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THE WHITE DOLPHINS
OF QINZHOU

白海豚



北京大学出版社
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谨以此书献给全体钦州的父老乡亲们

To our beloved and respected friends, the people of Qinzhou

我们“地”沉浸在回忆之中。

初中时，我最喜欢做的事就是坐在汕头海边的
岩石上，等待两只海豚的出现，起初它们从远
处向我游来时，我就会忘掉周围的一切，也不知
道时光在悄悄流逝。过了许多年，我读完了北京
大学的生物学系，后来便在中国西部寒冷的群山中
与新一类地的大熊猫为伍；再后来，我进入热带
丛林，在喀斯特石山中又是新一类地的研究“土地-人
口-经济”相互依存的生命之网。今日，我依然坐在
飞驰的快艇上寻找这种神奇的生物，我一辈子都为
它们的善举所感动，并怀着感恩的心，希望能为它们
的生存尽一份力量。

潘文石

2004年3月12日

于南部湾

Deep in thought, immersed in memories from long ago...

When I was in junior high in Shantou, I loved sitting on the seaside rocks waiting for two dolphins to appear. When I saw them swimming toward me, I would forget about everything else, even the passage of time. Years later, I completed my biology degree at Peking University. Eventually, I went to live with giant pandas in the frigid mountains, and even later I made my home amidst the karst hills to study white-headed langurs. Today, I find myself on a speedboat, again searching for these mysterious animals from my childhood. Through the decades I have never forgotten their kindness, and, bearing a grateful heart, I hope to do my part to ensure their survival.

Pan Wenshi

March 12, 2004

Sanniang Bay

生之愛





潘文石

北京大学教授。第十届全国政协委员。1980—1996年生活在野生大熊猫中间，发现了大熊猫依靠自然力就可以继续生存的“自然庇护所”，揭示了大熊猫不受竹子开花之害的原因，记录了野生大熊猫也具有黑熊一样的繁殖能力，从而在保护大熊猫的关键时刻帮助政府及国际组织作出正确的决策；又从1996年至今，在广西的热带丛林里，研究“土地—人口—野生动物之间的复杂关系”，提出自然保护的核心问题是“只有让百姓得到温饱，自然保护才能得以顺利进行”，从而在缺水、贫瘠的喀斯特石山中拯救了一群白头叶猴，保护了一片村庄；再从2003年至今，在北部湾研究白海豚继续生存的可能性，向钦州政府提出可持续发展的建议：以三墩路为界，争取经济建设（路西）和自然保护（路东）能取得共赢。

由于三十多年来在全球的自然保护运动中不断做出贡献，荣获过十多项中国国家级奖章和7个国际奖项：如1992年被评为全国“五一劳动奖章”获得者；1994年，获中华全国归国华侨联合会“爱国奉献奖”；1996年5月获北美大熊猫基金会的科学特别成就奖；1996年10月获美国圣地亚哥动物学会（Zoological Society of San Diego）野生动物保护金质奖章（Conservation Medal）；1996年获荷兰王子 Prince Bernhard（伯纳德王子）颁发的保护野生生物“金色诺亚方舟金奖（Golden Ark）”；1999年获世界野生生命基金会（WWF）颁发的最高奖鲍尔·盖提（Paul Getty）奖；2008年获福特汽车环保奖之“生态文明贡献奖”；2010年获“影响世界华人大奖”等。

Pan Wenshi
Professor at Peking University
Member of the 10th CPPCC National Committee

Professor Pan Wenshi has devoted more than 30 years to wildlife conservation. From 1980 to 1996, Prof. Pan lived with giant pandas in Qinling Mountains for 16 years and discovered the “natural refuge” of pandas, where no human interference is needed. He dispelled the myth that pandas were threatened by the flowering of bamboo, and revealed the fact that wild giant pandas are as fertile as black bears. These crucial findings helped governments and international organizations make the right decisions to protect the endangered species. In 1996, Prof. Pan shifted his focus to the tropical forest in Guangxi and has been studying the relationship of land, people and wild animals there since then. “Only when the local communities”, as the primary determinant in conservation according to him, “are free from basic food and clothing concerns, can conservative actions succeed.” Bearing this in mind, Prof. Pan has successfully saved the white-headed langurs population and protected the local villages in the sterile karst mountains. With the same approach, Prof. Pan has been conducting research on the viability of the white dolphin population in the Beibu Gulf since 2003. He suggested that the government of Qinzhou set Sandun Road as the dividing line between industry (west of the road) and nature (east of the road), so as to achieve a win-win situation between economic growth and ecological conservation.

To acknowledge his contribution to biodiversity conservation, Prof. Pan has been awarded more than ten national medals and seven international honors, including the National May 1 Labor Medal in 1992, the Overseas Chinese Contribution Prize by All-China Federation of Returned Overseas Chinese in 1994, the Award for Special Scientific Achievement by the Great Bear Foundation in 1996, the Conservation Medal from Zoological Society of San Diego in 1996, the Golden Ark Award by Prince Bernhard of the Netherlands in 1996, the Paul Getty Award by World Wildlife Foundation in 1999, the Outstanding Contributions to Ecological Civilization Award by Ford Motor Conservation & Environmental Grants in 2008, and “You Bring Charm to the World” Award in 2010.

前言

Preface

位于热带亚洲北部的北部湾是一片美丽的浅海区域，她所蕴藏的动植物种类既丰富又特殊，可以与世界上任何丰饶的海区相媲美。然而，由于北部湾沿岸的经济发展和庞大的人群，使这里特有的动植物多样性有可能受到严重的威胁。大量的滨海工业、浅海捕捞业、滩涂养殖业和淡水河流的污染，已经使很大一部分海区的水生生物减少，人们所特别关注的钦州白海豚的栖息地和种群的数量也有可能处于危险之中。但是一个拥有十三亿人口的国家希望百姓过上更好的生活，社会经济增长也是硬道理。因此必须建立一种经济建设与环境保护同时并存的策略。

白海豚曾广泛分布在中国南海到东海的广阔海域，但最近三十多年间，它们的栖息地遭到了严重的破坏，种群数量正在急剧减少。北部湾的白海豚有可能成为地球上最后一个健康的白海豚群体。我们不应该把白海豚仅仅看成是一种动物，它们的存在是一个象征——象征着我国在自然保护方面所做的努力。保护北部湾的白海豚，也就保证了成千上万种其他生命形式的生存；保护白海豚，也就保护了北部

The Beibu Gulf is a beautiful shallow sea in the north of tropical Asia, blessed with rich marine fauna and flora comparable to any fertile waters in the world. However, the rapid growth of economy and population along the coast could bring severe damage to biodiversity in this area. In fact, pollution from coastal industry, shallow-water fishing, mudflat aquaculture and inland runoff have already led to the decline of species in a great part of it. The habitat and population of the white dolphins here, though the center of attention, are also at risk. At the same time, the importance of economic growth can never be exaggerated in a nation of 1.3 billion people. Therefore, policies with an eye to both economic construction and environmental conservation are urgently in need.

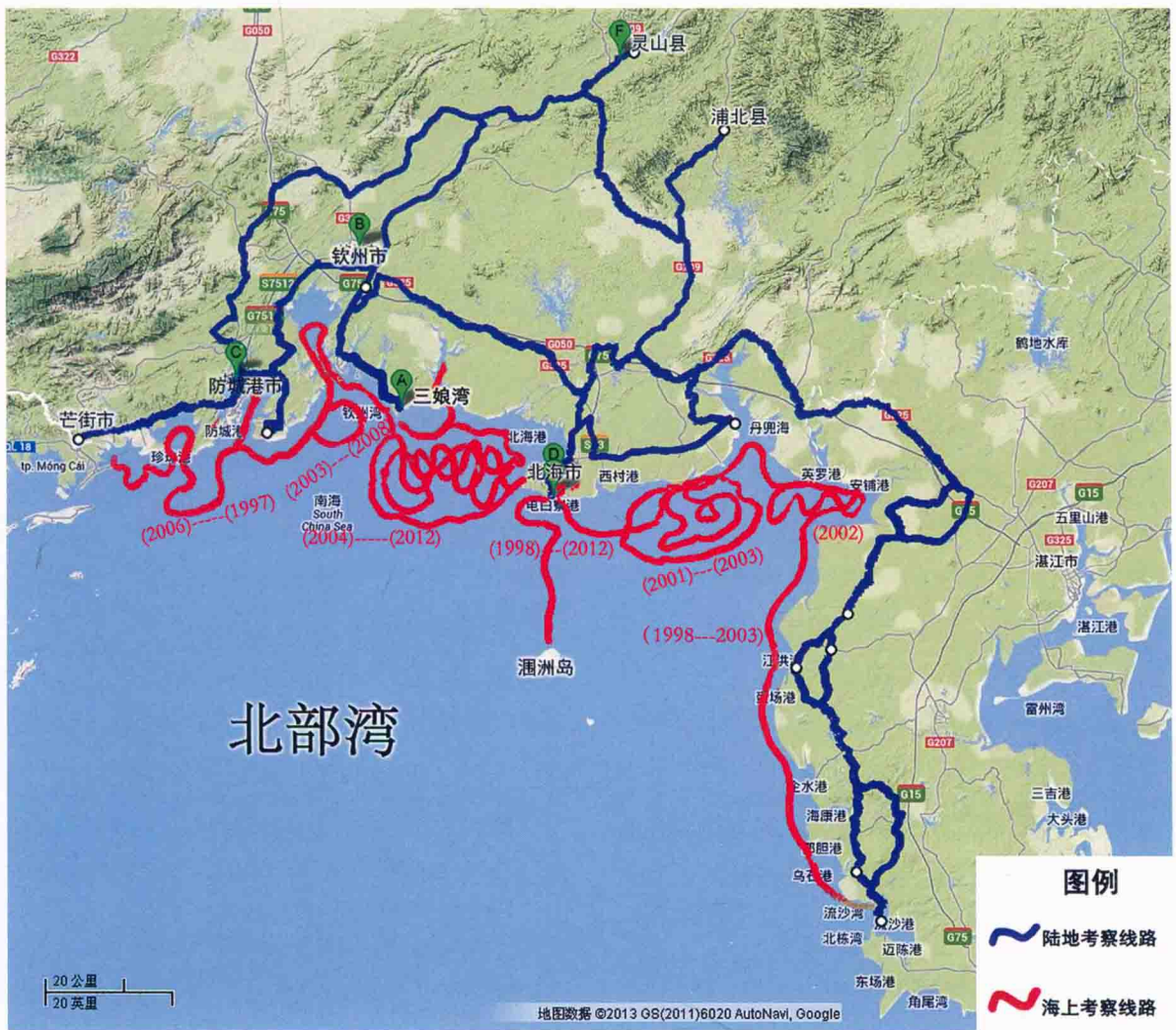
White dolphins used to range from the South China Sea to the East China Sea. However, their numbers dramatically declined due to severe habitat destruction in the recent 30 years. The Beibu Gulf population might turn out to be the last healthy white dolphin population on earth. The white dolphins here are not just a kind of animal but a symbol: their existence and preservation represent the nation's devotion to ecological conservation. To protect the white dolphins in the Beibu Gulf is to protect the tens of thousands of species in it, and the lives and property of the millions of people along the coast.

We first arrived in Beibu Gulf in August of

湾沿岸数千万至上亿人口的生命和财产。

1997年8月，我们首次翻越十万大山的东部余脉进入北部湾，并在随后6年中对这个海湾进行了全面的考察，其得天独厚的地理结构、富饶的浅海湿地、广袤的红树林、独特的珍稀物种和优美的自然风光……所到之处无不使我们为之感动。2004年4月，我们把第一个野外工作站设立在钦州三娘湾村，决心把这片海域当做一个自然保护的“实验室”，来研

1997 after crossing the eastern portion of the Shiwan Mountains. In the following six years, we performed a thorough survey of the area's geography, its fertile wetlands, mangrove forests, unique species and beautiful natural scenery. Every single place we have visited has strengthened our emotional connection with this land. In April 2004, we set up our first field work station in the village of Sanniangwan in Qinzhou, determined to make this area a laboratory for nature conservation. The aim of our research was to explore this topic: In the context of an overburdened earth, how can the people of Qinzhou uphold



研究小组在北部湾地区的考察线路和研究区域
Field exploration routes taken by our research team along the Beibu Gulf coastline

究在全球生态负荷超载的情况下，该如何坚持可持续发展的原则，才能既能改善人们生活质量，又保留住这片浅海的自然野性。不久，一支主要由北京大学的教师和学生组成的科研队伍组建起来了，后来又有来自社会各界的很多志愿者加入到这个行列中。

在研究的初期，要弄清楚白海豚的分布格局及种群数量是非常不易但又是极其重要的。我们采用最直接的办法是乘坐渔船和快艇到海上寻找白海豚的踪影；利用照相机、摄像机和GPS记录它们的形态、行为和活动地点。2004年4月至今，我们收集到了18万张照片、上千段视频及数千个GPS定位点，从这些资料中我们渐渐了解了北部湾白海豚的活动范围、种群数量、季节性迁移、发情、交配、产仔、觅食等方面的初步情况。我们特别关注白海豚所在的浅海-近岸-河口生态系统的生物多样性以及这里的入海河流的流域状况，期望通过系统整理北部湾的每一个生态学大事件和白海豚种群数量及行为变化间的关系，来明晰维持这个地理种群继续生存下去的保护策略。我们将9年来的部分研究成果总结成此书，希望能让更多的人了解和关注北部湾的白海豚。本书将从以下几个方面逐步展示白海豚的神秘生活并试图引发更深入的思考：

- 白海豚是自古就生活在中国的沿海吗？如果不是，它们从何而来？北部湾的白海豚和中国沿海的其他白海豚都一样吗？在第一章，我们从白海豚的形态学特征、地理分布状况、分子生物学及相关的地质历史事件推测中国沿岸的白海豚及其近缘种的

the principles of sustainable development while improving their standard of living and also protecting this precious remnant of wilderness? Before long, we had formed a research team consisting primarily of teachers and students from Peking University. As our research progressed, our team was joined by volunteers from all walks of life.

In the early days of our research, it was crucial but difficult to find out the population size and distribution pattern. We used a simple direct approach: we searched for white dolphins by boat, recording their morphology, behavior and appearance using cameras, video recorders and GPS receivers. We took 180,000 photos, more than one thousand video clips and thousands of GPS location points. With these records, we gradually understood many aspects of white dolphins and their life, including their population, distribution, migration, estrus, mating, breeding and feeding. We paid special attention to the biodiversity of estuarine-coastal-neritic ecosystem that white dolphins rely on and the basin state of its inflow rivers, in order to figure out proper conservation tactics to maintain this white dolphin population. Our work has been based on a systematic study on the relationship between local ecological events and dynamics of the dolphin population. This book presents some of the findings from our nine years of research. Hopefully it can facilitate the understanding of and draw more attention to the white dolphins in the Beibu Gulf. The secret life of the white dolphins will be unveiled from the following aspects as a starting point for future studies:

- Did the white dolphins originate along the coast of China? If not, where are they from? Are the white dolphins of the Beibu Gulf the same as those in other coastal areas of China? Chapter 1 explores the relationship and evolution of white dolphins in China and their sibling species according to their morphological characteristics, geographical distributions, molecular evidence and related geological events. It also addresses

演化过程；并从形态学和古气象学等角度分析了北部湾的白海豚与中国沿岸其他地区的中华白海豚的差异。认为北部湾的白海豚可以被视为一个独特的地理种群，是北部湾浅海-近岸河口生态系统中的重要一员。

- 白海豚在北部湾具体分布在什么范围？哪些自然因素决定了它们的空间分布？在第二章，我们从中国沿岸所有白海豚种群的分布范围归纳、总结出白海豚分布区的自然特征，认为热带和亚热带的河口、内湾等水深不足20 m的浅水区和洁净且水量充沛的淡水河口是白海豚赖以生存的首要条件。2004年至2012年的1080个野外调查定位点数据揭示了北部湾的白海豚主要分布范围在钦州的三娘湾至大风江口，生存于人类活动狭缝中的白海豚种群正面临着前所未有的危机。
- 种群数量是保护工作的最基本信息，也是描述一个野生种群的最重要的参数。在第三章，介绍了我们在北部湾估算白海豚种群数量的基本方法：基于照片识别的标记-重捕法。并以绘制发现曲线和利用统计软件（MARK软件的POPAN模型）的方法估算了整个北部湾和钦州湾白海豚的种群数量。结果显示：在钦州的三娘湾，存留着一个有一定数量的、健康的、极具保护意义的白海豚种群。
- 在第四章，我们计算了白海豚的有效繁殖群

the differences between the white dolphins of the Beibu Gulf and other white dolphins along the coastal area of China from the perspective of morphology and paleoclimatology. Based on these analyses, we propose that the white dolphins of the Beibu Gulf should be regarded as a unique geographic population (i.e., the Beibu Gulf white dolphin), and the species is an important component of the estuarine-coastal-neritic ecosystem of the Beibu Gulf.

- Where do the white dolphins live? Which natural factors determine their distribution? Chapter 2 summarizes the distribution data of all the white dolphins living along the coast of China, and concludes that tropical and subtropical estuaries and gulfs with water shallower than 20 m are the major habitats of white dolphins, especially river mouths with clean and plentiful water supplies. The 1080 GPS location points we collected from 2004 to 2012 delineate the primary distribution area inhabited by Beibu Gulf white dolphins. The data clearly shows that the population in the area with heavy human activities is facing an unprecedented plight.
- Population size provides basic information for conservation and the most important parameter in describing a wild population. Chapter 3 calculates the abundance of the white dolphin population in the Beibu Gulf. We adopted the Sight-Resight method based on photographic identification and estimated the population size by drawing a discovery curve and using statistical software (i.e. POPAN Model in Program MARK). The results suggest that the white dolphins of the Beibu Gulf are a significant healthy population to be conserved.
- Chapter 4 calculates the effective population size of Beibu Gulf white dolphins and analyzes a general issue concerning small populations: the loss of genetic diversity and inbreeding

体大小，分析了一个普遍意义上的小群体所可能面临的遗传多样性丧失和近交衰退等问题。我们根据现在掌握的种群参数，利用计算机模拟技术对这个种群进行了生存力分析，并预测了未来200年内这个群体的数量变化趋势。认为在当前北部湾进入经济开发的火热时期，对自然生境的监测以及对白海豚种群的保护是头等大事。

depression. Based on available data, computer simulation is conducted to predict the population dynamics in the following 200 years using Population Viability Analysis. The results suggest that, given the fact that the economic development of the Beibu Gulf is in full swing, monitoring and preserving the white dolphin population and their natural habitats should become a priority.



- 在第五章，我们初步确定了白海豚的食物种类，发现从取食鱼类的种数上，与*Sousa*属其他种群类似，但上中水层的物种明显较多。我们对比了三娘湾海域白海豚的年均取食量和当地的渔获量，发现除人类外，少有海洋哺乳类与其竞争食物。我们列出了三娘湾海域常见鱼类名录，从中可以发

- Chapter 5 lists out the diet of Beibu Gulf white dolphins. The number of species constituting the population's diet is similar to that of other *Sousa* dolphins, but Beibu Gulf white dolphins feed on more species of mid-upper ocean strata. By comparing annual consumption of white dolphins in the Sanniang Bay with local fish catch and other marine mammals' diet, it is found that white dolphins face little competition for food from animals other than humans.

现：丰富的鱼类物种，维持着三娘湾近岸-河口海洋生态系统的稳定，也为白海豚提供了丰富的食物资源。

- 在第六章，我们从组成北部湾近岸-河口生态系统的无机环境入手，叙述了北部湾的形成历史和地貌特征。分析了这一生态系统中浮游植物、无脊椎动物及鸟类的物种多样性和组成特征，认为相对稳定的温热气候、河口区域独特的地貌屏障、较少的陆源污染造就了这里健康、稳定、高生产力的生物群落，进而成为生物多样性热点地区和北部湾白海豚的自然庇护所。
- 在第七章，我们以生态足迹为指标来衡量钦州可持续发展的潜力。我们采集了钦州市区、灵山县、三娘湾渔村共计829户居民的基本生活数据，使用全球通用的生态足迹模型，统计发现钦州范围内的城市、渔村和山区小城镇的人均生态足迹普遍低于广西、中国和全球的水平。我们认为：在全球人口增长、生态超载的今天，钦州人民仍以一种顺应自然的方式生活着，除了获取自己生存必需的自然资源外，还可以把较多的自然财富留给子孙后代。
- 在第八章，我们以大量的图片表现钦州的美丽，不论是悠远的历史人文之美，还是淳朴的生态自然之美，都将在当代钦州人民的努力下铸造成永恒。这需要我们兼顾经济发展和环境保护，在可持续发展的伦理观之下，调整经济建设的布局并保护重

Following this, a list of common fish species of the Sanniang Bay is provided. The abundance and diversity of fish species here not only keep the coastal-neritic ecosystem stable, but also provide ample food resources for the white dolphins.

- Chapter 6 studies the inorganic environment that constructs the coastal-neritic ecosystem and reviews the formation of the Beibu Gulf and its geological features. The biodiversity and characteristics of the plant plankton, invertebrates and birds in this ecosystem is analyzed. Thanks to the stable mild and warm climate, the unique landform of the river mouth and little pollution from land-based sources, the fauna and flora prosper in good health and productivity, making the area a hotspot of biodiversity and a natural refuge for Beibu Gulf white dolphins.
- Chapter 7 estimates the ecological footprint of Qinzhou to measure its potential sustainability. We collected basic lifestyle data from 829 households in the city of Qinzhou, the County of Lingshan and the fishing village at Sanniang Bay. With the ecological footprint model, it is found that the average ecological footprint in the Qinzhou area is below that in Guangxi Province, China, as well as the world. In a world with exploding population and serious ecological overshoot, the people in Qinzhou are living a natural life, utilizing natural resources as they need and leaving more to the future generations.
- Chapter 8 showcases the charm of Qinzhou through pictures, covering both the customs and traditions of the local culture and the beautiful natural landscape. To preserve this beauty in the long run, we need the ethics of sustainability and a balanced approach addressing both economic restructuring and environmental preservation. If we can do this, a win-win situation will be

要自然生境，争取实现经济发展和自然保护的双赢。

主要栖息于三娘湾的钦州白海豚是中国沿岸最有希望继续健康存活的种群，从过去到现在，它们的生存完全取决于自然力，但是对于它们的未来，则必须在更大程度上取决于人类的爱护和管理。钦州市委、市政府能够以牺牲部分经济利益为代价来保护三娘湾-大风江口的白海豚，使我们看到了钦州人民在不远的将来取得经济建设和环境保护双赢的曙光。白海豚不仅是钦州人引以为荣的自然资源，同时也是钦州人精神世界的一部分。拯救北部湾的白海豚，更是我们对国家、对世界、对子孙后代、对共同生活的其他生命形式的未来所承担的义务和责任。

achieved.

The population of Beibu Gulf white dolphins is the most promising population living along the coast of China. They have survived the past on their own, yet their future is in our hands. The municipal government of Qinzhou has pioneered the way by putting the conservation of white dolphins of Sanniang Bay before economic interests. With the commitment from the government and people, we are going to see a better Qinzhou, prosperous and ecological. The white dolphins are not only the pride of the locals but also their love. It is our obligation and responsibility to preserve the white dolphins for the Beibu Gulf, for the nation, for the world, for the generations to come and for all life on this planet.

钦州的
白海豚

THE WHITE DOLPHINS
OF QINZHOU



致谢

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在钦州研究如何保护白海豚的十年间，让我们都欣喜地看到：自然保护工作正逐步地成为钦州人民的共同事业，如今这个事业已经紧密地整合了科学的、环保的、经济的、政治的、美学的、道德伦理的以及全社会的力量，为了建设一个崭新的、更加美好的钦州——“自然保护与经济增长都能取得双赢”的社会模式而努力奋斗。

研究工作自始至终都能得到广西各级党委和政府以及海内外的民间组织与个人的支持、鼓励和指导，使我们能够不断地明确科学研究的目標，勇敢地面对挑战并克服种种困难。

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