royal endorsement. The Tang dynasty emperors supported Buddhist masters all over the country in their practice of animal release and invested in transforming lakes into sacred

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[61] Tokuno, Kyoko. "The Book of Resolving Doubts Concerning the Semblance Dharma." *Buddhism in Practice:(Abridged Edition)* (2015): 187.
[62] Shiu, Henry, and Leah Stokes. "Buddhist animal release practices: historic, environmental, public health and economic concerns." *Contemporary Buddhism* 9, no. 2 (2008): 181-196.
[63] Ibid., 184.
[64] Buswell Jr, Robert E., and Donald S. Lopez Jr. *The Princeton Dictionary of Buddhism*. Princeton University Press, 2013.
[65] "Buddhist animal release practices: historic, environmental, public health and economic concerns.", 185.

areas for the ritual. The Tang emperor, Su Zong, established eighty-one ponds to increase kindness and trust from the people.[66] The practice continued beyond the Tang era. During the Song dynasty (960-1279) officials proposed assembling by the West Lake one day a year, the 8th day of the 4th moon, to release animals and pray for the emperor's good luck.[67] During the 1580's, the practice became more common among the scholarly elites, who wrote about their performance of the practice and their concern for animals, mentioning by name turtles and tortoises. The reason of this popularity in the scholarly community is unknown, but it did parallel with a time when Jesuit missionaries were frequenting elite groups and converting many literary writers. In many Ming-Qing texts, 1368 to 1912, animals also became an analogy for members of the community who were too afraid to stand up for themselves or were seen as weaker.[68] Seen as needing protection, the animals released represented protecting the weaker population. Whether in the Buddhist or literary community, the practice was motivated by compassion for others. It was also coupled with the belief of the accumulation of good karma for longevity and good health and that good karma could be transferred to one's loved ones.[69] Various animals were used in the *fangsheng* ritual but the turtle was and remains the most popular one. Today, the religious ritual is practiced at nearly every temple in China, where turtles are readily available "for people to set free into the sea with prices ranging from 39-1,000

[66] Ibid., 183.
[67] Smith, Joanna F. Handlin. "Liberating animals in Ming-Qing China: Buddhist inspiration and elite imagination." *The Journal of Asian Studies* 58, no. 01 (1999): 51-84.
[68] Ibid., 64.
[69] Tarocco, Francesca. *The cultural practices of modern Chinese Buddhism: Attuning the dharma*. Vol. 27. Routledge, 2007.

yuan."[70] The most expensive animal available was the sea turtle, available at the price of 50,000 yuan.[71] The study found that these turtles that were released into the wild are then caught to be sold into the turtle market. In 1999, a survey was done in Taipei that interviewed 1,000 people at random about whether they had ever participated in the ritual of animal release.[72] The study found that 29.5 percent of those interviewed had partaken in the act. Although an ancient ritual, it is still impacting ecosystems and turtle populations.

D. Chinese Food Culture

Turtles feature prominently in Chinese food culture dating back to its ancient past. Although there is evidence of earlier Chinese hominids in the country, China's recorded history opens with the Shang dynasty.[73] The dates, however, are still heavily argued by scholars today, with a range of opinions from 18th to the mid-16th century B.C.E. No matter the range, it is certain that the dynasty aligned during the bronze age. In the late 1920s, Yin, the last capital to the Shang, was uncovered and along with it thousands of artifacts from the period including bronze drinking container, utensils, axes, and tombs that offered useful clues to the history of China and today's customs.

One aspect of China's ancient cultural practices revealed by the artifacts is the findings of various cooking utensils and ingredients. Of special interest to us is the fact that shells were found in stew pots. Scholars conclude that "trade brought some exotic

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[70] Xin, Yang. "Money Sours Buddhism's Ceremonial Animal Release." Beijing Today. November 07, 2015. https://beijingtoday.com.cn/2015/11/money-sours-buddhisms-ceremonial-animal-release/.
[71] Ibid., 1.
[72] Severinghaus, Lucia Liu, and Li Chi. "Prayer animal release in Taiwan."*Biological Conservation* 89, no. 3 (1999): 301-304.
[73] "The Food of China," 25.

artifacts to the area; central China was scoured for turtles, and some species found originated from South China."[74] The discoveries prove that the food practices were not local and that the fad of turtle consumption was already heavily seen in trade even in this prehistoric decade. Fast forward to the Han dynasty, the second great imperial dynasty lasting from 206 B.C.E to 220 C.E.[75] The Han dynasty was iconic for the establishment of what is now considered Chinese culture, and the term "Han" is used when referring to someone who is ethnically Chinese. The period is famous for the development of a comprehensive agricultural development policy implemented by the imperial government which has since remained in China throughout history, although sometimes only representing a "pious hope" as Anderson describes it.[76] This policy included implementation of government-run agricultural colonies that aided in the exchange of land and equipment by having the farmers pay a share of the crop yield.[77] Turtles and tortoises were apparently among the popular foods of the Han as turtle shells and turtle bones were found among documentation in the kitchen and archeology digs.[78] This further proves Anderson's claim of non-existence of boundary between medicine and food in China's food culture.

Anderson explains that animals that are "very tenacious of life, or very unusual-looking and –acting, are regarded as having special powers," and among these are soft-

[74] Ibid., 52.
[75] Ibid., 144.
[76] Ibid., 43.
[77] Dubs, Homer H. *History of the Former Han dynasty*. Baltimore, MD: Waverly Press, 1938.
[78] Ibid., 67.

shelled turtles and tortoise.[79] Tortoises were chosen for their "phallic-looking heads," which is repeatedly used in folklore to promote potency.[80] In multiple sources of folklore, if a tortoise mates with a snake, it is a sign of impurity. The eggs were abandoned because of impurity, and the term "tortoise egg" became an abusive expression used towards a person born out of wedlock to imply corrupt moral character. Today, calling someone a "tortoise egg" is one of the worst insults you can say in Chinese.[81] These small traditions have been passed down throughout generations, seeping into the Chinese culture and language.

E. The Growing Demand

Traditional practice and folk beliefs are not the factors behind turtle consumption. China's economic development is an important driving force that cannot be overlooked. The soft-shelled turtle was seen as a delicacy because of taste when cooked correctly. Take Teochiu cooking for example. The Teochiu cuisine that embodies the tastes of both eastern and southern cooking in China is viewed as "one of the finest and most distinctive in China."[82] Representative of Cantonese cuisine, Teochiu cooking viewed stewed turtle as a specialty.[83] Not limited to Guangdong Province where the Cantonese live, the recipes are available all across China and each has their own ideas of how to best cook food, but each includes the turtle in their recipes.

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[79] Anderson, Kym. "Changing comparative advantages in China: effects on food, feed and fibre markets." *Changing comparative advantages in China: effects on food, feed and fibre markets.* (1990).
[80] "The Food of China"., 186.
[81] Ibid., 55.
[82] Ibid., 201.
[83] Ibid., 200.

Even though turtles were among preferred food items, in the socialist era (1949-1976) scarcity of food prevented the majority of people from enjoying this traditional item as much as they would have liked. After the Communist Party of China came into power in 1949, China began a centrally planned command economy adapted from that of the Soviet Union. The system included the abolition of household agriculture in favor of collectives, referred to as the "Rural People's Communes." The State Planning Commissions had complete control over the industrial input and output and gradually removed market forces in economic planning and commerce. Consumer goods were rationed, and wages of workers were set. The disastrous movement of the Great Leap Forward (1958-1961) promoted by then CCP chairman Mao Zedong to jump start China's modernization was partly responsible for a devastating famine, leading to approximately thirty million deaths according to one estimate.[84] Poverty was widespread and shortage of goods was a norm. Making a virtue out of necessity, the Communist ideology preached frugal living, condemning desire to consume as capitalist and politically wrong.

All this changed in 1977. Returning from political exile, Deng Xiaoping returned to China's political arena with a reformist agenda, and after all the turmoil in the past ten years of the Cultural Revolution, the Party and the people were finally ready to embrace new policies and reforms. The economic reforms first focused on agriculture, and new state policies encouraged economic incentives and the idea of pay based on amount and quality work. The previous concept of the "iron bowl" policy of state-assigned jobs and pay was eliminated, and with it, egalitarianism. China also began to actively integrate

[84] Perkins, Dwight Heald. "Reforming China's economic system." *Journal of Economic Literature* 26, no. 2 (1988): 601-645.

itself into the international community. In March 1979, Deng Xiaoping gave a speech advising "all those who can do so should learn foreign languages, so as to be able to read important foreign works on the social sciences without difficulty."[85]

With the implementation of new economic policies and privatization described above, China's economy took off and individual income climbed. Figure 1.1, Figure 1.2, and Figure 1.3 show an increase from 2006 to 2014 in average yearly wages for Chinese workers, China's GDP per capita, and China's population growth rate. These figures demonstrate an increase in demand because there are more people to feed, and more people with income willing to spend more for what they want. According to the World Economic Forum, the change in consumption in recent years in China was driven by the increase in the upper-middle-class and affluent households. Wage increases gave people more spending power, resulting in a different consumption culture in China. While older generations were taught frugal habits, only buying what was needed, with more money in hand, a new generation of consumers came into being who are freer with spending habits and more sophisticated in consuming. Consumption has become a new way of life. The World Economic Forum estimates that in 2020 the rate of consumption, the quantity of goods and services used during a particular period , in households with annual income more than $24,000 will rise to 81 percent.[86] Within that statistic, the demographic of 35 years or younger will make up 65 percent of the consumption growth.

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[85] Goldman, Merle. *Sowing the seeds of democracy in China: Political reform in the Deng Xiaoping era*. Harvard University Press, 1994.

[86] "3 Great Forces Changing China's Consumer Market." World Economic Forum. Accessed January 26, 2016. https://www.weforum.org/agenda/2016/01/3-great-forces-changing-chinas-consumer-market/.

Figure 1.1 | Average yearly wages in China

Source: Trading Economics – China Average Yearly Wages

Figure 1.2 | China GDP Per Capita

Sources: Trading Economics – GDP per Capita

Figure 1.3 | China Population Growth Rate

Source: Trading Economics – China Population

Figure 1.4 shows the World Economic Forum's estimate for consumption growth between 2015 to 2020 for the top consuming countries in the world. The estimated growth rate from 2015 to 2020 for China, shown in blue, estimates consumption growth 1.3 times that of Germany and the United Kingdom in just a five year span.[87] According to the same source, current upper-middle-class consumers who are 35 years of age and younger are spending on average 40 percent more than the last generation at the same income level. Demand for premium goods and services, including education, healthy eating, and travel will rapidly develop and dominate the consumption trends. The younger generation is also eight times more likely to graduate from college and twice as likely to travel abroad.[88] These transformations in wages, GDP, and population have led to a new generation of spenders who are influencing demand for turtles.

[87] Ibid., 1.
[88] Ibid., 1.

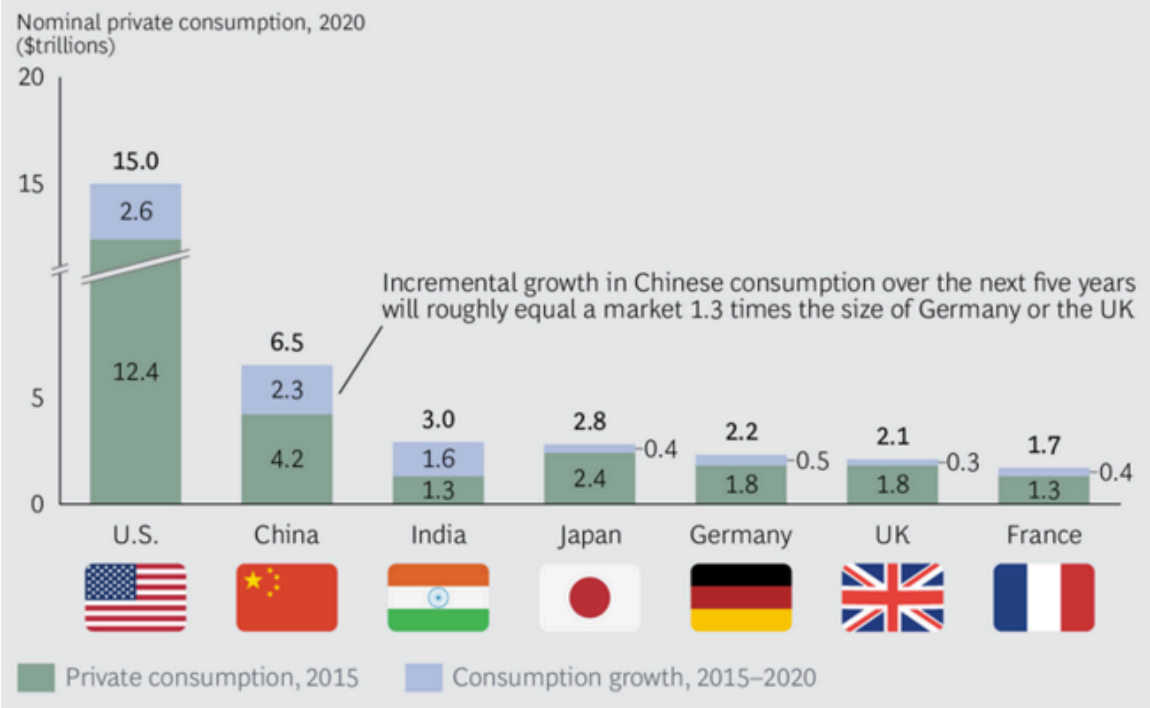


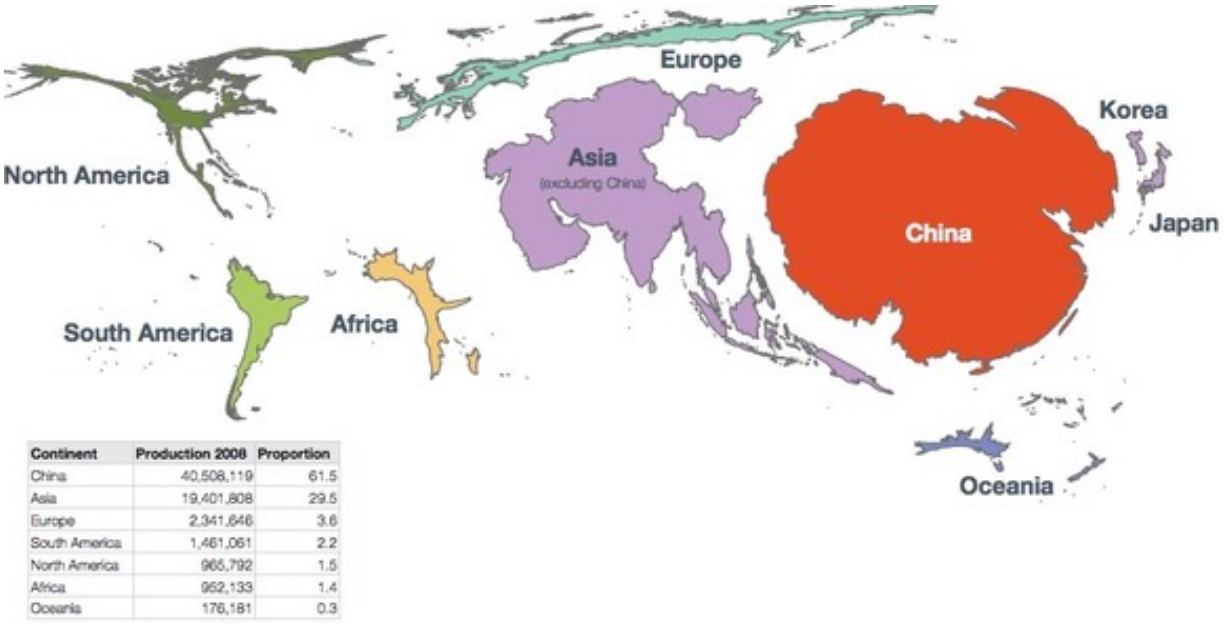
Figure 1.4 | Nominal private consumption increases estimated between 2015 to 2020 (trillions)

Source: World Economic Forum

One area notably impacted by this new consumption culture is aquaculture. The demand for seafood, seen in China as a more luxurious food than meat, saw a dramatic increase. China is leading the aquaculture sector of the world, and it is not a close race. According to the World Fish Center and Conservation International records for global aquaculture production, China accounted for 61.5 percent of the world's aquaculture sector in 2008, including exports.[89]

[89] "The Scariest Chart About Seafood You'll See This Year." The Atlantic. http://www.theatlantic.com/health/archive/2011/06/the-scariest-chart-about-seafood-youll-see-this-year/240465/.

In Figure 1.5, China is illustrated as its own continent to emphasize the dramatic difference in aquaculture production in volume in comparison to other continents. Chinese aquaculture production accounted for more than all the other continents combined in aquaculture production in 2008.



Continent	Production 2008	Proportion
China	40,508,119	61.5
Asia	19,401,808	29.5
Europe	2,341,646	3.6
South America	1,461,061	2.2
North America	965,792	1.5
Africa	952,133	1.4
Oceania	176,181	0.3

Figure 1.5 | World aquaculture production by continent in 2008 with land area proportionate to reflect production volume

Source: The Atlantic

Figure 1.6 can be seen that direct consumption of food grains and vegetables have seen a decline in per capita, whereas aquatic products such as seafood and animal products such as meat, dairy, and eggs have seen a steady increase in per capita consumption. The changing Chinese food culture has meant a shift in aquaculture demands, and although there are certain aquaculture products that have been demanded for centuries because of acclaimed health benefits, the extraordinary economic growth in recent decades has shifted the demands to an unsustainable level. It is obvious that the

younger generation is willing to spend for the high end product, and seafood has been seen as more of a luxury than agriculture products. Aquaculture products have traditionally been seen as more preferred items because they are not easily farmed like cows and pigs, and this preference seems to have persisted. The per capita aquaculture supply has experienced an increase from 0.7kg in 1970 to 7.8 kg in 2006, producing an average annual growth rate for the aquaculture sector of 6.9 percent.[90] According to Broughton and Walker, China's production of aquatic animals in 2009 totaled 36.2 million tons, and the pond yield alone made up for over 69.9 percent of the entire inland aquaculture.[91] Due to size of the country, its population and economy, it is not surprising that China has become the world's largest producer of aquatic animals.[92]

[90] Cai, Chunfang, Xiaohong Gu, Yuantu Ye, Caigeng Yang, Xiuying Dai, Dongxing Chen, and Chao Yang. "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China." *Aquaculture Research*44, no. 5 (2013): 795-806.
[91] Broughton, Edward I., and Damian G. Walker. "Policies and practices for aquaculture food safety in China." *Food Policy* 35, no. 5 (2010): 471-478.
[92] Ibid., 801.

a) Rural

Year	Per capita income	Food grains	Vegetables	Cooking oil	Meats	Poultry	Poultry Eggs	Aquatic products	Sugar	Alcoholic drinks	Milk and dairy products
1978	134	248	142	1.96	5.76	0.25	0.80	0.84	0.73	1.22	n.a.
1980	191	257	127	2.49	7.75	0.66	1.20	1.10	1.06	1.89	n.a.
1985	398	257	131	4.04	10.97	1.03	2.05	1.64	1.46	4.37	n.a.
1990	686	262	135	5.17	11.34	1.26	2.41	2.13	1.50	6.14	n.a.
1995	1578	259	105	5.80	11.29	1.83	3.22	3.36	1.28	6.53	0.64
2000	2253	250	107	5.45	14.41	2.81	4.77	3.92	1.28	7.02	1.06
2001	2366	239	109	5.51	14.50	2.87	4.72	4.12	1.43	7.10	1.20
2002	2476	237	111	5.77	14.87	2.91	4.66	4.36	1.64	7.49	1.19
2003	2622	222	107	5.31	15.04	3.20	4.81	4.65	1.24	7.67	1.71
2004	2936	218	107	4.31	14.76	3.13	4.59	4.49	1.11	7.84	1.98
2005	3255	209	102	4.90	17.09	3.67	4.71	4.94	1.13	9.59	2.86
2006	3587	206	101	5.84	17.03	3.51	5.00	5.01	1.09	9.97	3.15
2007	4140	199	99	5.96	14.88	3.86	4.72	5.36	1.07	10.18	3.52
2008	4761	199	100	6.25	13.94	4.36	5.43	5.25	1.11	9.67	3.43
2009	5153	189	98	6.25	15.33	4.25	5.32	5.27	1.07	10.08	3.60
2010	5919	181	93	6.31	15.80	4.17	5.12	5.15	1.03	9.74	3.55

b) Urban

Year	Per capita income	Food grains	Vegetables	Cooking oil	Meats	Poultry	Poultry Eggs	Aquatic products	Sugar	Alcoholic drinks	Milk and dairy products
1982	535	145	159	5.78	18.67	2.26	5.88	7.67	2.80	4.48	n.a.
1985	739	135	144	5.76	19.32	3.24	6.84	7.08	2.52	7.80	n.a.
1990	1510	131	139	6.40	21.74	3.42	7.25	7.69	2.14	9.25	4.6
1995	4283	97	116	7.11	19.68	3.97	9.74	9.20	1.68	9.93	4.6
2000	6280	82	115	8.16	20.06	5.44	11.21	11.74	1.70	10.01	11.55
2001	6860	80	116	8.08	19.12	5.30	10.41	10.33	1.67	9.68	13.76
2002	7703	78	117	8.52	23.28	9.24	10.56	13.20	n.a.	9.12	18.12
2003	8472	80	118	9.20	23.74	9.20	11.19	13.35	n.a.	9.39	21.71
2004	9422	78	122	9.29	22.85	6.37	10.35	12.48	n.a.	8.94	22.19
2005	10493	77	119	9.25	23.86	8.97	10.40	12.55	n.a.	8.85	21.67
2006	11760	76	118	9.38	23.78	8.34	10.41	12.95	n.a.	9.12	22.54
2007	13786	78	118	9.63	22.14	9.66	10.33	14.20	n.a.	9.14	22.17
2008	15781	n.a.	123	10.27	22.70	8.00	10.74	14.00	n.a.	n.a.	19.30
2009	17175	81	120	9.67	24.20	10.47	10.57	14.30	n.a.	n.a.	19.27
2010	19109	82	116	8.84	24.51	10.21	10.00	n.a.	n.a.	7.02	18.10

Figure 1.6 Per Capita Food Consumption (1978-2010, kg)

Source: The Australian Government Department of Agriculture, Fisheries and Forestry

Reasons for turtle exhaustion can be seen in this context as the aspect of changing diet and affluence lead to negative consequences for wild turtles, ecosystems, and global

biodiversity. The role the turtle has played in the development of Chinese culture has been essential in fully understanding, and consequentially addressing the issue of sustainable turtle consumption. Today, the demand for turtles is increasing because of economic development and population growth that has outgrown the natural turtle supply. To solve increasing demand, countries have turned to aquaculture to reproduce turtles at a faster rate in turtle farms. Chapter Two will first examine the international agreement protecting wildlife to better explain the reasons the regulations resultant of the agreement are failing to show improvement in turtle populations in China and across Asia. The negative environmental and health impacts of Chinese culture regarding the turtle will highlight the reasons why the current turtle trade is unsustainable for turtle populations.

CHAPTER TWO: Consequences of Chinese Culture Surrounding the Turtle

It is evident from Chapter One that turtles are not merely another reptile inhabiting the waterways of China. Chinese culture involving turtles exceeds ordinary consumption and desire. The turtle can be explored as the essence of several fundamental practices in Chinese society and practiced religions. Whether it be enjoying turtle soup during family dinners or making turtle jelly to help balance the *yin*, the turtle has been prevalent in Chinese culture for generations. To curb the pressure of demand on wild turtles, countries have begun investing in turtle farming as a way to reproduce turtle at a rate to sustain consumption demands. As the largest consumer of turtles in the world,

China's consumption and turtle farming practices have been reported as the greatest threat to the Asian turtle population.[93]

This chapter will explore the negative consequences that have resulted from Chinese culture and the aquaculture sector. First, an understanding of the global rankings for level of species endangerment will be assessed to better understand the current international involvement in turtle conservation. The failure of international organizations to put pressure on China's government to engage in turtle conservation can be better understood as examined further in the chapter. The harm the aquaculture industry has had on wild turtle populations will be investigated, as well as the spread of disease and invasive species due to China's turtle practice.

A. International Pressures

In 1963, the World Conservation Union gathered to propose a resolution to the growing animal population declines due to trade that spanned across borders and lacked an international outlet for collaboration.[94] An international treaty concerning wildlife trade among governments was then drafted. In March 1973, representatives from 80 countries met in Washington, D.C. to discuss the resolutions, and on July 1, 1975, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was implemented. Although a voluntary agreement, the involved States are legally responsible, and it is their obligation to adopt the necessary domestic legislation to adhere to CITES. Not all animals overseen by CITES are endangered, but the goal is to

[93] Cheung, Sze Man, and David Dudgeon. "Quantifying the Asian turtle crisis: market surveys in southern China, 2000–2003." *Aquatic Conservation: Marine and Freshwater Ecosystems* 16, no. 7 (2006): 751-770.
[94] IUCN Species Survival Commission. *IUCN Red List categories and criteria*. IUCN, 2001.

aid species for sustainable existence for future generations to come. CITES is now the largest conservation agreement with a total of 181 States. The growth of CITES new member States can observed in Figure 2.1, which examines membership increase from 1975 to 2013.

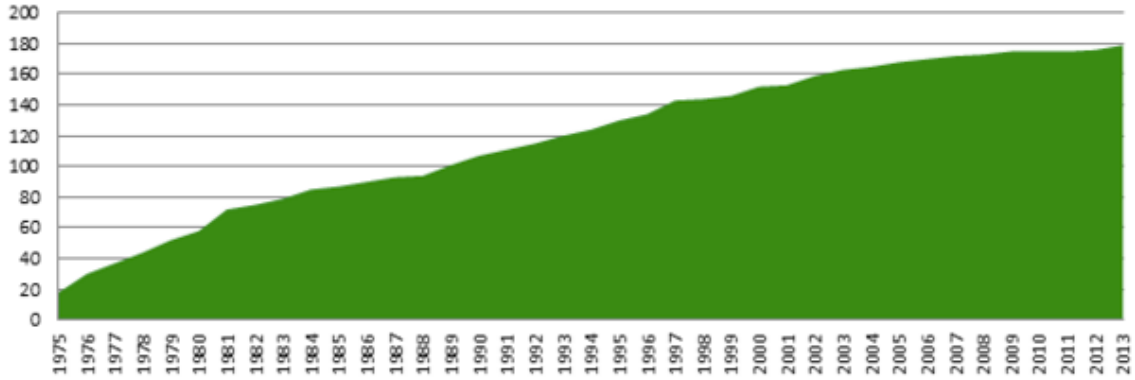


Figure 2.1 | A graph of the number of CITES new member States from 1975 to 2013

Source: Convention of International Trade in Endangered Species in Wild Fauna and Flora

In 1994, China's Agenda 21 revealed that the biodiversity of the country ranks eighth globally and first in the northern hemisphere. Almost one quarter of the 640 most endangered species found in CITES's Appendix I can be located in China, and the World Wildlife Fund lists three of these native species on the list of top ten most endangered species in the world.[95] In 1981, China agreed to CITES and brought the exploitation of fauna and flora into public eye. CITES has three appendices written to explain the severity of protection needed, unique for each species. Depending on the endangerment of a species, it will be placed within a particular appendix to indicate the amount of trade

[95] Nagle, John Copeland. "Why Chinese Wildlife Disappears as CITES Spreads." *Geo. Int'l Envtl. L. Rev.* 9 (1996): 435.

that is allowed with the species. Species within Appendix I face the highest severity of endangerment. With the threat of extinction, turtles in Appendix I are banned from all commercial trade, both internal and external, unless a two-thirds majority vote is reached at a CITES Conference of the Parties, which is a conference including all CITES States and some non-governmental organizations. Appendix II lists species not currently at risk of being extinct, but that are facing population decline to a rate that needs to be closely monitored. All turtles listed on Appendix II are still allowed to be traded, but States are encouraged to closely monitored them.[96] An import permit is not required, however an export permit requires two-thirds of the majority vote at a CITES Conference of the States. The data on these species is unclear at times, due to the fact that some species look similar and may skew the data on endangerment. All species listed in Appendix III may be legally acquired. There is an export certification required, but no voting or unilateral listing by States.

The Conference of the Parties is held every two to three years, and it is not just open to States who are involved in CITES. Non-government organizations can attend the conference and have a say in which animals are assigned to which appendix list. At the Conference of the Parties in 2013, the sixteenth conference to take place, over 2,500 people attended, and China was one of the participants.[97] CITES regulations expand across hundreds of millions of plants and wildlife products, including but not limited to medicines, food products, leather, and instruments.[98] CITES is now protecting over

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[96] Inskipp, Tim, and Harriet J. Gillett. *Checklist of CITES species and annotated CITES appendices and reservations: a reference to the appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora*. United Nations Envir Programme, 2005.
[97] Ibid., 1.
[98] Ibid., 1.

35,000 species of animals and plants and regulating sectors of trade animal products being sold.

B. Decline in Asian Turtle Population

With an already high natural mortality rate of hatchlings, and a maturity rate that can take decades, the survival of each individual turtle is important to the balance of the ecosystem. With the recent boom in Asian turtle trade during past decade discussed in Chapter One, the rate at which turtles are being collected is unsustainable.[99] This section will examine evidence of Asian turtle decline and identify how these numbers are being addressed by Asian governments participating in CITES.

Figure 2.2, taken from the Turtle Conservation Fund global action plan published in 2007, reveals the threat level turtles species are facing worldwide, with a concentration below focused solely on Asian turtles. The level of endangerment is assigned based on the 2000 IUCN Red List, consisting of 293 species worldwide and 88 species of Asian tortoises and freshwater turtles. Of the worldwide turtle population, fifty-one percent are either vulnerable or already extinct in the wild. In Asia, sixty-six percent of Asian turtles are either are vulnerable or already extinct. Asian turtles are facing the highest level threat of threat, but that is not all that is shockingly revealed in Figure 2.3.

[99] Nijman, Vincent. "An overview of international wildlife trade from Southeast Asia." *Biodiversity and conservation* 19, no. 4 (2010): 1101-1114.

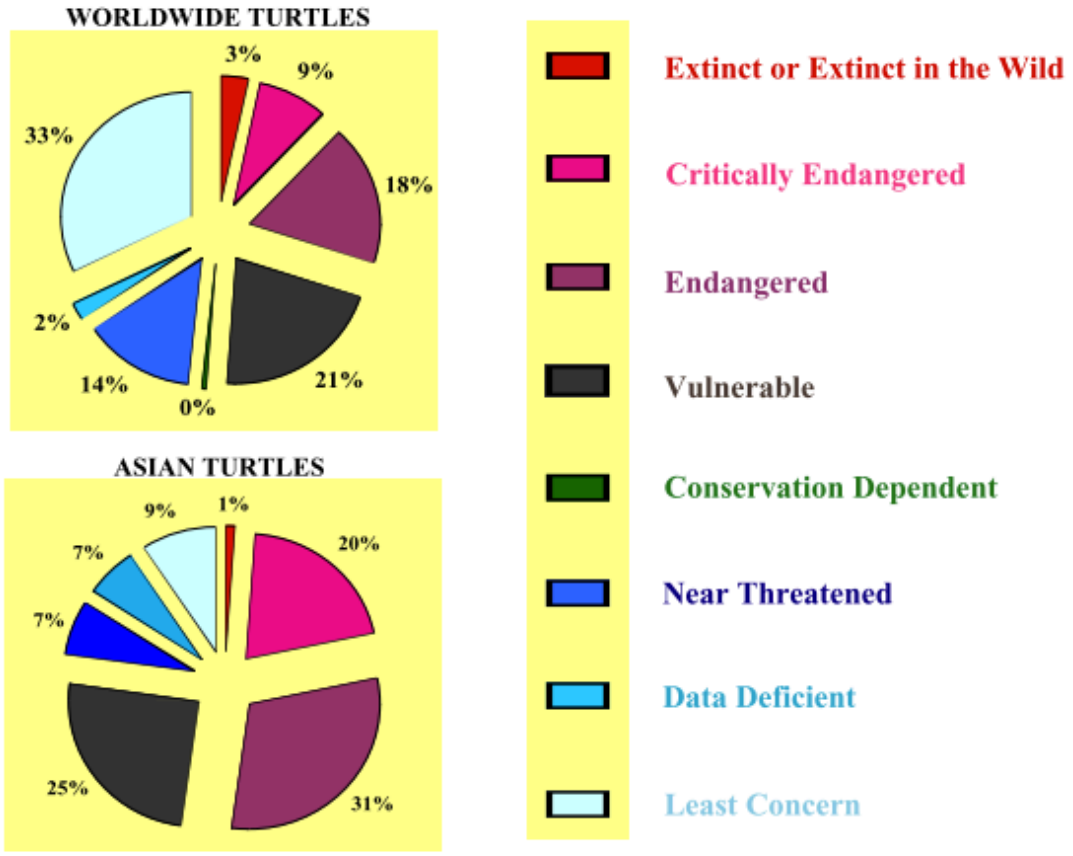

Figure 2.2 | The state of endangerment for turtles worldwide and in Asia

Source: Biodiversity and Conservation

When observing Figure 2.2, the lack of sufficient data in turtle population numbers recorded in Asia more than tripled that of the rest of the world. The seven percent data deficiency is not that large of a number, but the problem does not lie in the deficiency, but rather the inaccuracy of the data. CITES admits that, "for the submission of documents for CoP15, biennial reports were available for only 14 of the 25 Asian Parties with native tortoises and/or freshwater turtles for the years 2003-2004, and only

12 of 26 for the years 2005-2006".[100] Countries may be making claims for vigorous campaign for public awareness and government action on behalf of the endangerment of local tortoises and freshwater turtles, but the data does not reveal any improvement in turtle populations, and those numbers are not even reliable. This is especially a problem in China, where there is a lack of transparency in data seen in several fields. The New York Times quoted Mark Williams, chief Asia economist for Capital Economics saying "the government appears to view targets as essential for policymaking. It is unlikely that the National Bureau of Statistics would publish numbers lower than the target number."[101] China officials have admitted to falsifying data for the benefit of what the targeted numbers are in several sectors, including the housing market, GDP growth targets, the steel industry, retail data, and others, and the aquaculture and wildlife protection sectors are no exception.

Figure 2.3 is taken from the Turtle Conservation Fund global action plan published in 2007 to provide a visual representation of where turtles species are most heavily populated. Asia contains the highest number of diverse species of tortoises and freshwater turtles, greater than any other continent in the world, accounting for a total of 90 different turtle species out of the 315 species in the world.

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[100] "CITES Member Countries." Convention of International Trade in Endangered Species in Wild Fauna and Flora. Accessed January 28, 2016. http://www.cites.org/.

[101] New York Times. "Why Is There Lack of Transparency in China's Official Economic Data? - The Economic Times." The Economic Times. February 27, 2016. http://economictimes.indiatimes.com/news/international/business/why-is-there-lack-of-transparency-in-chinas-official-economic-data/articleshow/51167559.cms.

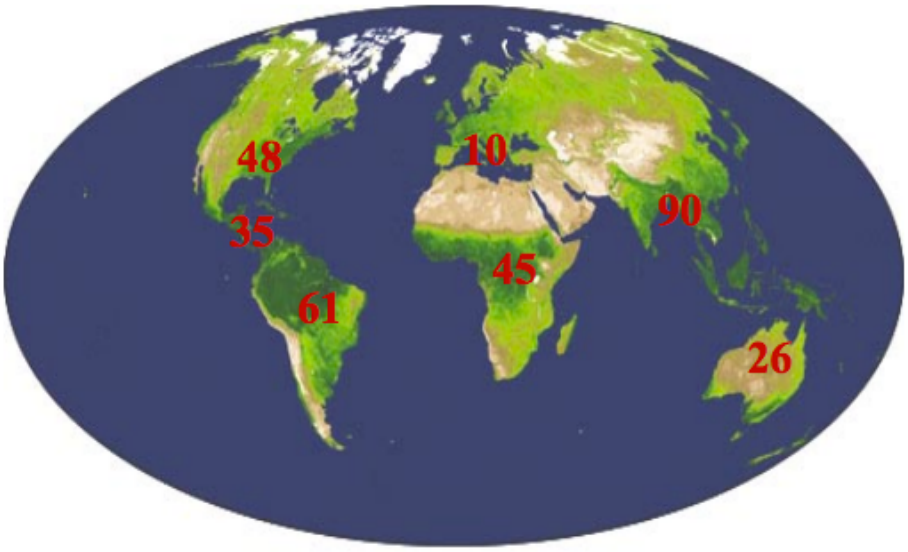

Figure 2.3 | Number of tortoises and freshwater turtles species inhabiting each broad geographical region: North America (48), Mesoamerica (35), South America (61), Mediterranean (10), Asia (90), and Australia (26)[102]

Source: Turtle Conservation Fund

CITES has placed pressure on Asian countries where the most damage is possible and currently happening. The awareness CITES has brought to the public has increased non-governmental participation and local citizens dedication to reducing the strain on these species and regulating trade correctly. Countries populated with turtles listed by CITES have shown increased initiatives towards tackling the source of problems of endangerment on local turtles.[103] This is particularly true in Asia, where several turtle campaigns and legislation have been passed. However, the actions from Asian governments, although passed in legislation, are not making a difference on the declining turtle population.

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[102] Fund, Turtle Conservation., 30.

[103] *Checklist of CITES species and annotated CITES appendices and reservations: a reference to the appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora*. United Nations Envir Programme, 2005.

Indonesia has seen dramatic decline in the Roti snake-necked turtles, reported in Appendix II of CITES, that has led to intervention within the prevalent commercial trade of the country. Conservation programs have been implemented to require the release of fifty captive-bred animals of commercial origin back into their natural habitat. A local workshop was held educating the public about the CITES conservation agreements, held by CITES and TRAFFIC SE Asia. Malaysia (Peninsular) established a conservation program in 1968, with the regulation of egg production.[104] Eggs are to be incubated to later serve as population enhancers in the wild. Two more of these facilities have been built since the establishment of the conservation program. When Myanmar began seeing devastating declines in the Myanmar Star Tortoises populations, a reintroduction program was formed in partnership with the local Zoo to begin captive breeding of the species. Research was also executed to enhance transparency of the issue to build pressure on officials to continue furthering conservation efforts. In January 2009, Myanmar hosted a workshop to educate the public about how confiscated tortoises and freshwater turtles should be released back into the wild using different strategies of response depending on the species.[105] The Striped Giant Soft-shell Turtle, native to Thailand and exported to other Asian countries, saw significant decline from the depletion of adults. The country now has established breeding programs expanding across the shores to address the reproductive strains and enhance breeding numbers. In 2004, Hong Kong SAR created a

[104] Schoppe, Sabine. *Science in CITES: the biology and ecology of the Southeast Asian Box Turtle Cuora amboinensis and its uses and trade in Malaysia*. 2008.
[105] Shepherd, Chris R., and Vincent Nijman. "The trade in bear parts from Myanmar: an illustration of the ineffectiveness of enforcement of international wildlife trade regulations." *Biodiversity and Conservation* 17, no. 1 (2008): 35-42.

brochure, 'Protect Endangered Freshwater Turtles' to educated citizens about the endangerment of freshwater turtles, and what can be done to help.[106]

China has participated in the turtle conservation movement with other Asian countries, but the result has been abysmal. In 2005, CITES reported six public awareness posters from Chinese officials focusing on endangered species groups listed in CITES Appendix. The posters, which were published in both Chinese and Vietnamese due to China's strong relationship with Vietnam in turtle stock exchange, were promoted to bring public awareness to the most critically endangered species on the CITES trade list. Countries populated with turtles listed by CITES have shown increased initiatives towards tackling the source of problems of endangerment on local turtles.[107] This is particularly true in Asia, where several turtle campaigns and legislation have been passed. However, the actions from Asian governments, although passed in legislation, are not making a difference on the declining turtle population.

C. Turtle Farming: The Lesser of Two Evils

The National Oceanic and Aquatic Administration of the United States defines aquaculture as the breeding, rearing and harvesting of animals and plants in water environments.[108] Aquaculture has been key in meeting the growing demands of seafood, and it has been successful for several different species. The California finfish have been bred, reared and released into the wild to supplement the stock that is being caught for

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[106] McFadden, Eric. "Asian Compliance with CITES: Problems and Prospects." *BU Int'l LJ* 5 (1987): 311.

[107] *Checklist of CITES species and annotated CITES appendices and reservations: a reference to the appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora*. United Nations Environmental Programme, 2005.

[108] "NOAA - National Aquaculture Program." National Oceanic and Atmospheric Administration. http://www.lib.noaa.gov/retiredsites/docaqua/reports_noaaresearch/benetti_dec_2006_update.pdf.

recreational purposes off the coasts of California.[109] The technology has been successful in reducing the pressures of wild species and replenishing these populations to prevent extinction. Aquaculture has become a popular practice for providing turtles to meet the demand from Asian societies, particularly China. Both indoor and outdoor ponds have been built throughout China to house different turtle species that may need a particular climate if not native to the area. The fruitful industry is one of the largest aquaculture sectors in the world. The aquaculture industry generates an enormous profit as one of the most traded species worldwide.[110] The sector has grown from 2.94 billion USD in 1984 to 61.9 billion USD in 2010, and China's aquaculture sector accounts for 49.3 percent of worldwide aquaculture production by value.[111] Turtle aquaculture can be seen as a solution, but in fact it increases the problem. The pollution of turtle farming has led it to become one of the dirtiest forms of aquaculture, with water run-off ruining the waterways that native species inhabit, as well as creating a harmful disease prone environment for the turtles living on the farm.[112] It has become one of the highest pressures Asian turtles are facing, but the Chinese government and citizens fail to recognize the impacts of the industry and the severity of this only temporary fix.

Turtle farmers purchase wild caught turtles for several benefits. Wild caught turtles increase their total stock of adult animals, and they are constantly seeking wild breeders. Continual generations of farm raised turtles has seen an impact on the reproductive abilities. The reliance on wild caught turtles represents that turtle farming is

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[109] Ibid., 1.
[110] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China.", 795.
[111] "Organic aquaculture in China: A review from a global perspective.", 243-253.
[112] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China.", 795.

an unsustainable practice. Famers are unsuccessful with keeping their stocks of farm raised turtles because turtles are not meant to be farm raised. Turtles do not reach the age of sexual maturity until 10-15 years of age, and therefore farming populations of new born turtles are not reproductively active.[113] Turtle farmers are being forced to turn to the wild caught sexually mature adult turtles, and this is depleting the wild populations. When one only focuses on the short term benefits on turtle farming, it appears that importing species reduces the strain on the native turtle population in Asia. This is not sustainable. These imported turtles will not be able to produce future generations for the long term success of the farm.

Farmers will have succumb to capturing native population as the farmed turtles are unable to reproduce.[114] Even turtle farmers that have made enough capital are still turning to the native turtle populations, knowing that they will increase the reproduction rates and profits. The gains are only temporary, where as the depletion of the wild caught turtle population will be long term. Wildlife collecting and trading stations have been established all throughout China to bring illegally captured wild turtles to be used in captivity and the farming industry. Species such as the big-headed turtle *(Platyseternon megacephalum)* are especially suffering because of their particularly slow rate of maturity and their inability to breed successfully in the harsh conditions of captivity.[115] Farmers have no choice but to succumb to capturing the species in the wild.

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[113] Sung, Yik‐Hei, Nancy E. Karraker, and Billy CH Hau. "Demographic evidence of illegal harvesting of an endangered Asian turtle." *Conservation Biology* 27, no. 6 (2013): 1421-1428.
[114] Shekelle, Myron, R. Meie, Mochamad Indrawan, Ibnu Maryanto, and Agus Salim. "When ‘‘not extinct’’is not good news: conservation in the Sangihe Islands." *Conserv Biol* 21 (2007): 4-5.
[115] "Demographic evidence of illegal harvesting of an endangered Asian turtle.", 1428.

Although it is documented that sixteen provinces in China have turtle farms, many farms are not documented, and therefore not operating any of the legislation that China has implemented towards turtle farms. The situation is delicate. Yes, turtle farming is threatening the wild turtle populations, but the solution is not as simple as putting an end to turtle farming all together. Some activists advocating to end all forms of aquaculture believe ending the practice will "reduce the burden on wild turtle and fish stocks".[116] Certain environmental organizations, such as United States organization the Greens, oppose farming and turtle consumption all together. Fish should be caught only at a sustainable level that will avoid depletion of the species. This ignores culture and demand. Turtles are not just a delicious snack, but a sacred ingredient in many Asian countries for meals and medicines. Turtle trade and symbolism has influenced the development of food culture in China and many cultural practices still used today. If not bought legally for consumption, turtles would be sold and bought in the black market with higher demand, and therefore it can be predicted that illegally captured wild stock would be consumed at higher levels.

Figure 2.4 displays the growth in Chinese aquatic production since the beginning of economic reform and China's adoption of a market economy. Cultured freshwater (green), wild freshwater (yellow), cultured marine (orange) and wild marine (grey) have all seen a significant increase in production with the trends of economic and population growth in the country. In 2010, China's aquaculture made up 61.2 percent of worldwide aquaculture production by weight, with a production increase from 1.3 million tons in

[116] Bate, Roger. "The ban on DDT is killing millions in the third world." *Review-Institute of Public Affairs* 56, no. 1 (2004): 14.

1970 to almost 47.8 million tons in 2010.[117] The aquaculture production was worth 2.94 billion USD in 1984 and by 2010, it increased to 61.9 billion USD, making up 49.3 percent of the world's aquaculture production by value.[118]

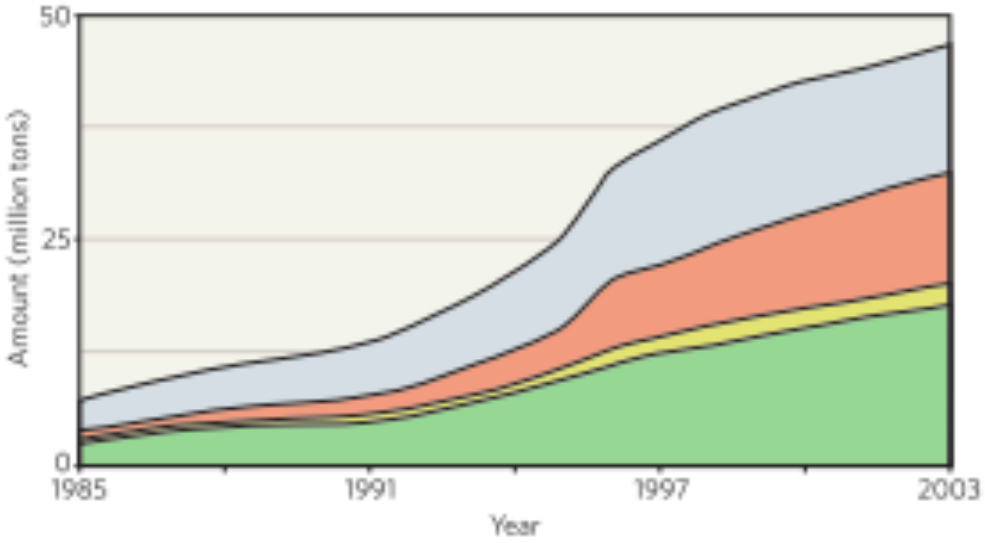

Figure 2.4 | Chinese Aquatic Turtle Production (in million tons)

Source: Nature 435

Of the 61 species found in the Yuehe Pet Market in Guangzhou discussed in Chapter One, only 15 were native to China and 46 were imported from other continents.[119] CITES listed 38 of these species, four of which are in CITES most endangered species list, Appendix I, while 26 are encouraged to be closely monitored in trade on CITES Appendix II and eight not currently facing threat in CITES Appendix

[117] Ibid., 1.
[118] "Organic aquaculture in China: A review from a global perspective.", 243-253.
[119] "The chelonian trade in the largest pet market in China: scale, scope and impact on turtle conservation.", 213-216.

III.[120] Four species were also categorized on the IUCN Red List as critically endangered, and the demand is only increasing.[121]

D. United States and China

There is not a large amount of data revealing the extent of turtle trade between China and other countries. China and the United States are two countries that have the most data gathered regarding the trade. For this reason, examination of turtles in United States and their relationship to China can be used to learn more about the extent of farming across boarders, and the impact Chinese culture has had on the growth of turtle farms and turtle trading around the world. The practice of human harvesting and the resultant depletion of turtle population are not limited to China. The United States faces a similar problem. For example, the Florida Turtle Conservation Trust examined Florida waterways that inhabit over 25 turtle species, and found that in these rivers, swamps, and coasts, several species are significantly declining due to human collection for consumption. Conservations have warned that if this high rate of consumption continues, the U.S. freshwater turtle species will near extinction. But some steps are being made to save the turtles and the state of Florida has been a leader in the initiatives to prevent the trajectory of turtle species extinction and has written legislation to keep commercial harvesting out of Florida waters.

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[120] Gong, Shi-Ping, Alex T. Chow, Jonathan J. Fong, and Hai-Tao Shi. "The chelonian trade in the largest pet market in China: scale, scope and impact on turtle conservation." *Oryx* 43, no. 02 (2009): 213-216.

[121] Lucas, John S., and Paul C. Southgate. *Aquaculture: Farming aquatic animals and plants*. John Wiley & Sons, 2012.

Not all turtles are under CITES protection, but the U.S. currently has all tortoises under CITES protection, and some have full ESA protection as well. The terrestrial and freshwater turtles that can be found in the CITE Appendixes are as follows:

Box turtles – Appendix I

Box and Wood turtles – Appendix II

Alligator snapper and map turtles – Appendix III

Alabama red-bellied, Bog, Flattened musk, Plymouth red bellied, Ringed map and Yellow-blotched map - ESA

Thirty-one of these species remain under no Federal status according the U.S. Fish and Wildlife Service. In 2014, the U.S. Fish and Wildlife Service took action to propose four new species to be listed on the CITES list.[122] The four species included snapping turtle, Florida soft-shell turtle, smooth soft-shell turtle, and spiny soft-shell turtle, all in great demand from Asian turtles.

There is a lack of data that specifies the extent of trade between the United States, but one species has better data than most. The alligator snapper is one example of turtle species that are highly demanded from the U.S. by China. It can be observed from Figure 2.5 that China is the United States' largest importer of turtles and the total imports are more than half the other leading four importers of alligator snapper turtles combined. When Hong Kong and China are considered together, they import the majority of the

[122] Turtle Conservation Fund., 1.

alligator snapper turtle from the United States in 2009 while other countries are minuscule in comparison.[123]

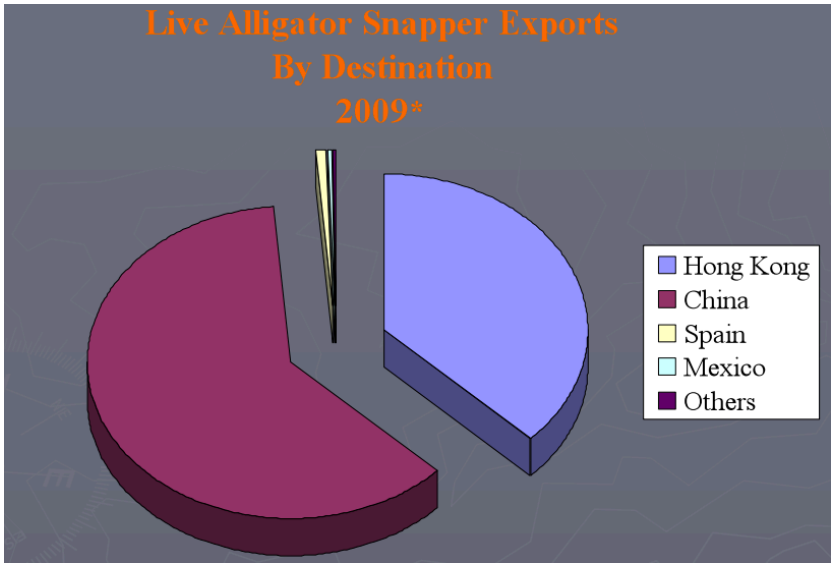

Figure 2.5 | Amount of live alligator snappers exports by destination in 2009

Source: United States Fish and Wildlife Service

Aware of the grave threat to turtles, CITES States in Southeast Asia, where the most turtles in Asia reside, and where the most trade occurs, has constructed an Action Plan to generate effective conservation for large riverine turtles. A 2011 CITES paper reports that the plan is "currently taking shape through the efforts of the Turtle Survival Alliance, San Diego Zoological Society, Universiti Terengganu Malaysia, Wildlife Conservation Society, IUCN/SSC Tortoise and Freshwater Turtle Specialist Group."[124]

[123] Ibid., 1.
[124] Nijman, Vincent, and Chris R. Shepherd. "The role of Thailand in the international trade in CITES-listed live reptiles and amphibians." *PloS one* 6, no. 3 (2011): e17825.

The States participating in the plan must comply to the IATA guidelines of shipment across borders of live tortoises and freshwater turtles.

E. The Spread of Disease and Invasive Species

Translocated species and strains have been reputed to spread exotic diseases that have the potential to be detrimental to indigenous wild populations and pet owners. The Buddhist practice of *fangsheng* is particularly guilty, releasing non-native species into ponds already inhabited by other turtle species. The increased consumption of the turtle in Chinese culture has also attributed to the issue. More farms are being established to meet the demand of turtles in Chinese culture. When imported farm stock escapes into the wild, the habitat of the wild turtles becomes home to a new turtle, and the ecological balance may be upset. Unfortunately, the quantitative evidence of how many animals escape from aquaculture facilities and the pet trade market in China is limited.[125] Those that do escape disturb the balance of the ecosystem and wild populations become vulnerable to genetic dilution. The red-eared slider is a native to the Mississippi drainage from Illinois south, but now the species has established habitat all over the world.[126] The genetic integrity of the native yellow-bellied sliders of the southeastern states is put in jeopardy due to red-eared sliders reproducing with the populations and contaminating the

[125] Shen, Jin-yu, Xiao-yi Pan, Xu-ping Yu, Wenlin YIN, Zheng CAO, and Ying-lei WU. "Pathogen in white abdominal shell disease of soft-shelled turtle (Trionyx sinensis)." *Journal of Fishery Sciences of China* 5 (2007): 815-822.

[126] Ramsay, Neil F., Pek Kaye Abigayle Ng, Ruth M. O'Riordan, and Loke Ming Chou. "The red-eared slider (Trachemys scripta elegans) in Asia: a review." In *Biological invaders in inland waters: Profiles, distribution, and threats*, pp. 161-174. Springer Netherlands, 2007.

pure genetic pool of the species. This is threatening the native biodiversity of the region and has the potential to impact the way the species grow and reproduce.[127]

In China, particularly the Guangdong region, there has been evidence of devastating loss in wild populations. Lack of regulation and proper construction on farms increases the likelihood of aquatic species escaping into the wild. These regions are often without risk analysis and proper controlled containments, and native species suffer habitat loss and increased competition for food.[128] Once the non-native species are introduced into the new ecosystem, they can take over the habitat and create competition for already endangered native turtles. Native turtles are not the only ones being harmed by these invasive species.

Disease spread among humans who have interacted with turtles has been a deathly threat for many turtle pet owners. In 1975 the Food and Drug Administration banned domestic sale of turtles that were less than four inches in length due to the consistent contamination of salmonellosis, with an estimated number of 300,000 cases reported yearly.[129] The farmed turtles were fed from polluted water and scraps that were at high risk of containing salmonella because of the lack of sanitary precautions. Once children came into contact with the turtle and forgot to wash their hands, the bacteria can infect the child. The adult turtles are no less contagious, but their larger size makes them less easily held, and therefore the chance of contamination is greatly reduced. As a response

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[127] Fong, Jonathan J., and Tien-Hsi Chen. "DNA evidence for the hybridization of wild turtles in Taiwan: possible genetic pollution from trade animals." *Conservation Genetics* 11, no. 5 (2010): 2061-2066.

[128] Zhu, Xin-Ping, Chen-Qing Wei, Wei-Hua Zhao, He-Jun Du, Yong-Le Chen, and Jian-Fang Gui. "Effects of incubation temperatures on embryonic development in the Asian yellow pond turtle." *Aquaculture* 259, no. 1 (2006): 243-248.

[129] "The Terrible Turtle Trade: The pet trade is decimating turtle populations and spreading disease. One veterinarian calls it" the greatest reptile crisis since the demise of the dinosaur.", 44.

to this new regulation, United States turtle farmers began catching wild adults to sell in the states, and the hatchlings were shipped overseas to be sold in countries unrestricted by the FDA. Twenty years after the FDA ban, approximately 8 million new born turtles were annually exported to over 60 nations. The problem of salmonella was decreasing in the U.S., but other countries paid little attention to it and continued to sell the turtles..[130]

It can take up to two years for a sick turtle to begin showing symptoms, either from abuse or disease. A turtle may be infected by salmonella, but the owner may never know. This timeline builds the facade that when the turtle is sold, it can appear perfectly healthy. For pet stores, this is not a problem. Turtles are sold at a relatively low price with the expectation that the buyer will purchase the more pricey habitat and dietary needs of the turtle. If the turtle does pass away relatively soon after, the widowed pet owner will most likely buy a new one, having already spent money and time constructing the necessary housing for the turtle.

The economic divide in China is wide so that the lifestyle of the rural population versus the lifestyle of the urban population differ greatly. Urban areas have access to different foods and a unique lifestyle that may require food for convenience rather than land production availability. The highest convenience, however, does not always have the consideration of the environment in mind. When the demand for a production has the pressure to produce more, the policy, regulation, and impacts regarding the production are no longer a priority. The highest aquatic products in demand are no longer investing

[130] Ibid., 44.

the energy and resources to ensure the production at farms and fisheries are sustainable and ethical.[131]

Chinese culture has fed the growth of the aquaculture industry. Turtle farming has expanded throughout China as a method for reproducing turtles at a high rate, although the method has never actually successfully done so. The turtle population cannot sustain itself it a farming environment. Farming, despite successes with other species, cannot reproduce turtles at a faster rate than they are being taken from the wild. The method has in fact led to wild populations used as turtle farming stock. Turtles are being captured from the wild to be used on turtle farms to aid reproduction. The long-term consequences of these actions are devastating, but farmers are unable to see past the short-term success of the method. Although the method is unsustainable in the long-run, while being used in the short-term, it should be explored for ways to make the industry sustainable. If turtle farming were to be banned today, wild turtles would become the sole stock sold in the Chinese market. Turtle farming is a pressure that will eventually deplete turtles. However, the method is creating time for investment in innovation and new methods to solve the turtle crisis.

The answer to the turtle problem lies deep in Chinese cultural practices concerning turtles. There are multiple efforts to curb the consequences of Chinese culture, but the turtle species continue to spiral towards extinction. The reason these efforts of policy implementation and public campaigns have failed will be further investigated in Chapter Three. There needs to be more action than merely implementing policy without enforcement. By examining the programs and legislation of successful

[131] "Organic aquaculture in China: A review from a global perspective.", 243.

organizations and governments, solutions for lessening the devastating exploitation and environmental impacts from Chinese culture can found and applied.

CHAPTER THREE: How to Sustain Chinese Culture and the Turtle

Farming, in theory, should assuage the consumption demands on wild species and replenish populations. It can do just that in other sectors of aquaculture farming, such as the California finfish, salmon and shrimp, but turtles have a significant biological distinction. Many species take a long time to reach maturity, sometimes nearly half way through their lifecycle. Farmers succumb to illegal capture of wild adults to expand their farming stock. Instead of the farmed turtles replenishing themselves, wild turtles are needed for reproduction. Chapter One has shown that the pressures from trade and consumption are as prevalent now as ever. Turtle farming is believed by many in China to relieve these pressures on wild turtle stock, allowing for farmers to produce turtles season after season from within their own pool of turtles. Unfortunately, turtles do not work like that.

Farming has increased pressures on wild stock, and turtles are being farmed to extinction. Is it too late for turtles? No. Is ending turtle farming all together a solution to resolving the unsustainable consequences? No. Either way, turtles will still be vulnerable to the growing population's demands. From increased pressures by environmental conservationists to solve the formidable future for turtle, countries now have no choice but to begin taking action with the community and turtle farmers. However, Figure 2.3 in Chapter Two revealed that the Asian turtle populations are facing significantly worse extinction rates compared to the rest of the world. Although Asian countries have seen an

increase in campaigns and legislation towards turtle conservation, the implementation of policy and campaigns does not seem to be having a strong impact on the turtles. Governments are taking action all throughout Asia. Myanmar partnered with the zoo to develop an action plan for conservation and Thailand established breeding programs to assist in endangered animal reproduction. Even with these global efforts, the populations of threatened species are still facing endangerment, and some extinction.[132] The data that has been collected by international organizations, such as CITES, does not reveal significant improvements to the turtle populations since the development of conservation efforts. Publicity and campaigns are not enough. If the environment and turtles are to see an improvement, either the methods for turtle farming need to change or the cultural ideology that has been ingrained into Chinese society for centuries.

Although these techniques are not wasted, and some efforts on the issue are better than none, there is a different approach that may prove more useful in the long run. Chapter One demonstrated Chinese culture dependence on the turtle and the importance it has had in China for centuries. Rather than imposing policy after policy that the Chinese government has obeyed by releasing inaccurate numbers, the approach should be focused on innovating sustainable farming techniques, and campaigning to the public about awareness and change in cultural practices.

A. Government Solutions

The international trade of wildlife makes it difficult to have an unified set of regulations across borders. As mentioned in Chapter Two, the international treaty

[132] Nagle, John Copeland. "Why Chinese Wildlife Disappears as CITES Spreads." *Geo. Int'l Envtl. L. Rev.* 9 (1996): 435.

CITES was established in the 1960s to enhance international cooperation between countries trading wildlife and create an international space to discuss and prevent exploitation of animals. Chapter Two examined the initiatives of these countries, predominantly located in Asia. These countries have implemented new regulations towards turtle trade and implemented awareness campaigns for educating the public on why it is important to protect the turtles. The efforts from Asian governments look good on paper, but the data reveals the truth of their impact. After 35 years of CITES commitment and initiatives in China, turtles continue to face extinction at a rapid rate. China has developed multiple efforts that have been explained in Chapter Two, but the country and CITES lack enforcement and how to integrate regulation into the existing, and rapidly expanding, economic development dependent on turtle trade. China approaches the issue in a way that may appear proactive to the public, but no long term improvement results. John Nagle gives an example of the attitude that is common in sectors affecting the environment. He says that when poachers were caught killing endangered elephants in China, the poachers were persecuted. However, there were no adjustments or restrictions added to the trade.[133] In 1990, the List of States Mainly Protected Wild Animals listed 96 animals that were protected and prohibited from killing.[134] Although China has created several agencies to implement legislation, the country still faces trade in endangered species. China's large involvement in the aquaculture sector, that has been proven to increase demand on wild turtles, and the cultural traditions involving turtles make it difficult for CITES to regulate the expanding turtle trade.

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[133] "Why Chinese Wildlife Disappears as CITES Spreads.", 435.
[134] Ibid., 435.

Due to the expanse of the global turtle market, comprising of the turtle farming and aquaculture industry as well as international overseas trade, data collection by individual governments concerning the growth or decline of turtle populations and documentation of engagement in international trade by species is central for evaluating the destruction of the turtle crisis and immediacy in finding a solution. Countries exhibiting the most significant deficiency in data collected and published reveal more about their views on turtle conservation than that of their conservation campaigns and legislation. Furthermore, without an understanding of how the turtle population is being impacted by government movements concerning turtle preservation, all conservation efforts evade the accountability essential to regulation enforcement and ultimate prosperity. However, if the government allocated the necessary resources towards collecting and publishing truthful data, the severity of turtle population decline in China would become more precise and the government would demonstrate to the international community the intentions of allegiance in working towards sustainable conservation innovations. A greater transparency on the reality of turtle endangerment in China would provoke more international pressure than there already has been in recent years.

In the United States, there are several enforcement departments, such as the ESA and state departments, that have the means to implement consequences to those who break laws. There are fines to those who do not follow regulations, and the United States can sanction countries that do not regulate their trade according to laws.[135] The Pelly Amendment is an example of authority that has been implemented at the national level to abide by CITE regulations. The amendment gives the President the ability to enforce

[135] Ibid., 435.

trade sanctions on countries that do not follow CITES. In 1994, Taiwan received a penalty, but mainland China did not.[136] This demonstrates that the delicate relationship China has with countries has built China's confidence in being able to get away with breaking environmental laws and has strengthened the turtle trade. The United States, and the international community, must offer to work with China to work towards developing sustainable farming practices that will sustain the Chinese culture evolved around turtles, as well as the turtle population.

B. Adequacy of Solutions - Evidence

As explained in Chapter One, and further in Chapter Two, disease is a serious risk in the turtle interaction with humans. There can be as much legislation as possible, but if turtle farming and human-turtle interaction persists, which explained in Chapter One is very likely, the disease threat from turtles must be addressed. Turtle farms have severely increased the risk since they are not regulated to the extent of preventing salmonella transmission, which may never be apparent in the turtle until the holder is infected. The transportation of infected turtles also leads to an increased risk of spread to wild stocks. Disease is a serious world wide threat of the turtle-human relationship, and turtle farming has not helped. Once one farmed turtle is infected, it is likely that all turtles in the farm are as well. Government action in the past has reduced cases, but ultimately the only solution if turtle traditions and farming are to persist, is to find a way to end salmonella spread in the farms. Turtle farming has only assisted in the spread of salmonella, but it is a serious problem with any handling between human and turtles.

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[136] Ibid., 435.

After the FDA legislation passed in 1975, participants in the turtle industry began exploring solutions, rather treatments, to the salmonella epidemic. This research industry sponsored and has not only discovered new information explaining the relationship between turtle pet trade and salmonella outbreaks, but also uncovered practices involving human interaction with turtles that have shown success in reducing the risk of salmonella contamination.[137] The days of salmonella contamination are not of the past yet, but with new innovations and a possible treatment for Salmonella infected turtles, there could be a near end to turtles harboring the harmful bacteria.

Ron Siebeling, a professor in microbiology at Louisiana State University in Baton Rouge, was contacted by several turtle farmers just years before the U.S. Federal Drug Administration ban on trading and selling of small turtles on took effect in the 1970's.[138] He was on a mission to not only solve the problem of Salmonella contamination in turtles, but better understand why turtles were so vulnerable to contraction of the bacteria. He began looking at other farm sites in the poultry industry, particularly chicken and turkey farming. An antibiotic, or "antibiotic bath" referred to by Tad Hardy, was being used on the eggs to eliminate Salmonella before the eggs hatched.[139] The practice was extremely successful with turkey and chicken eggs, but it was time to test the treatment on turtles. The treatment was tested on several bacteria, not just isolating Salmonella, and it seemed successful. Siebeling believed the treatment could "eliminate the 30-40 percent contamination rate and provide a standardized, reliable method for producing certifiable

[137] "The tortoise and the scare.", 76-79.
[138] Ibid., 78.
[139] Ibid., 79.

turtles".[140] He was prepared to present the breakthrough discovery and flew to the Center for Disease Control in Atlanta to defend the case in 1976. It was too late. The 1975 ban from the FDA was in effect and already showing results. Although the treatment was beneficial in reducing the spread of Salmonella and other bacteria in turtle hatchlings, it was not important. The government was more concerned with ending the harmful trade rather than innovating to eliminate the problem.

This is just one example of sustainable measures taken to help make the turtle-human relationship more sustainable, whether it be in the continuation of turtle farming or in the black market to be sold illegally in one of the three sectors of Chinese culture reviewed in Chapter One. As long as turtles remain part of Chinese culture, and other Asian countries, disease will remain a threat. The findings from Hardy that show Salmonella can be treated is not being implemented by the United States. There is a lack of information behind the reasoning why the U.S. has not adopted the use of Hardy's technology. Turtle farming is one of the dirtiest aquaculture sectors in China, and new methods must be developed to make it cleaner for the turtles being harvested and the water being polluted from runoff of the poorly kept farms.[141] If the government were to implement the new initiatives and search for more initiatives, it could yield the same results as seen in the Salmonella-reduced poultry industry and improve more areas of the practice. Other sustainable environmental initiatives are already being explored by the United States, and Florida is one example of where clean farming and conservation of

[140] Ibid., 78.
[141] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China.", 795.

water use has been made not only a priority, but a strongly enforced law. China has the potential to learn and follow, to save no only the turtles, but their culture.

C. Model Aquaculture: Florida Fish and Wildlife Conservation Commission

World Chelonian Trust, a non-profit focusing on the care and survival of turtles and tortoises, documented more than 700,000 wild-caught U.S. turtles from 2003 to 2005, and claimed that the majority of these exports headed to Asian turtle farms[142]. The director of Conservation International's freshwater turtle and tortoise conservation program, Peter Paul van Dijik, currently sees turtle farming as the "lesser evil." Turtles are not approaching extinction as the result of the turtle aquaculture sector. Conservation researchers have argued that eliminating turtle farming would alleviate the current pressures turtles are facing. Without any turtle aquaculture, wild turtles would be the only source sustaining Chinese culture and turtle demand, therefore species would be decimated.[143] Turtle farming holds the possibility of offsetting these pressures and helping reduce the strain on wild turtle populations to meet worldwide consumption demands. Other countries, like U.S., are already implementing specific enforcement of conservation laws and regulations to protect wild turtle populations and their habitat, while progressing towards a future of sustainable turtle farming. Florida is one of the leading examples of initiatives taken to make the turtle farming industry more sustainable.

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[142] Norris, Scott. "China's Turtle Farms Threaten Rare Species, Experts Say." National Geographic. January 23, 2007. Accessed January 29, 2016. http://news.nationalgeographic.com/news/2007/03/070323-turtle-farms.html.

[143] Hankwerk, Brian. "Millions of U.S. Turtles Consumed in China Annually." National Geographic. July 24, 2009. http://news.nationalgeographic.com/news/2009/07/090724-turtles-china.html.

Due to the distinct collection of freshwater turtle species in Florida waterways, the state has faced pressures to export these turtles overseas. As observed in Chapter Two, Figure 2.5, less than 10 years ago the United States was exporting the majority of turtle exports to China. The State realized the growing demand for the turtles from China and the bleak future for turtles and the balance of the Florida waterways that followed. The Florida Fish and Wildlife Conservation Commission (FWC) took action. In 2012, the FWC Division of Law Enforcement and sections of the Department of agriculture and Consumer Services' Office of Agricultural Law Enforcement was merged to protect the natural resources of Florida in a proactive and responsive manor.[144] Turtles listed on Florida's imperiled species are prohibited from being extracted from their natural habitat and persecutors face a fine or court order.[145] To ensure no loopholes to this rule, the Commission also implemented that turtles similar in appearance to the imperiled species were not to be taken from the wild.[146] No one could capture the species and claim to have thought it was another. There was no way around it. An accident was foolproof.

In order to transport more than one turtle a day from the wild, the transporter must have a license for sale or exhibition of that turtle or an aquaculture certification that are granted only by the Department of Agriculture and Consumer Services.[147] An application process must be completed along with a required educational video, and the license must

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[144] Fish, Florida. "Wildlife Conservation Commission (FWC)." *US Fish and Wildlife Service, National and Marine Fisheries Service, and Sea Turtle Late-Term Nest Collection and Hatchling Release Protocols for the Florida Panhandle and Alabama in Response to the Deepwater Horizon (MC-252) Incident* 16 (2010).
[145] Ibid. 1.
[146] Ibid., 1.
[147] Ibid., 1.

be renewed annually. A valid copy of the Annual Certificate of Harvester Education Training video accompanies every application.

Florida aquaculture is also focusing on issues that are important for the region, and can impact not only species being farmed, but the habitat of native species that are facing run off water problems from farming. The aquaculture sector is one of the main threats to freshwater resources. Turtle farming in China is one of the dirtiest sectors of aquaculture, and specific attention needs to be taken to address the impacts the pollution of water is having on native populations.[148] Florida is taking this into account with new legislation to protect and regulate water use and waste from aquaculture facilities. Aquaculture facilities using well water are required to have a consumption use permit. These permits may be acquired at one of Florida's five water management districts. The Clean Water Act demands that "if an aquaculture facility produces more than 100,000 pounds of live product and discharges production-related water off the farm for more than 30 days per year, then they must acquire a National Pollution Discharge Elimination Permit".[149] In comparison to this law, China currently has enacted an out of date Water Law that was written in 1988 but not implemented until over ten years later in 2002. The law predates aquaculture development in China and contains no direct reference to aquaculture.[150] The problem with China's policy regarding aquaculture is that it is not being regulated.

D. Alternative Solutions

[148] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China.", 795.
[149] "33 U.S. Code Chapter 26 – Water Pollution Prevention and Control." LII / Legal Information Institute. Accessed January 29, 2016. https://www.law.cornell.edu/uscode/text/33/chapter-26.
[150] Lang, Tim, and Michael Heasman. *Food wars: The global battle for mouths, minds and markets*. Routledge, 2015.

Chinese cultural preference for the turtle has ensured that the demand for turtles will increase with or without the aquaculture. Although turtle farming is having negative impacts on turtle populations, the innovation of Ron Siebeling's research in eradicating the threat of salmonella in turtle trade has led the industry in the direction of becoming more sustainable. If a way to make turtle farming sustainable was found, the practice has the potential to absorb the pressures of turtle demand with Chinese culture. The industry is large, as well as the profit form turtle sales. Turtles deserve to be credited for the success of the industry.

If China was to strictly impose regulation and enforcement laws throughout the country's turtle farms, farmers would have more incentive to farm in a sustainable fashion. To supplement the enforcement of these policies, a fine for violators should be implemented to create pressure on farmers to abide by the government rules. Currently, China has implemented several of these laws, but none of these have been effective in transforming turtle farming methods to make a more sustainable industry. Through the implementation of enforcement and fine collection on already instated laws, the turtle industry would no longer be regarded as the dirtiest aquaculture practice in China.[151] The revenue generated from collecting fines would promote enforcement of turtle farming laws by the government and could be allocated to invest in sustainable turtle farming innovations to sustain the profitable aquaculture sector for the future.

The entirety of the industry is dependent on the survival of the turtle, and if turtles are depleted to extinction, the industry will fail and zero profit will be generated. To

[151] "Assessment of pollutant loads discharged from aquaculture ponds around Taihu Lake, China." *Aquaculture Research 44*, no. 5 (2013): 795-806.

ensure that the industry remains successful and profitable, money should be taken directly from the aquaculture sector to fund studies towards discovering sustainable farming techniques. If the Chinese people had a better understanding of this truth, conservation of turtles may be seen throughout the country as a more pressing issue. More farmers and consumers could put pressure on the Chinese government to allocate the received profit from the aquaculture sector towards finding sustainable farming methods and existing conservation efforts to protect the turtle and Chinese culture.

Wang Jinnan, a leading environmental researcher in China, claims that the Chinese people are unwilling to accept the environmental consequences of their developmental success.[152] To supplement this attitude, the education in China concentrating on environmental issues is limited. Communities lack education about the importance of turtle conservation and knowledge about why turtle farming is harming them. Although recent Chinese generations are more likely to receive an education, there is little in the field of environmental conservation being taught in China, and the generations are continuing the ideology of focusing on development and Chinese culture.[153] Chinese education at the secondary level is "closely tied to national environmental protection policies which are in turn finely tuned to developments at the international level," however the development of the country is regarded as the highest

[152] Kahn, Joseph, and Jim Yardley. "As China Roars, Pollution Reaches Deadly Extremes." The New York Times. August 25, 2007. http://www.nytimes.com/2007/08/26/world/asia/26china.html.
[153] "3 Great Forces Changing China's Consumer Market." World Economic Forum. Accessed January 26, 2016. https://www.weforum.org/agenda/2016/01/3-great-forces-changing-chinas-consumer-market/.

priority of focus, leaving environmental initiatives to the sidelines.[154] Food culture in China is such an integral part of the foundation in tradition that it is difficult to transform.

The Chinese government needs to address the misconceptions throughout the population regarding turtle farming, and address the impact of cultural practices. How can this be done? Educational programs in secondary schools that target upcoming generations that will be exigent in the future of aquaculture and animal conservation. Sea Turtles 911, located on Hainan Island in the South China Sea, encourages sustainable ecotourism to increase revenue on the island that is subsequently used towards the organization's conservation programs, turtle hospitals, ocean farming protection initiatives, hatchling nurseries, and education programs.[155] The organization believes sea turtles are a "flagship species", in that turtle conservation has the potential to impact the protection of other critically endangered species worldwide.[156] Sea Turtles 911 has trained teachers within the school system on Hainan Island about environmental conservation, specifically involving turtles, in secondary schools. The program is fashioning Chinese student experts on the history and future of Asian turtles. These students will one day take their role in society, and the hope of the program is that their knowledge concerning turtle decline and Chinese culture will transform the future view of the subject. These future leaders will have the power to implement countrywide change in turtle consumption and the Chinese culture.

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[154] Lee, John CK, and Danielia Tilbury. "Changing environments: the challenge for environmental education in China." *Geography* (1998): 227-236.
[155] "Sea Turtles 911: Saving Sea Turtles in the South China Sea." Sea Turtles 911: Saving Sea Turtles in the South China Sea. Accessed February 11, 2016. http://www.seaturtles911.org/.
[156] Ibid., I.

The education does not stop at the secondary level. Additionally, Sea Turtles 911 arranges school field trips, ecotourism education, hotel education programs, and university meetings focused on teaching a variety of groups, each with their own ability to influence Chinese culture surrounding the turtle and educating their own social circles about the severity of endangerment species face.[157] The educational programs each aim to demonstrate the importance of sea turtles in the marine ecosystem and why the turtles are listed critically endangered. After expressing the severity of the problem, the program demonstrates ways the people on the island can support turtle conservation and sustainable practices of Chinese culture. Through education, the program cultivates passionate turtle conservation enthusiasts about the complexities of the endangerment of these creature and how to help preserve one of the last living prehistoric species.

As turtles face endangerment and extinction, some aspects of Chinese culture face the risk of fading into history. Turtle farming is a method that has the potential to save the turtle population, but the high demand and lack of education and factual information on the issue prevents awareness of the consequences resultant of the turtle in Chinese culture. The Chinese culture with the turtle has led to a demand of turtles globally, being shipped specifically to China for turtle farming stock and eventual consumption. The United States has been a guilty party of exploiting turtles to sell into the market, but proper laws, regulation, and enforcement have prevented the issue from escalating. The turtle populations are being spoken for in the United States and violators are being punished for their actions. It is time for China to implement the same regulations and legislation, but the damage is too great to stop there. The specific aspects of Chinese

[157] "Sea Turtles 911: Saving Sea Turtles in the South China Sea." Sea Turtles 911: Saving Sea Turtles in the South China Sea. Accessed February 11, 2016. http://www.seaturtles911.org/.

culture that is exhausting turtle populations must be addressed. Through proper education in secondary schools and beyond the newer generations of Chinese can become more aware and connected to the impacts of Chinese culture and turtle farming practices.

CONCLUSION

It cannot be expected that the cultural pressures from China will resolve overnight, or that the a sustainable solution to meeting the increasing demand of turtle consumption will be discovered tomorrow. Indeed the already constructed legislation and implemented regulations by international organizations and governments are capable of making an impact on the conservation of turtles. Unfortunately, the demand for turtles is more complicated than other consumed species, and explanations must be explored. To disregard the history of Chinese culture regarding the turtle would be to overlook one of the major determining forces in the species survival. The driving forces behind the endangerment of the turtle can be traced back through the history of Chinese culture and examined in the establishment of Chinese society. It is not until one develops an understanding of the integral role the turtle has played in Chinese culture that the turtle crisis can fully be understood, and consequentially addressed. The turtle has traveled through centuries of Chinese generations, and although the province and governance style may have shifted during its evolution, the meaning and significance of the turtle has been sustained from within the culture. Now, the Chinese culture involving the turtle is threatening the very foundation of its practices.

The demand for turtles driven by Chinese culture is increased by the influence of economic development, and population growth has outgrown the turtle supply.

Worldwide countries have invested in turtle aquaculture practices to compete with the growing, profitable sector that is turtle trade. China has expanded turtle farming across the nation to sustain turtle consumption and Chinese culture. However, through the expansion of turtle reproduction in the controlled aquaculture environment, turtles have only faced greater difficulties in survival and decline persists through the expansion of the aquaculture industry. The immediacy of the problem has been marginalized as the Chinese government continues to act in the best interest of the economy and turtle trade rather than the sustainability of the environment, species, and Chinese culture.

The decline of species involved in trade and consumption worldwide has become more apparent through international intervention from conservation organizations. Unfortunately, these bodies fail to understand why these species are facing decline further than the engine of profit. Chinese culture revolving around the turtles surpasses mere consumption and desire, and can be explored as the essence in the fundamental structure of Chinese society. Only after this is understood can the issue of turtle conservation be discussed for developing effective solutions towards not only the protection of the turtle, but the sustainability of Chinese culture involving the turtle. Existing research in this field that has purposed solutions for resolving the rate of turtle decline from consumption continue to overlook the underlying reasons for turtle demand and aquaculture growth. Unlike these solutions, this paper offers further investigation and a holistic perspective of the deeper drives in turtle consumption and trade that, in order to fully comprehend the current endangerment of the turtle, one must explore entirely. Therefore, it is through the angle of Chinese culture and the history of Chinese society

that this paper will then analyze the severity of turtle trade and how to properly confront the current unsustainable turtle demand.

Firstly, through close study of the Chinese history and culture that has evolved from the turtle, the importance of the turtle in the development of Chinese society today is exposed, and with it the complexities in solving turtle depletion. The writing system of China, one of the most complex in the world, has cultivated in the tradition of Chinese turtle shells. The simple practice of writing divination records on turtle shells has been influential to present day understanding of Chinese character development and Chinese spiritual beliefs concentrating on ancestor worship and the balancing of both the *yin* and *yang* in the body through turtle consumption. Based on these findings, the foundation of one of the highest threats to the turtle population, traditional Chinese medicine market, can be further understood within Chinese culture, therefore empowering the assessment of impact from turtle demand and the growth of aquaculture as the result of this market. Traditional Chinese medicine has been practiced since the beginning of the first known documentation of Chinese culture through symbols recorded on turtle shells. The medicinal recipes that date back centuries are still being consumed in contemporary China, and the traditional Chinese medicine market is continuing to accelerate with the support of the Chinese government and importance to the Chinese people. The consumption of the turtle has not been limited to medicinal purposes. The turtle has had an instrumental role in the establishment of Chinese society, particularly in food culture that has become on of the most valued and distinctive cultural facets to persist through centuries of political, social, and geographical change in China. Chinese food culture is one of the leading causes in high turtle consumption, with recipes involving the turtle

seen as delicacies at the dinner table and throughout the Chinese food industry. Turtles are not solely found in Chinese households for the purpose of consumption, and the turtle pet market in China has grown to the largest in the world. Pet trade to China faces unique obstacles stemming from Buddhist practices of *fangsheng* and unheeded salmonella contamination.

Through the study of the aforementioned areas where turtles have been fundamental in the establishment of Chinese culture and society prevalent today, a stronger understanding of the environmental implications of Chinese culture and the current turtle demand is formed. The notion that these factors of Chinese culture causing demand can be solved through increase in aquaculture turtle farming and turtle conservation efforts underestimates the value of Chinese culture as a complex driving force towards turtle decline. The current consequences resultant of turtle farming are comparable to the potential impacts from current conservation researchers advocating for the eradication of the turtle aquaculture sector all together. It is then that it can be better explored why turtle farming is the lesser of the two evils. Turtle farming is not the root of increased turtle endangerment, and if the eradicated, the problem would continue to grow. Activists should not be simply pushing the removal of the practice, but rather investing this energy in persuading countries to redirect resources towards the innovation of sustainable farming techniques. Innovative solutions towards the negative consequences of disease spread on turtle farms and throughout the turtle trade, specifically the pet trade as identified in Chapter Two, have already been undertaken. After years of research and trial by error, a technique for exterminating salmonella in turtles was advocated. This example of innovation to increase productivity in turtle trade

and health of turtle farms highlights the important role science in the field of aquaculture and sustainability. Other countries, like the United States, have already begun efforts towards more sustainable farming through evident state action. Although sustainable technology is not currently being invested towards, turtle farming can already be seen as more sustainable for wild turtle populations. Florida is an example of where conservation of the native turtle species grew to be an imminent requirement if turtles were to remain in the State. From the determination and impetus of passionate conservationist in their efforts, and a government willing to listen and act, the State was successful in redesigning regulatory legislations and constructing new enforcement rules to produce a more effective State workforce in the protection of the native turtle species.

This analysis of Chinese culture has revealed that even if turtle farming was to cease, turtle consumption would prevail and with the demand turtles are already facing. The demand for turtles will increase with or without the aquaculture sector, and turtle farming has the potential to help offset pressures from Chinese culture if used correctly. Turtle farming also faces the possibility of economic benefits in innovating sustainable farming technologies. The industry is one of the largest aquaculture sectors in the world, and the profit is great. Profit from the aquaculture industry should be invested towards sustainable turtle farming and conservation, after all, without turtles the industry would cease and no profit would be generated. If the Chinese had a better understanding of this truth, turtle farmers and consumers would be more likely to pressure the Chinese government into allocating resources towards sustainable farming and conservation to protect Chinese culture. Future centuries of Chinese generations will be at the forefront of handling issues pertaining to turtle demand and Chinese culture. Through the

implementation of educational conservation focused programs, accountability for turtle farmers to abide by government enforced environmental regulations, and the investment in the exploration of sustainable turtle farming, there is hope for future Chinese generations to participate in the Chinese culture that the generations before them have enjoyed. However, to successfully engage in the aforementioned initiatives towards solving the turtle crisis, an understanding of Chinese culture involving the turtle is imperative. The foundation of China rests on the shell of the turtle, but the shell cannot be saved without fully understanding Chinese culture.

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