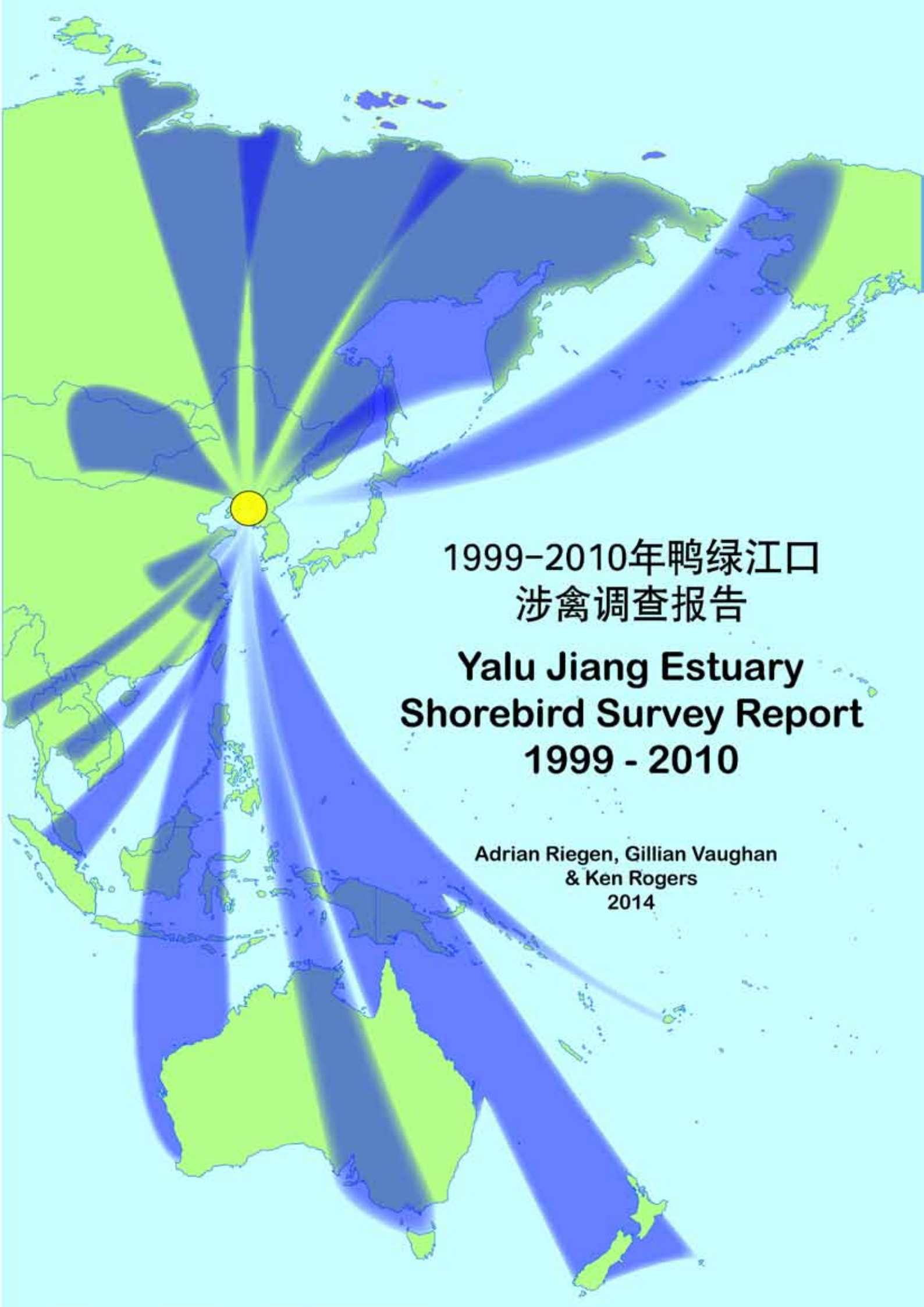

1999–2010年鸭绿江口涉禽调查报告

Yalu Jiang Estuary Shorebird Survey Report 1999 - 2010

Adrian Riegen, Gillian Vaughan
& Ken Rogers
2014

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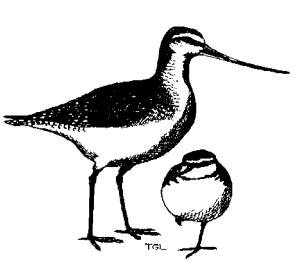

中国丹东鸭绿江口湿地国家级自然保护区–新西兰米兰达自然基金联合项目

A Joint Project Between Yalu Jiang Estuary Wetland National Nature Reserve - China and Miranda Naturalists' Trust - New Zealand

Adrian Riegen, Gillian Vaughan and Ken Rogers

2014

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签署谅解备忘录
Signing the Memorandum of Understanding

米兰达涉禽中心
Miranda Shorebird Centre

孤山管理站
Gushan Management Station

序

回顾过去十二年在黄海地区调查涉禽所经历的点点滴滴，令我印象最深刻的片段便是1999年5月首次拜访丹东鸭绿江口湿地国家级自然保护区第一天的情景。

在黄海地区调查的日子里，我们总是对新的调查点充满了期待。还记得初到鸭绿江口湿地国家级自然保护区时,我们的面包车在西边的人工养殖塘区爆胎了，那个位置距离海防大堤只有一小段距离，所以在百无聊赖的等待中，有些不耐烦的我们便抓起望远镜和单筒跳出面包车，快步走向海防大堤。一到那里我们就看到远处滩涂的一个临时鸟类休息场所，有好几大群刚被潮水驱赶起来的涉禽向四面八方飞去。随后我们发现，在鸭绿江口只要估算好调查时间，就能在鸟群被潮水驱赶到海防大堤附近时以很近的距离观察大群涉禽；事实上，这个情况当天就被验证了，那天我的野外记录本上记载了7800只斑尾塍鹬、6300只大滨鹬、3700只黑腹滨鹬以及1400只灰斑鸻(白腰杓鹬和红腰杓鹬)。我们还看见了一只从澳大利亚维多利亚州飞来的带橙色旗标的斑尾塍鹬。这为我们接下来连续8天沿保护区60公里海岸线的涉禽调查拉开了精彩的序幕。而整个调查中共记录到25种152,000只涉禽，我们发现了一个对涉禽极其重要的迁徙补给地。

如本报告所述，在北迁时期的4、5月份内不同的时间段里先后共进行了9次覆盖整个保护区海岸线的完整的涉禽调查。调查结果显示鸭绿江口对14种涉禽来说是有国际重要意义的栖息地；在整个迁徙路线上，前往繁殖地的斑尾塍鹬(包括 *baueri* 和 *menzbieri* 亚种)、红腰杓鹬、大滨鹬、黑腹滨鹬和灰斑鸻的迁徙种群中，很大一部分的个体都会在保护区内栖息。近1000笔的旗标收回记录将鸭绿江口与8个国家直接地联系起来。对单个物种的迁徙物候的分析结果表明在整个北迁时期，约有250,000只涉禽在鸭绿江口保护区停歇和补充能量。

如今，随着韩国新万锦湿地被围垦而殂落，鸭绿江口继任为黄海地区北迁涉禽最重要的迁徙补给地。新万锦湿地之殇已经给人类上了很沉重的一课。澳大利亚最新的涉禽种群监测数据表明，新万锦工程围堤后，那里的几个关键物种的种群数量开始大幅下降，而且可以肯定的是，这主要是由于它们在新万锦的栖息地的消失造成的。

如果是在几年前，我永远也无法相信这其中的两种涉禽，大滨鹬和红腰杓鹬，会被国际自然保护联盟(IUCN)列入受胁等级“易危”之列。它们用死亡的代价来向我们证实失去关键的迁徙停歇地对一个物种的惨痛影响，同时也是对我们在这个极度渴求发展的世界里，无力保留一丝自然空间让人与自然共存的控诉。每当思忖着这两个物种的前景，以及如果鸭绿江口也遭受到与新万锦同一命运,届时斑尾塍鹬的未来时，都让人感到不寒而栗。

这份报告的主旨是为了让决策者注意到鸭绿江口湿地国家级自然保护区的重要性，从而能更有科学根据地制定决策。这份报告也阐述了一个不可否认的事实——保护鸭绿江口湿地国家级自然保护区的滩涂，为了涉禽也为了人类。

Mark Barter 2011

FOREWORD

The most enduring memory I have of the twelve years I spent surveying for shorebirds in the Yellow Sea occurred on the first day of my first visit to Yalu Jiang Estuary Wetland National Nature Reserve (YJNNR) in early May 1999.

Full of the anticipation that always occurs when visiting a new and, at that time, unsurveyed site, we were wending our way through the aquaculture ponds in the western part of the reserve when our vehicle had a puncture a short distance from the seawall. Impatiently, grabbing our binoculars and telescopes, we jumped out of the van and walked rapidly towards the wall, very soon seeing huge flocks of shorebirds flying in all directions as they were disturbed by the incoming tide from preliminary roosts on the outer mudflats. We found later that if you get the timing right at the Yalu Jiang Estuary it is possible to closely observe large flocks as they are pushed towards the seawall by the tide; that is exactly what happened that first day and my field notes record that we counted 7,800 Bar-tailed Godwit, 6,300 Great Knot, 3,700 Dunlin and 1,400 curlew. We also found an orange-flagged godwit from Victoria, Australia. A brilliant start to the 8-day survey of the 60 km coastline of the reserve! The complete survey count totalled 152,000 shorebirds of 25 species confirming that we'd discovered an extremely important shorebird staging site.

As this report describes, there have been a further seven complete and one partial counts of the reserve coastline, all carried out at different times in the April-May northward migration period, which show that the Yalu Jiang Estuary is internationally important for 14 species; of these the reserve supports very high proportions of the breeding populations of Bar-tailed Godwit (both the *baueri* and *menzbieri* subspecies), Eastern Curlew, Great Knot, Dunlin and Grey Plover. Sightings of over 1,000 leg-flagged birds have directly linked the reserve with eight countries. Analysis of the migration phenology of the individual species indicates that the reserve supports around 250,000 shorebirds during the northward migration period.

Today, the Yalu Jiang Estuary is the number one site in the Yellow Sea following the demise of South Korea's Saemangeum, enclosed by a seawall. There is an important lesson for us here. Recent monitoring in Australia of key species using Saemangeum has shown that some have declined greatly since the closure and it is believed that this is due mainly to the loss of Saemangeum. Only a few years ago I would never have believed that two of these species, the Great Knot and Eastern Curlew, would be Red-listed as Vulnerable by the International Union for Conservation of Nature (IUCN). It is a graphic demonstration of the impact that the loss of a key migration stopover can have on a species and is an indictment of our inability to allow room for nature to coexist in a development-hungry world. It is frightening to contemplate what will happen to these two species, and Bar-tailed Godwit, if the Yalu Jiang Estuary suffers the same fate as Saemangeum.

The rationale for this report is to draw the attention of decision makers to the importance of the Yalu Jiang Estuary Wetland National Nature Reserve so that they can make decisions based on good science. The report makes an undeniable case for conservation of the Yalu Jiang Estuary Wetland National Nature Reserve's mudflats – for shorebirds and for people.

Mark Barter 2011

序

水鸟是湿地生态系统的重要组成部分，她与人类生活息息相关，是人类环境健康的重要指标。水鸟使人类社会绚丽多彩。水鸟是人类的朋友，人类的伙伴。

黄海湿地是水鸟南北迁徙的重要驿站，是东亚-澳大利西亚水鸟迁徙路线的重要组成部分。她那广阔的海岸滩涂为上百种，数量超过千万只的迁徙水鸟提供了优良的中途停歇地，使其得以补充继续飞行所需的脂肪储备。特别是每年4－6月份的北迁时期，约18种鸻鹬鸟类超过30%的种群数量，5种鸻鹬鸟类的数量甚至是其迁徙种群的全部数量(弯嘴滨鹬、斑尾塍鹬、白腰杓鹬、大滨鹬和环颈鸻)。大约80%的大杓鹬和40%的半蹼鹬迁徙种群在北迁期间利用黄海湿地。

54种鸻鹬鸟类在南迁或北迁期间利用黄海地区，支持的鸻鹬鸟类总量可高达200万只之多，占整个迁徙路线迁徙鸻鹬鸟类种群的40%，而南迁期间也有大量的鸻鹬鸟类经过这里，总数达100万只以上。

鸭绿江口湿地国家级自然保护区位于中国辽宁省丹东市，处于中国海岸线的最北端。这里物种资源非常丰富，为多种生物提供了适宜的生存环境，是东亚-澳大利西亚水鸟迁飞路线上的一个重要停歇地。每年仅从澳大利亚、新西兰飞来途经此地的鸻鹬鸟数量达几十万只。保护区大片的滩涂湿地为鸟类迁飞提供了大量而又丰富的食物。她是东亚－澳大利西亚鸟类迁徙路线上非常重要的一块湿地。

2004年4月，在湿地国际的帮助下，鸭绿江口湿地国家级自然保护区管理局与新西兰米兰达 (Miranda) 基金会签订谅解备忘录，缔结为姊妹保护区。8年来，中外专家共同合作，每年在鸟类迁飞季节开展对鸭绿江口湿地鸻鹬鸟类的调查与监测，不仅收集到大量鸟类迁徙资料，而且交流了经验，使保护区管理水平不断提高，管理手段与方法得到改善，科研技术得到增强，宣传教育收到显著成效，地区与国际交流层面得到扩大-成为东亚-澳大利西亚涉禽保护区网络中的佼佼者，为推动东亚-澳大利西亚涉禽保护区网络的合作与交流作出积极的贡献。这充分说明国际合作的重要性。

最近，新西兰米兰达基金会的专家会同鸭绿江国家级自然保护区的专家完成了“鸭绿江口鸻鹬鸟类调查报告{1999-2010}”(Yalu Jiang Estuary Shorebird Survey Report 1999 – 2010)。这份长达70页的技术报告，对鸭绿江口国家级自然保护区内北迁鸻鹬鸟10年的调查分析，确认每年全球214种鸻形目鸟中的14种，数量至少在25万只以上在此停歇。充分揭示该保护区在鸟类迁飞路线上所处的重要位置。同时，特别指出保护区面临被开发的威胁，希望当地政府采取措施，鼓励开展研究工作，进一步加强保护区管理的力度，使其真正成为东亚-澳大利西亚鸟类迁飞路线上一颗永不消失的璀璨明珠。

湿地与鸟类保护是一项伟大的事业，我衷心祝愿这份报告[中英文版本]的问世，为各国政府，特别是为中国辽宁省、丹东市政府在鸭绿江口湿地国家级自然保护区保护与管理提供最有力的支持，推动中国和东亚地区湿地保护事业的发展！

湿地国际-中国办事处 2011年9月

FOREWORD

Waterbirds constitute an integral part of wetland ecosystems, they are closely linked to human life and are very important indicators for the health of human environmental conditions. Waterbirds make human society bright and colourful. They are our friends as well as our partners.

Wetlands surrounding the Yellow Sea are significant stopover sites for waterbirds during their north and southward migrations. The extensive coastal mudflats provide quality stopover sites for many thousands of migratory waterbirds of more than 100 species. Here they replenish their fat reserves before continuing their migrations, specifically during the northward shorebird migration between April and June each year. The Yellow Sea supports more than 30% of the estimated flyway breeding populations of 18 shorebird species, and for five of the species, Curlew Sandpiper, Bar-tailed Godwit, Eurasian Curlew, Great Knot and Kentish Plover this region supports almost the entire flyway population. Approximately 80% of the estimated flyway population of the Eastern Curlew uses the Yellow Sea on northward migration as does 40% of the Asian Dowitcher population.

At least 2,000,000 shorebirds of 54 species use the Yellow Sea region during northward migration, this number being approximately 40% of all the migratory shorebirds in the East Asian-Australasian Flyway (EAAF). Large numbers are also present during southward migration when perhaps 1,000,000 shorebirds pass through the region.

The Yalu Jiang Estuary Wetland National Nature Reserve (YJNNR) is located in Dandong, Liaoning Province of China at the northern end of the Chinese coastline. This reserve has a rich species resource and provides suitable habitat for many species. The reserve is also an important staging site for waterbirds that migrate along the EAAF with several hundred thousand shorebirds migrating from Australia and New Zealand to this reserve every year. The vast tidal wetlands within the reserve provide abundant and ample food resources for migratory birds. The YJNNR is a very important wetland in the EAAF.

In April 2004, with assistance from Wetlands International, the YJNNR management team signed a Memorandum of Understanding with the Miranda Naturalists' Trust (MNT) from New Zealand and have since then built a sister site partnership. In the last eight years, Chinese and international experts have worked together, conducting shorebird surveys and other monitoring work at the Yalu Jiang Estuary during the migratory season. Such cooperation has not only enabled the collection of extensive amounts of bird migration data but also the exchange of experiences. Subsequently the management standard of the reserve has increased, the management methods and strategies have improved, scientific research techniques have been strengthened, advocacy and education have been significantly effective and regional and international exchanges were expanded. The reserve has become an outstanding member within the East Asian-Australasian Network for the Protection of Migratory Birds and has made a positive contribution to the cooperation and exchange within the network. These results highlight the importance of international cooperation.

Recently, experts from the MNT and YJNNR have completed the "Yalu Jiang Estuary Shorebird Survey Report 1999-2010". This technical report has analyzed the northward migration of shorebirds in the YJNNR and neighbouring Yalu River West over the last ten years. It confirmed that among the 214 shorebird species of *Charadriiformes* in the world, 250,000 individuals of 41 species stage at the Yalu Jiang Estuary each year, therefore revealing the important position that the Yalu Jiang Estuary plays along the flyway. Meanwhile, the report specifically points out the threats of development in the reserve. It is hoped that the Dandong government can take action to encourage research work, reinforce the management within the reserve and make the reserve an everlasting pearl along the EAAF.

Wetlands and bird conservation are a great career option, and I sincerely hope the publishing of this report in Chinese and English will encourage students to study these wonderful ecosystems and that it will also provide support for governments of many different countries, but especially for the conservation and management of the YJNNR by the local government of Liaoning Province in China. I also hope the publishing of this report will promote other wetlands conservation activities in China and East Asia!

Chen Kelin
Director Wetland International - China
October 2011

摘要

鸭绿江口湿地国家级自然保护区(以下简称鸭绿江口保护区)位于中国东北部与朝鲜毗邻，保护区总面积10.1万公顷，包括鸭绿江入海口西侧60公里长的潮间带湿地及堤内的人工养殖塘、稻田、芦苇地及部分沿海海域。

1999年，鸟类调查人员发现鸭绿江口保护区及其周边地区是东亚-澳大利西亚鸟类迁徙路线上主要的涉禽迁徙补给地。在2002年，鸭绿江口保护区被确立为黄海地区9个最重要的鸟类迁徙补给地之一，北迁时期在这些地点栖息涉禽均超过10万只。

2004年，新西兰米兰达自然基金会和鸭绿江口保护区建立姊妹保护区关系，并签署了谅解备忘录。基金会和保护区共同开展的鸟类调查结果显示，每年北迁时期(3至5月)承载着至少250,000只涉禽停歇的鸭绿江口是东亚-澳大利西亚鸟类迁徙路线上最重要的鸟类迁徙补给地。本报告概述了1999年至2010年间9次鸟类调查的结果。

在鸭绿江口保护区内共记录到涉禽41种，其中有15种涉禽每年或经常出现，且它们的种群数量均达到国际重要意义标准(《拉姆萨尔湿地公约》)。这一类涉禽中包括极危物种小青脚鹬。

鸭绿江口保护区及周边河口湿地是斑尾塍鹬最重要的迁徙补给地，北迁时期有超过9万只斑尾塍鹬在此停歇。尽管不同亚种对鸭绿江口保护区的利用情况还在调查之中，但估计从新西兰起飞向北迁徙的斑尾塍鹬中有70-80%的个体会在鸭绿江口停歇。在2007年，携带卫星跟踪器的斑尾塍鹬“E7”，从新西兰米兰达出发，连续飞行10,200公里，经过7日7夜飞抵鸭绿江口。

据估计有7-8万只大滨鹬及2.2万只红腰杓鹬和白腰杓鹬在北迁时期经过鸭绿江口保护区。另外本报告还估计了另外5种涉禽的迁徙种群大小。

涨潮时，涉禽在飞入堤内人工养殖塘和的休息场所之前，会先在潮间带高程较高的区域内聚集。我们将涉禽聚集的主要区域沿海岸线划分为15个点位，并在这些点位进行涉禽调查。记录到涉禽数量最高的几个点位都集中在鸭绿江口保护区的东部(靠近东港市)，其中一个点的最大计数为4月底的73,583只。另外还有7个点的最大计数也都超过20,000只。但是这些调查结果只能反映涉禽在高潮期休息场所的分布格局，它们觅食地的分布可能有所不同。

在鸭绿江口保护区及周边河口湿地共记录到了超过1000笔来自8个国家19个地区的佩带旗标和彩环的涉禽回收记录。由此可见，鸭绿江口可谓东亚-澳大利西亚迁徙路线上的旅途集散中心，来自许多不同地区的涉禽都会途径此地。

针对鸭绿江口保护区涉禽保护的情况，本报告还提出了若干建议。希望这些意见与建议会对鸭绿江口湿地的保护起到借鉴作用。

斑尾塍鹬史诗般的旅行将新西兰和中国紧密的连结起来，为了保护这些鸟类，我们必须携手共进。

Executive Summary

The Yalu Jiang Estuary Wetland National Nature Reserve (the Reserve) in NE China, adjacent to North Korea (DPRK) covers a total area of 101,000 hectares of intertidal mudflats, coastal aquaculture ponds, rice paddies, reedbeds and part of the shallow seabed, along 60km of coastline westwards from the Yalu River.

In 1999 it was discovered that the reserve and the adjacent areas are a major shorebird staging region on the East Asian-Australasian Flyway (EAAF). In 2002 the reserve was identified as one of nine mega sites, sites used by more than 100,000 shorebirds, in the Yellow Sea during migration.

The Miranda Naturalists' Trust signed a partnership agreement with the reserve in 2004 and since then joint surveys with reserve staff have shown Yalu Jiang Estuary to be the most important staging site on the EAAF for migratory shorebirds with at least 250,000 passing through the area during northward migration (March–May). This report outlines the results of nine surveys that occurred between 1999 and 2010.

A total of 41 shorebird species have been recorded in the reserve, 15 of these species occur annually or regularly in internationally important numbers (Ramsar Criteria). Included in this group is the critically endangered Spotted Greenshank.

The Reserve and River are without doubt the most critical sites for Bar-tailed Godwit, with an estimated 90,000+ using the area while migrating north. The use of the reserve by the different godwit subspecies is under investigation but it is estimated that 70%-80% of all godwits migrating north from New Zealand will pass through the reserve. In 2007 the godwit 'E7' (being tracked by satellite (page 65)), flew 10,200km non-stop from Miranda in New Zealand to the Yalu Jiang Estuary a journey taking over seven days.

It is estimated that 70,000-80,000 Great Knot, and 22,000 Eurasian and Eastern Curlews also pass through the reserve on northward migration. Migrating population estimates are given for five more species in this report; minimum numbers are given for those species where an estimate cannot yet be made.

Shorebirds gather at 15 main areas (known as Sites) along the reserve's 60km of coastline on the incoming tide, before moving to aquaculture ponds and the River to roost. Birds were counted at these sites during surveys. The sites with the highest counts of shorebirds were concentrated at the eastern end of the reserve (near Donggang) with the highest count being 73,583 recorded in late April. A further seven sites have counts of over 20,000 each. These counts focus on roosting distribution, which may differ from feeding distribution.

Over 1,000 banded and other marked shorebirds from 19 regions in 8 countries have been identified in the reserve and River, highlighting Yalu Jiang Estuary's location as a focal point during migration for shorebirds from many parts of the flyway.

Recommendations for the protection of shorebirds at Yalu Jiang Estuary Wetland National Nature Reserve are presented. It is hoped these suggestions and recommendations can provide a reference for effecting the conservation of the Yalu Jiang Estuary Wetland.

New Zealand and China are tied together by the epic journey of the Bar-tailed Godwit. To protect this and the other species, we must work together.

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Jan van der Kam

1 前言

直到1999年5月 Mark Barter 和 Jim Wilson 到鸭绿江口寻找迁徙的涉禽，我们才第一次了解到鸭绿江口的涉禽栖息情况。沿着丹东鸭绿江口湿地国家级自然保护区的滩涂，他们发现了近152,000只涉禽。涉禽是属鸻形目的214种鸟类的统称，它们在全球所有大陆和众多岛屿都有分布。鸭绿江口的涉禽大部分都是旅鸟，它们途经这里到达中国北部、蒙古、西伯利亚及阿拉斯加的繁殖地，繁殖结束后回到位于东南亚和澳大利西亚的越冬地。鸭绿江口是联系这些鸟类繁殖地和越冬地的枢纽，鸟类在此补充食物并积蓄能量，为下一阶段的飞行做准备。米兰达保护者基金会的会员和丹东鸭绿江口湿地国家级自然保护区的工作人员经过连续10年的涉禽调查，确定保护区及其周边河口湿地是这些迁徙鸟类极其重要的迁徙补给地。

涉禽调查结果显示，每年3至5月承载着至少250,000只涉禽停歇的鸭绿江口地区是东亚-澳大利西亚鸟类迁徙路线上最重要的鸟类迁徙补给地。在鸭绿江口栖息的涉禽中有14种的数量超过其在迁徙路线上种群总数量的1%，达到国际重要意义标准。有一些涉禽每年会不停歇的连续飞行1万公里甚至更远到达鸭绿江口。全球多个地方的研究表明，许多涉禽会对其迁徙路径进行微调，以更好地利用迁徙途中有限的几个栖息地所提供的特有的食物资源，如果这些栖息地因为某种原因而丧失，这些鸟类的种群数量将会受到严重影响。对于这25万只或甚至更多的涉禽而言，在鸭绿江口栖息是它们每年生活史中重要的一环。

如今，丹东鸭绿江口湿地国家级自然保护区在国内外享有很高的知名度，每年春天都有许多观鸟者和游客慕名前往丹东地区观赏万鸟腾飞的壮观景象。然而，由于鸭绿江口处于沿海地区，经济活动较为发达，如果在经济发展的过程中不考虑这些鸟类的需求，这些发展就可能对鸟类产生负面的影响。

本报告重点介绍了北迁时期鸭绿江口涉禽的种类、数量、栖息地利用情况以及人类活动和工业发展对本区域鸟类及栖息地带来的压力。

Adrian Riegen

1. Introduction

Virtually nothing was known about migratory shorebirds at the Yalu Jiang Estuary until Mark Barter and Jim Wilson visited in May 1999 to look for them. Along the coast of the Yalu Jiang Estuary Wetland National Nature Reserve (YJNNR) they found 152,000 shorebirds. Shorebirds (also known as waders) comprise about 214 species of the order Charadriiformes and are found globally, on all continents and many islands. Shorebirds at the Yalu Jiang Estuary are mostly migratory using the area to refuel en-route to their breeding grounds, which stretch from northern China and Mongolia to Siberia and Alaska, and their non-breeding grounds in East and Southeast Asia and Australasia. Over ten years members of the Miranda Naturalists' Trust (MNT) and staff of the YJNNR have surveyed the shorebirds and confirmed that the Reserve and the adjacent Yalu River West are extremely important staging sites during these migrations.

Survey counts now show that the Yalu Jiang Estuary is the single most important staging site known on the East Asian-Australasian Flyway (EAAF), with at least 250,000 shorebirds using the area to refuel between March and May each year. At least 14 species use the reserve in internationally important numbers. Some birds travel 10,000km or more non-stop each year to reach the Yalu Jiang Estuary. It has become clear from studies around the world that many shorebirds have fine-tuned their migrations to take advantage of very specific food resources at a limited number of sites and if these sites are lost for any reason their populations can be seriously affected. The Yalu Jiang Estuary is a key link in the annual life cycle of 250,000 or more shorebirds.

The Reserve is now well known across China and internationally and the shorebirds are attracting growing numbers of Chinese visitors to the Dandong Region eager to marvel at these remarkable birds during their brief stay each spring. In contrast the Yalu Jiang Estuary sits next to a rapidly growing industrial part of China and this development is likely to have detrimental effects on shorebirds if their needs are not considered during development planning.

This report highlights the number of shorebirds and different species using the Yalu Jiang Estuary during northward migration, the coastal habitat in the reserve and the pressures, both human and industrial, being placed on the birds and the environment. We recommend strategies to ensure shorebirds have a stable future amid the local economic development and ensure the conservation of shorebirds and local economic development can be coordinated. Shorebirds and people can coexist if that is the people's wish but it requires careful thought and planning as to where developments take place, so that the needs of birds are also considered. It is hoped this report will help in these decision-making processes.

我们建议制定合理的发展策略使得在当地经济发展的过程中，仍可以保留这些涉禽生存所需的一席之地，实现涉禽资源保护与地方经济协调发展。只要人们有这样的意愿，鸟类就可以和人类共存，但是这需要从鸟类的利益出发考虑，谨慎规划和选择发展地点。希望这份报告将有助于这些决策的制定。

1.1 涉禽简介

涉禽是指那些适应在沼泽和水边生活的鸟类，鸻形目鸟类和鸥及燕鸥都属于这一类，其中以鸻鹬类(包括鸻类、鹬类、蛎鹬类和长脚鹬类)最为有名且种类最多。绝大多数涉禽都沿海岸线分布，但也有一些涉禽会在内陆湿地完成部分或是整个生活史过程。另外，尽管鸭类、鹤类和鹭类也在沿海湿地分布，严格来说它们并不是涉禽。

有一些涉禽是终生都生活在同一个地方的留鸟，其他的涉禽则是每年往返于固定的繁殖地与越冬地的候鸟。本报告里涉及到的涉禽都是候鸟，它们主要在阿拉斯加、西伯利亚，中国和蒙古繁殖，并迁徙到从亚洲至澳大利亚和新西兰的越冬区域。

一只成年的斑尾塍鹬(见附录1学名)每年要飞行大约3万公里，从新西兰途经中国黄海飞到阿拉斯加再飞回新西兰 (Gill *et al.* 2009)。它们长途飞行的目的是为了在北半球夏季食物丰富的阿拉斯加繁殖。阿拉斯加气候恶劣，而且每年有长达6至8个月的冰封期，鸟类必须在冰雪开始融化之际达到并开始繁殖，然后在冰封期到来之前离开。之后它会回到南方。有些涉禽，例如在澳大利亚麦夸里岛 (Macquarie Island) 越冬的斑尾塍鹬、灰斑鸻和翻石鹬 (Selkirk *et al.* 1990),它们会从繁殖地一直向南飞，飞到它们差不多又要遇到南半球的冰封之地为止。

不是所有的迁徙涉禽能够完成如此长的迁飞。一些涉禽的迁飞路线是到日本或南亚的短距离迁飞它们每次飞行前积累大量的脂肪和肌肉，这是成功迁徙的关键。另外，它们不仅仅只增加体重，一些身体器官还会暂时性的萎缩，这样鸟类才能在飞行中携带更多的能量。因此，它们迁徙途中停歇的地方必须有能提供丰富、稳定和优质的食物资源的觅食区以及在高潮期间，当位于潮间带的觅食地被潮水淹没时为鸟类提供可以躲避潮水的安全的休息场所的停歇区。如果栖息地无法满足以上两个必备的条件，涉禽将无法继续进行迁徙乃至繁殖，或者在迁徙途中死亡，因为它们不能像海鸟一样在海洋中休息和觅食。正因为如此，不同的物种都有非常重要且特定的栖息地。例如在美国的特拉华州海湾(Delaware Bay)，美洲鲎(*Limulus polyphemus*)的过度捕捞导致了迁徙红腹滨鹬的重要食物鲎卵的数量急剧下降，从而使得北迁

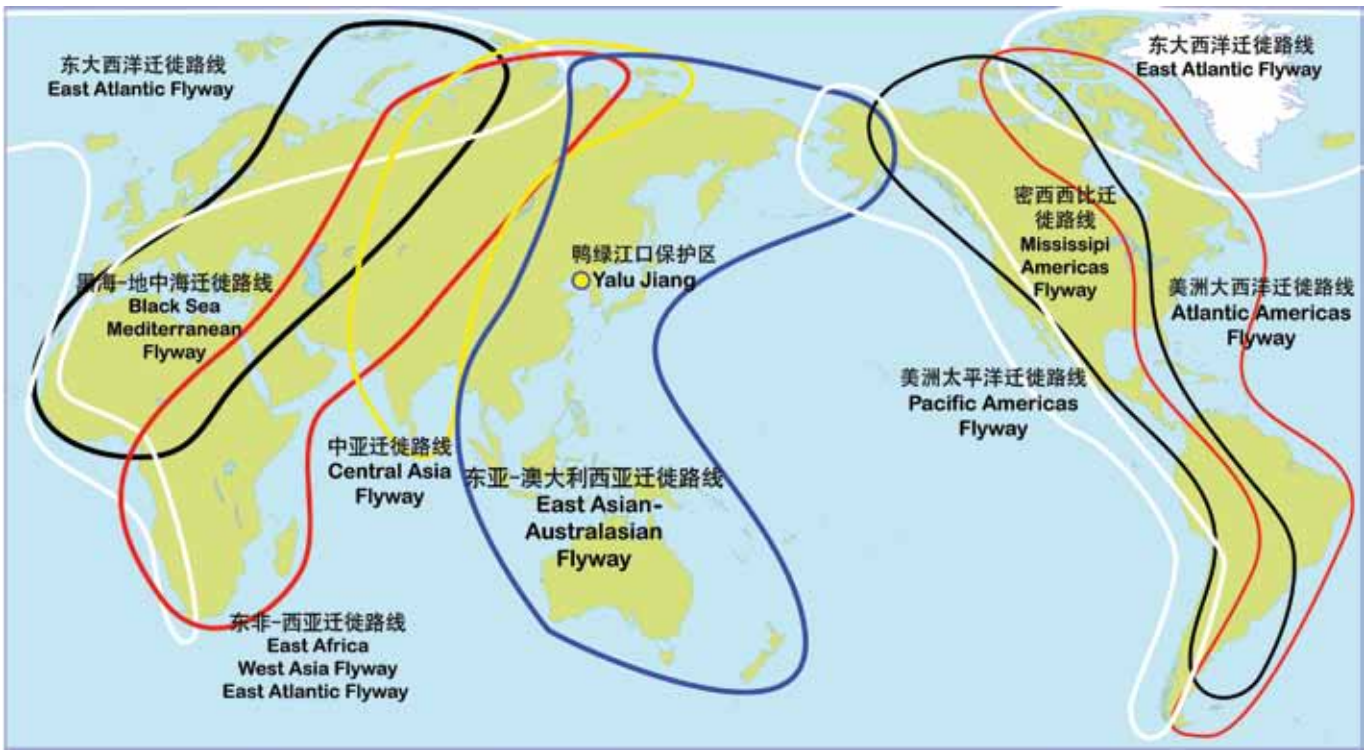


图1.1 涉禽的全球飞行路线。
Fig. 1.1 Global Shorebird Flyways.

1.1 What is a Shorebird?

The group of birds known as Shorebirds belong to the order Charadriiformes, which also includes gulls and terns. The most well known and numerous members of this group are the plovers and sandpipers, but it also includes others such as oystercatchers and stilts. The majority of the species in these groups feed along coastal areas, although many can be found inland for some or all of their lives. Technically speaking ducks, cranes and egrets are not shorebirds even when they are found on the coast.

Shorebirds can be either resident, staying in one local area for their entire life, or migratory, moving between specific breeding and non-breeding areas each year. The shorebirds that are covered in this report are migratory, most breeding in Alaska, Siberia, China and Mongolia, and migrating to non-breeding areas from Asia to Australia and New Zealand.

Each year an adult Bar-tailed Godwit (see Appendix 1 for scientific and Chinese names) will travel around 30,000 kilometres, from New Zealand, through the Yellow Sea then onto Alaska and back to New Zealand (Gill *et al.* 2009). The aim of all this travel is to reproduce in Alaska where there is an abundance of food over the northern summer. Covered in snow for six to eight months of the year, Alaska has an unforgiving climate and the birds need to arrive as soon as the snow begins to melt, breed, then leave before it starts freezing over again. They then return south. Bar-tailed Godwits, Grey Plover and Ruddy Turnstone have been found spending their non-breeding season as far south as Macquarie Island, Australia, about as far south as they can go without running into more ice (Selkirk *et al.* 1990).

Not all migratory shorebirds undertake such long migrations. Some species undertake shorter migrations to Japan or southern Asia. Some will make short hops, while others like the Bar-tailed Godwit make very long flights on their migrations, for example, over 10,000km from New Zealand to the Yalu Jiang Estuary without stopping to feed or sleep, followed by the 6,000km flight from the Yalu Jiang Estuary to Alaska, again without stopping. What makes these flights possible are the large amounts of fat and muscle the birds are able to accumulate before leaving on their flights; not only does their weight increase substantially but non-essential body organs shrink so that even greater fuel reserves can be carried. To do this the sites where they stop to refuel must have feeding areas with large amounts of high quality suitable food as well as safe spaces for roosting when the tide is covering their mudflat feeding grounds. If their staging sites are unable to provide both of these essential elements then the shorebirds will either not migrate, and therefore not breed, or perish during migration. They cannot stop on the sea to rest or feed as a seabird might.

Because of this pattern, specific sites become very important for different species. An example of this is Delaware Bay in the USA, where human overharvesting of Horeshoe Crabs (*Limulus polyphemus*) has lead to a huge loss of crab eggs, a vital food source for Red Knot during migration and this has meant that the numbers of Red Knot using that site on northward migration has fallen from around 100,000 to 15,000 and counts of non-breeding birds indicate that the population may have dropped from 100,000-150,000 to just 18,000-33,000 (Niles *et al.* 2010). Similarly the closure of the seawall at Saemangeum, South Korea has lead to a drop in the population of Great Knots by an estimated 90,000 birds (Moores *et al.* 2008).

1.2 Shorebird Flyways

Shorebirds travel along what are known as 'Flyways', on their annual migrations. Globally there are at least eight such flyways with the East Asian-Australasian Flyway being the only one associated with this region (Fig. 1.1).

1.3 Shorebirds and the EAAF

Species such as the Bar-tailed Godwit breed in the tundra regions of the Northern Hemisphere and migrate to New Zealand, Australia and Southeast Asia for the non-breeding period and then return each year. In performing these migrations they undertake some of the most impressive feats of endurance known, following a path that takes them north to Asia and then onto their northern breeding grounds in Siberia and Alaska before returning to their non-breeding sites, mostly in the southern hemisphere. These flights are so extreme that everything must be right for them to be successful; not only must they be in peak body condition but the wind strength and direction are important as well. As such they are extremely dependent on a network of sites within different countries; changes at any one site may affect the numbers that complete the journey each year.

The multitude of paths that these birds use link many countries, and the areas they stop at are collectively known as the East Asian-Australasian Flyway (EAAF). At least 95 species of shorebird occur regularly along the EAAF, and of these some five million birds of 48 species are migratory (Milton 2003).

The populations of most species of shorebirds along the flyway and around the world appear to be declining. In 2003 only four of the 48 migratory shorebird species in the EAAF were given threat rankings by the IUCN (Milton 2003), but such is the rate of change occurring in the Flywathat in 2010 this number nearly doubled; no species had a reduced threat ranking and the status of Spoon-billed Sandpiper had deteriorated markedly to 'Critically Endangered', the highest threat category (Table 1.1).

途中在此栖息的红腹滨鹬数量从100,000只下降到15,000只；在越冬地的调查也发现，红腹滨鹬的种群数量可能从100,000－150,000只下降到只有18,000－33,000只(Niles *et al.* 2010)。同样的，在韩国新万锦(Saemangeum)的围海造地工程已经导致全球大滨鹬的种群数量减少了约9万只。

1.2 涉禽迁徙路线

鸟类的迁徙路线是指每年迁徙过程中由越冬地到繁殖地所经过的地方。全球一共有8条这样的涉禽迁徙路线，本报告涉及到的仅包括东亚-澳大利西亚迁徙路线(见图1.1 蓝色迁徙路线)。

1.3 涉禽和东亚—澳大利西亚迁飞路线

斑尾塍鹬等物种每年都在北极地区繁殖，繁殖结束后迁徙到位于新西兰、澳大利亚和东南亚的越冬地，翌年再返回北极繁殖。为了完成这些迁徙，这些涉禽以惊人的耐力，沿着这条指引它们途经亚洲到达位于西伯利亚和阿拉斯加的繁殖地，再返回南半球的越冬地的路线飞行。在这些极限飞行中，任何因素都会影响到迁徙成功率，鸟类不仅仅要达到最佳的身体状态，风力和风向也是非常重要的。因此，在迁徙过程中，鸟类会非常依赖这些在不同国家、多个地点组成的栖息地网络，每一个栖息地的改变都会影响可以顺利完成全年旅程的鸟类数量。

这些大量的连接鸟类飞行经过国家的路径和它们所停歇的地区统称为东亚-澳大利西亚迁徙路线。至少有95种涉禽经常出现在这条迁徙路线上，其中48种约5百万只鸟是迁徙鸟类(Milton 2003)。

在东亚-澳大利西亚迁徙路线以及全球范围来讲，大多数涉禽的种群数量已经呈下降趋势。2003年这条迁徙路线上的48种迁徙涉禽中只有4种被列入国际自然保护联盟(IUCN) 濒危物种红色名录(Milton 2003)；而到了2010年，这个数字已经翻倍；没有一个物种的受胁等级排名被降低，而勺嘴鹬的情况非常恶化，被列入了最高的受胁等级—极度濒危(Critically Endangered)之列。

尽管很多物种仍旧被国际自然保护联盟列入无危 (Least Concern) 等级，但是它们的种群数量已经开始急速下降。在澳大利亚东南部的鸟类调查结果表明，2005年至2009年间迁徙涉禽的平均数量远低于1981年至1985年。虽然有些鸟类的种群数量很稳定，但是还有一些表现出下降趋势。例如在一些地区弯嘴滨鹬的数量下降了75%(Oliveira & Clemens 2009)，因此未来国际自然保护联盟濒危物种红色名录很可能会加入更多的涉禽种类。

导致涉禽种群数量下降的原因是多方面的，但最主要的原因之一是栖息地的丧失。从大尺度来看，在韩国的新万锦湿地被破坏之后，大滨鹬和白腰杓鹬的种群数量快速下降，没多久这两个物种就被列入濒危物种红色名录。而小尺度方面，在新西兰一些河口，红树林的扩张影响了红腹滨鹬和斑尾塍鹬的觅食地。一些物种，如在西伯利亚和东南亚的勺嘴鹬还面临着捕猎的问题(Zockler *et al.* 2010)。在韩国水稻田觅食的黑尾塍鹬还受到了杀虫剂的影响(Moores *et al.* 2008)。

1.4 姊妹保护区合作关系

位于黄海最北端的鸭绿江口滩涂湿地是北迁候鸟最后，也是最主要的一个能量补给地。沿海岸线约60公里长的广阔滩涂为涉禽提供了食物丰富的觅食地。鸭绿江口湿地国家级自然保护区(以下简称鸭绿江口保护区)位于黄海 东北岸的中国辽宁省境内。保护区始建1987年，1997年12月升级为国家级自然保护区，主要的保护对象为珍稀野生动植物。保护区为包含内陆湿地和水域与海洋和海岸生态类型的复合生态系统。在过去的10年里我们发现，鸭绿江口保护区不仅有重要的文化意义，同时还是每年涉禽北迁时极其重要的能量补给地。保护区哺育着当地的人民和野生生物，而涉禽不但在海堤外的滩涂觅食，它们还会在高潮期飞入堤内的人工养殖塘休息和躲避潮水。

上世纪九十年代，Mark Barter 确立了黄海地区9个最重要的鸟类迁徙补给地，这些地方每年栖息着超过10万只涉禽，而鸭绿江口保护区就是其中的一个。如今，3个重要的栖息地已经在经济发展过程中被破坏而丧失了。在2006年，围绕韩国新万锦湿地的大堤合拢之后，鸭绿江口保护区成为了东亚-澳大利西亚迁徙路线上北迁涉禽已知的唯一最重要的迁徙补给地。

但鸭绿江口湿地与其他几个尚存的重要栖息地一样，鸭绿江口保护区也面临着经济发展带来的巨大威胁。

Many species that are still classed as of 'Least Concern' by the IUCN are nonetheless undergoing rapid population declines. Work now being done in southeast Australia shows that the average number of migratory shorebirds counted between 2005 and 2009 is well down on the numbers counted between 1981 and 1985. While the numbers of some species are stable others are showing declines, one example being the Curlew Sandpiper, now showing declines of up to 75% in some areas (Oliveira & Clemens 2009). Future revisions to the IUCN threat list are therefore likely to contain more species of shorebirds.

Reasons for declining populations of shorebirds are varied but habitat loss is a significant issue. At a large scale, Great Knot and Eurasian Curlew were both given threat rankings after the destruction of the mudflats at Saemangeum, South Korea, caused large declines in their populations. At a smaller scale, mangrove expansion in some New Zealand estuaries is affecting the feeding grounds of Red Knot and Bar-tailed Godwit. Hunting is an issue for some species, including the Spoon-billed Sandpiper both in Siberia and Southeast Asia (Zockler *et al.* 2010). Pesticides are having an effect on species such as the Black-tailed Godwit, which feed in rice paddies in South Korea (Moores *et al.* 2008).

1.4 The Sister Site Relationship

Located at the northeast corner of the Yellow Sea the mudflats surrounding the Yalu River are the last major refuelling sites for migrating shorebirds on northward migration. Extensive mudflats along some 60 kilometres of coast provide a rich feeding area for shorebirds.

The Yalu Jiang Estuary Wetland National Nature Reserve is situated on the northeast coast of the Yellow Sea in Liaoning Province, China. It was established in 1987 and approved as a National Nature Reserve in December 1997, to protect rare wildlife. The reserve is composed of inland wetlands and coastal and marine ecosystems. Over the last ten years it has been shown that, in addition to being important culturally, this reserve is an essential refuelling site for shorebirds on the northward leg of their annual migration. The reserve is used by both people and wildlife, with shorebirds generally using the coastal strip of mudflats for feeding, and coastal aquaculture ponds for high-tide roosting.

In the 1990s Mark Barter identified the YJNNR as one of nine mega sites in the Yellow Sea; these are sites which contained more than 100,000 shorebirds. Three of the others are now destroyed, lost to development. With the closing of the seawall at Saemangeum, South Korea in 2006, the YJNNR became the single most important staging site known for shorebirds on the EAAF during northward migration. However, the Yalu Jiang Estuary Wetland is in a similar situation to the remaining mega sites, being under serious threat from development.

The Miranda Naturalists' Trust (MNT) is an independent charitable trust with headquarters on the shores of the Firth of Thames, New Zealand. The nearby 8,500ha of mudflats support more than 20,000 birds over the course of the year.

The MNT operates the Miranda Shorebird Centre, an education and accommodation facility where tourists and students can visit to learn about shorebirds, the flyway and the natural history of the Miranda area. Training courses are run here for both specialist groups and the general public, and surveys and shorebird banding are co-ordinated by the Trust and its members.

The MNT has a high degree of expertise in shorebird studies, yet relies heavily on volunteers, with only one full time and two part time staff members. Volunteers contribute more than 6,500 hours of support a year. All of the work done by MNT members at YJNNR is done on a voluntary basis, with those attending usually funding their own travel costs.

Little data about shorebirds in the YJNNR were available prior to 1999, when the first full shorebird survey of the reserve was undertaken by Mark Barter and YJNNR staff (Barter et al. 2000). This survey found that the mudflats and coastal aquaculture ponds were likely to be of immense importance to migratory shorebirds. A second survey carried out in late-May 2000 confirmed this. In 2004 a group from the Miranda Naturalists' Trust, led by Adrian Riegen, visited

表1.1 东亚–澳大利西亚迁徙路线受胁涉禽情况变化(IUCN 2010)。
Table 1.1 The changing threat status of migratory shorebirds that use the East Asian-Australasian Flyway (from IUCN 2010).

		2003 年		2010 年	
极度濒危	Critically Endangered	--		勺嘴鹬	Spoon-billed Sandpiper
濒危	Endangered	小青脚鹬	Spotted Greenshank	小青脚鹬	Spotted Greenshank
易危	Vulnerable	勺嘴鹬	Spoon-billed Sandpiper	红腰杓鹬 大滨鹬	Eastern Curlew Great Knot
近危	Near threatened	红腰杓鹬 半蹼鹬	Eastern Curlew Asian Dowitcher	黑尾塍鹬 白腰杓鹬 半蹼鹬	Black-tailed Godwit Eurasian Curlew Asian Dowitcher

新西兰米兰达自然基金是一个独立的慈善信托基金，总部设在新西兰泰晤士河口边。其附近的近8500公顷的滩涂每年栖息着超过两万只的鸟类。米兰达涉禽中心是在米兰达自然基金的支持下运营，中心提供教育宣传和食宿设施，来此参观的旅客和学生可以学习有关涉禽、迁徙路线以及米兰达地区的自然历史等知识，同时中心还为专家群体或是普通大众开设了培训课程。米兰达自然基金和基金会员还负责统筹涉禽的调查和环志工作。

米兰达自然基金有着高水平的涉禽研究专家的专业支持，且仍在很大程度上依赖志愿者的帮助，现在只有全职和兼职工作人员各2名。每年，志愿者们贡献的服务时间累计都超过了6500小时。米兰达自然基金长期组织会员到鸭绿江口开展鸟类调查工作，会员在鸭绿江口所有工作也都是志愿行为，而且旅行费用一般都由会员自己承担。

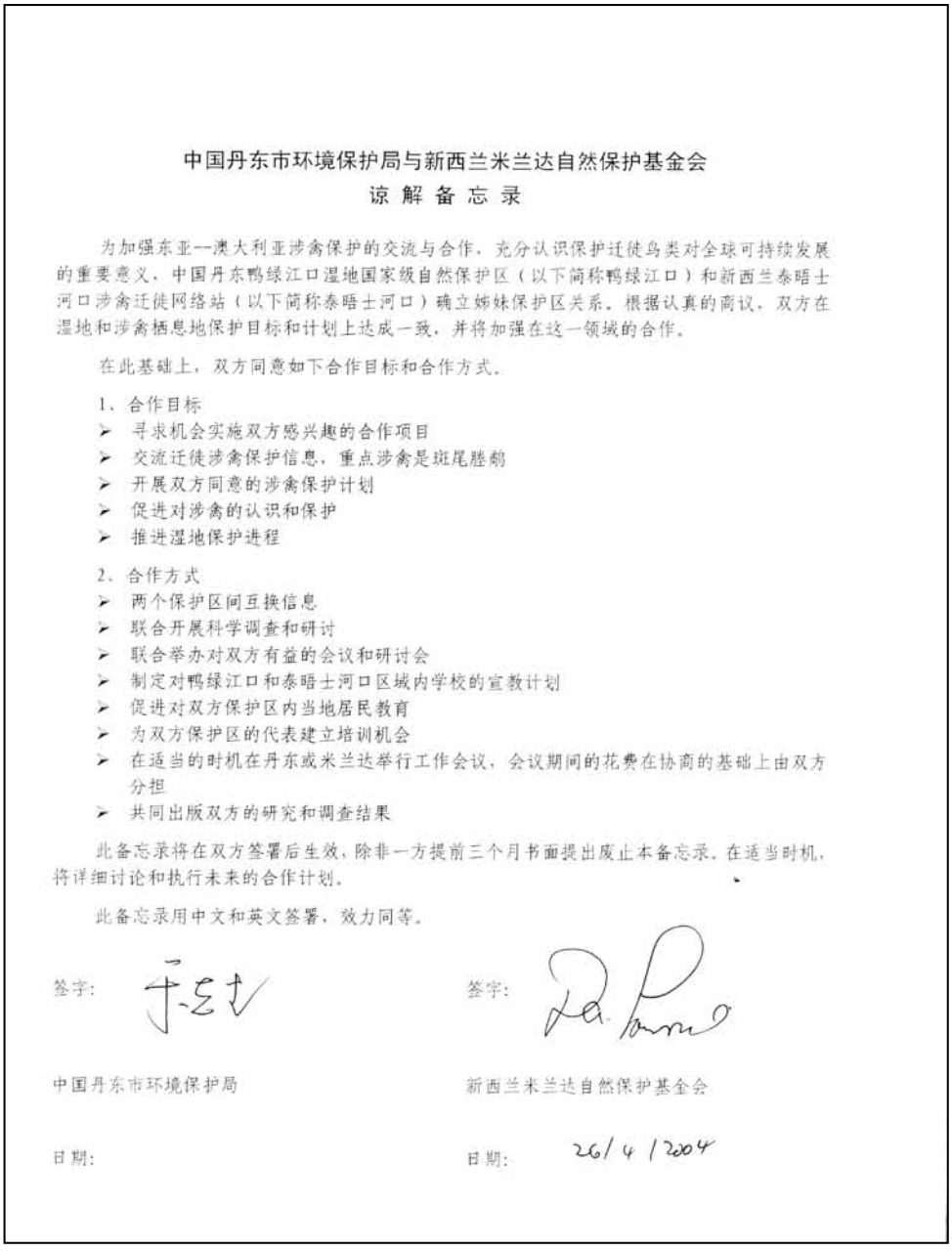
在1999年 Mark Barter 和鸭绿江口保护区工作人员首次进行全面的涉禽调查之前，鸭绿江口保护区的涉禽研究还是一片空白(Barter *et al.* 1999)。该次调查发现，沿海的滩涂和人工养殖塘对迁徙的涉禽至关重要。而2000年5月底进行的第2次调查也证实了这一发现。2004年由 Adrian Riegen 带领的一组米兰达自然基金会员，访问了鸭绿江口保护区并进行详尽的涉禽调查，而且这次调查是首次在4月进行的调查。调查后，米兰达自然基金和鸭绿江口保护区建立姊妹保护区关系，并同丹东市环保局签署了谅解备忘录，开始了两个机构间的正式合作，共同致力于加强涉禽的保护。

姊妹保护区合作最积极的成果之一即是在2006至2010年间两个组织每年共同进行的涉禽调查。

涉禽调查的目的是：

- 了解鸭绿江口保护区涉禽的种类和数量
- 了解在4至5月的迁徙期，鸟类的变化规律
- 了解涉禽对保护区内栖息地的利用情况
- 了解鸭绿江口保护区在黄海地区乃至整个迁徙路线上的重要作用
- 估计涉禽种群数量的基础数据，以便发现鸟类种群数量的变化

本报告概述了1999年和2010年之间9次调查的结果。



中国丹东市环境保护局与新西兰米兰达自然保护基金会

谅 解 备 忘 录

为加强东亚—澳大利亚涉禽保护的交流与合作，充分认识保护迁徙鸟类对全球可持续发展的重要意义，中国丹东鸭绿江口湿地国家级自然保护区（以下简称鸭绿江口）和新西兰泰晤士河口涉禽迁徙网络站（以下简称泰晤士河口）确立姊妹保护区关系。根据认真的商议，双方在湿地和涉禽栖息地保护目标和计划上达成一致，并将加强在这一领域的合作。

在此基础上，双方同意如下合作目标和合作方式。

1、合作目标

- 寻求机会实施双方感兴趣的合作项目
- 交流迁徙涉禽保护信息，重点涉禽是斑尾塍鹬
- 开展双方同意的涉禽保护计划
- 促进对涉禽的认识和保护
- 推进湿地保护进程

2、合作方式

- 两个保护区间互换信息
- 联合开展科学调查和研讨
- 联合举办对双方有益的会议和研讨会
- 制定对鸭绿江口和泰晤士河口区域内学校的宣教计划
- 促进对双方保护区内当地居民教育
- 为双方保护区的代表建立培训机会
- 在适当的时机在丹东或米兰达举行工作会议，会议期间的花费在协商的基础上由双方分担
- 共同出版双方的研究和调查结果

此备忘录将在双方签署后生效，除非一方提前三个月书面提出废止本备忘录。在适当时机，将详细讨论和执行未来的合作计划。

此备忘录用中文和英文签署，效力同等。

签字：　　签字：

中国丹东市环境保护局　　新西兰米兰达自然保护基金会

日期：　　日期：26/4/2004

the reserve and conducted a further survey, the first to occur in April. After that survey a Memorandum of Understanding was signed between the MNT and the Dandong Environmental Protection Bureau, which formalised co-operation between the two organisations with the aim of strengthening cooperation on shorebird conservation.

One of the most positive outcomes of the sister site partnership to date has been the shorebird surveys, conducted annually between 2006 and 2010 by reserve staff and members of the MNT.

The aims of the shorebird surveys are:

- to determine which species use the reserve and in what numbers
- to determine how this changes over the migration period of April and May
- to determine how different areas of the reserve are used
- to understand how YJNNR fits into the overall Yellow Sea picture and the rest of the flyway
- to provide baseline population estimates so that changes in numbers can be detected.

This report outlines the results of the nine surveys between 1999 and 2010.

Memorandum of Understanding between the Dandong Environmental Protection Bureau in the People's Republic of China and the Miranda Naturalists' Trust in New Zealand

The Sister Site Relationship between the Yalu River National Nature Reserve, Dandong of China (hereinafter referred to as Yalu River) and the Miranda Naturalists' Trust, New Zealand (hereinafter referred to as Miranda) exists to strengthen the cooperation on shorebird conservation at these sites in the East Asian/Australasian Flyway. Both parties fully realize the importance of conserving migratory shorebirds and their wetland habitats as a contribution to global sustainable development. Following substantial negotiation, the two parties reached consensus on their objectives and projects for future cooperation to conserve wetlands and their shorebird habitats and to strengthen research in this field.

On this basis, the two parties agreed on the following objectives and meansof cooperation.

I. Objectives of Cooperation

- To seek opportunities to develop and support projects of mutual interest;
- To exchange information on the conservation status of migratory shorebirds, especially Bar-tailed Godwit;
- To implement mutually agreed shorebird conservation projects;
- To promote awareness and conservation of shorebirds;
- To promote the conservation of wetlands.

II. Means of Cooperation

- Exchange information between the reserves;
- Jointly conduct scientific surveys and research;
- Jointly organize meetings and workshops for the benefit of both sites;
- Establish projects between schools in Yalu Jiang and Firth of Thames regions;
- Promote the education of local people at both sites;
- Establish training opportunities for representatives from both sites;
- Hold working meetings when appropriate in Dandong City or Miranda, with costs to be shared on an agreed basis;
- Jointly publish results of research and surveys were appropriate.

This Memorandum will enter into force upon signature by both parties and shall remain in force unless terminated by either party having given three months written notice. Specific future cooperative projects will be discussed, finalized and implemented as and when appropriate.

This Memorandum will be signed in two originals of equal validity in English and Chinese.

Signatures: 丁三石

For the Dandong Environmental Protection Bureau in The People's Republic of China

Date:

Signatures: P.C. Powrie

For the Miranda Naturalists' Trust in New Zealand

Date: 26/4/2004

2 方法

2.1 保护区简介

鸭绿江口保护区位于中国黄海北岸，总面积为101,000公顷，包括自东港市向西60公里长的海滨湿地(如图2.1,2.2)。保护区北界为G201/丹大高速公路，自北界向南至距沿海大堤约1-3公里处主要为农田。近堤的1－3公里主要是自上世纪50年代开始修建的人工养殖塘，这些人工养殖塘建于东港海防大堤内，总面积约为9000公顷，每个养殖塘的大小不等。除了位于最西端的天然礁石海岸。海防大堤以南是潮间带滩涂。鸭绿江口保护区潮汐为正规半日潮，受潮水高度影响，每当潮水高度超过6.0米后，鸟类就无法在潮间带滩涂栖息，必须飞入内陆寻找落脚点，或是沿鸭绿江西水道往上游飞，寻找没有被潮水淹没的区域，该区域一些滩涂直到潮水高于6.8米时才会被淹没。沿支流再向上，则很少被潮水淹没，即便潮水有影响也较为短暂。

保护区及周边共有12条主要河流入海，东部为鸭绿江水系，包括鸭绿江、安民河、柳林河和石佛沟河；中部为新沟河、二道河、沙坝河、龙态河、枣儿河、依龙河六条河流；西部有大洋河、小洋河和双岔河，属于大洋河水系。

基于养殖塘的基本管理模式，每年冬季养殖塘放水后会进行修塘、晒塘，未放水的养殖塘会被冰封。至来年4月上旬，各养殖塘开始陆续蓄水，为新一年的养殖做准备。在高潮时期，旱塘为鸟类提供了良好的躲避潮水的休息场所，但是这个时期，渔民也会利用高潮将海水引入养殖塘，随着养殖塘内水位的升高，鸟类便无法栖息。当所有养殖塘都被灌满水时，鸟类会在植物和人类活动较少的养殖塘的堤坝上休息。

2.2 潮汐规律

在研究地区我们主要参考两个位置的潮汐表，一是大鹿岛潮汐表，另一个是丹东新港潮汐表。本报告中的潮汐高度均引自丹东新港潮汐表，而以前的鸭绿江口调查报告都采用的大鹿岛潮汐表，所以本报告所提及的潮汐高度会比以往报告中出现的潮汐高度高1米左右。

鸭绿江口保护区内的最高潮差约为7米，当潮水到达6.0－6.3米高时，在大部分潮间带地区都会被淹没，潮水可以到达海防大堤所在位置；而潮水达到6.5米后，除12号点外，潮间带其他地区都会被潮水覆盖；当潮水高达6.8米时，12号点也会被淹没(图2.3)。

每年我们都会选择潮水高度相似并且日间潮高度超过6米的时期进行鸟类调查。

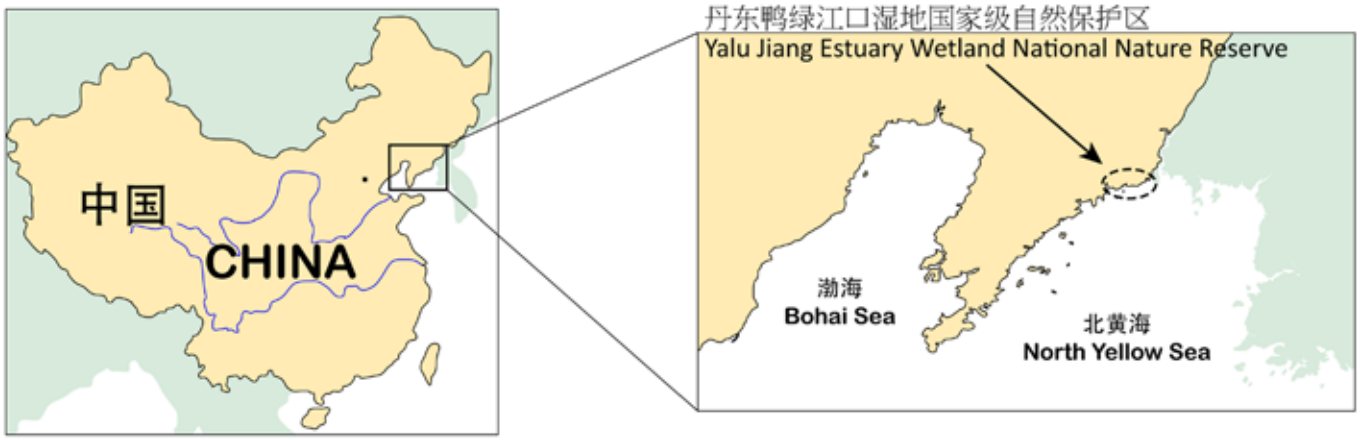


图2.1 鸭绿江口保护区(放大图中黑框所示区域)在中国的地理位置。
Fig. 2.1 Location map - China - Enlargement shows reserve's location.

2. Methodology

2.1 Reserve Description

The 101,000 hectare Yalu Jiang Estuary Wetland National Nature Reserve stretches for about 60km westwards from Donggang along the shores of the Chinese part of the Yellow Sea (Fig. 2.1 & 2.2). The reserve's northern boundary is approximately the Dandong to Dalian main road (G201). Rice paddies extend from the road southward to within 1-3km of the coast. The last 1-3km is largely made up of aquaculture ponds built from the 1950s onwards, which are built inside the Donggang coastal levee. The total area of these ponds covers approximately 9,000 ha. The entire length of the reserve apart from the naturally rocky coast at the western end of the reserve (see Figure 2.9, Site 14), has an artificial rock lined seawall on the outermost ponds, and several kilometres of mudflats stretching south from the seawalls. High tides over about 6m inundate the tidalflats, forcing the shorebirds to leave the mud and find roost sites inland, or shift to areas still available along the Yalu River West Estuary, referred to as the 'River', where mud is still available up to tides of about 6.8m. The upper reaches of the Yalu River West Estuary are rarely covered by the tide and then only for very brief periods.

Twelve rivers flow into the sea through the reserve. The Yalu River system including the Yalu, Anmin, Liulin and Shifogou Rivers dominate the eastern section. The middle section has six rivers, the Xingou, Erdao, Shaba, Longtai, Zaoer and Yilong. In the west is the Dayang River system, which includes the Dayang, Xiaoyang and Shuangcha Rivers.

In early-April aquaculture ponds are being prepared for the growing season, having been emptied or frozen over winter. Empty ponds make good roost sites and shorebirds will use these opportunistically but will sometimes be forced from these ponds as they are filled with seawater at high tide. Once all ponds are full of water birds will roost on pond banks that are free from vegetation and where there is little human activity.

2.2 Tide Tables

Tide heights and times are measured at two different locations in the region, one at the island of Dalu Dao, and the other at Dandong New Harbour. Tide heights referred to in this report are from Dandong New Harbor and will therefore vary by about an additional metre from previous Yalu Jiang Estuary survey reports, which used the Dalu Dao tide tables.

The tidal range in the reserve is approximately 7 metres and at most sites the tide reaches the seawall at about 6.0–6.3m. There is no exposed mud left in the reserve on tides of 6.5m and above, except at Site 12, where the mudflat is covered on tides of 6.8m. The height of the tides can vary significantly from day to day, depending on weather and atmospheric conditions (Fig. 2.3).

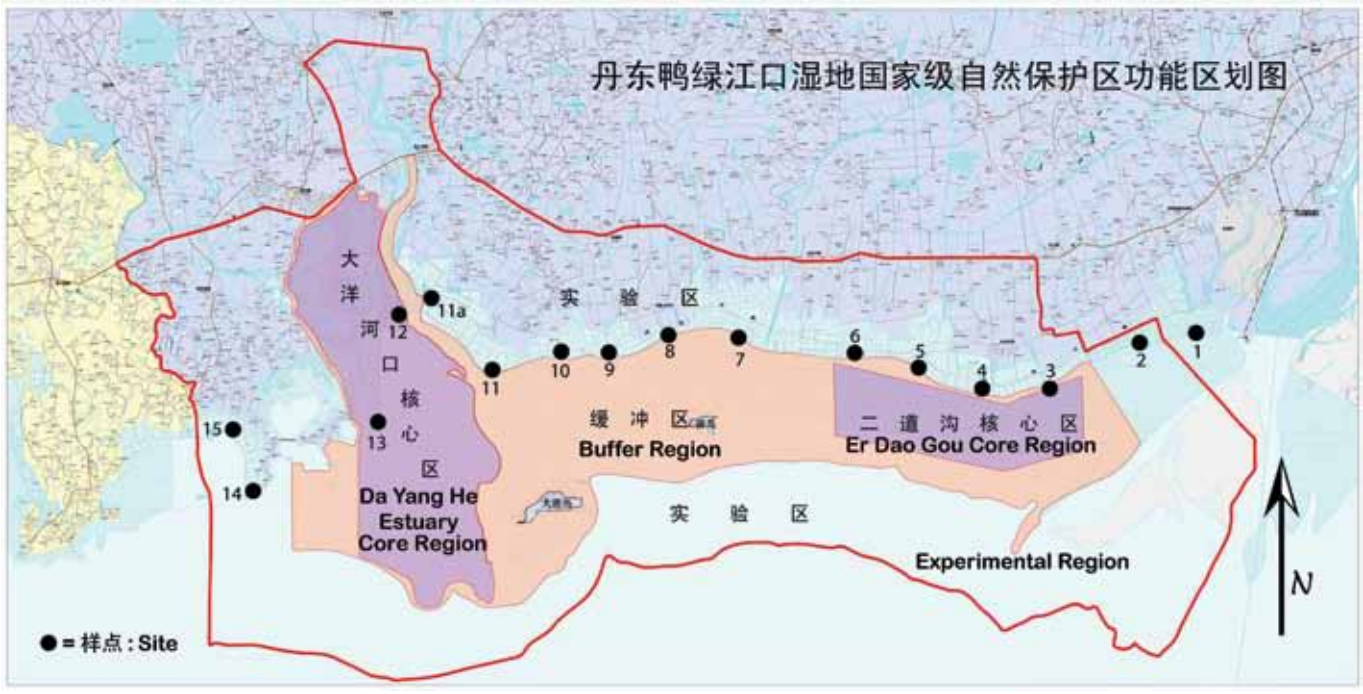


图2. 2 丹东鸭绿江口湿地国家级自然保护区。
Fig. 2.2 Dandong Yalu Jiang Estuary Wetland National Nature Reserve.

大部分的调查地点都在河流入海口或是海防大堤的交叉点上，调查点间的间隔约为3－4公里。在这些地点调查的区域大都是高程相对最高的滩涂，当涨潮时，鸟类会聚集于此。尽管4－5月间，内陆的大部分稻田还没有开始耕作且有裸露的土地，看起来很适合鸟类休息，但可能是由于距离海岸线太远或者其他原因，除翻石鹬和黑腹滨鹬外，其他涉禽很少利用稻田作为休息场所。

为了方便调查，我们将保护区沿海岸线划分为15个区域，每个区域中主要的计数点我们称为“x号点”，并用“x号点”代表该调查区域(如图2.2中所示黑点，最右边的点为1号点)。另外我们对芦苇地和保护区域外的西水道港区也进行了调查。

鸭绿江西水道

本报告所提及的西水道为位于中国大陆与朝鲜薪岛之间的鸭绿江西水道(见图2.4)。在潮位较高的时候，西水道中间的一条沿伸至中游的水渠能够使船只到达航道较浅的两个小港。尽管这个区域不在保护区范围内，但是对于整个鸭绿江口的潮间带生态系统而言，作用极其重要，很多在保护区东部活动的涉禽会在此栖息。

鸭绿江口呈向上游迅速束窄的狭长形喇叭口，江口最宽处为2.5公里。在上游8公里左右河口宽度减少为1.2公里。向上游接下来的3公里河面持续变窄，而在这一段的江边也曾经有涉禽飞过的记录。在一些高潮期，鸭绿江西水道两侧大量裸露的泥滩可以为涉禽提供休息场所。另外，一些鸟类可在附近电厂的储灰池中停歇，该储灰池水位较低处生长着芦苇等湿地植物，砺鹬等涉禽已在此繁殖。由于不受涨潮和人为干扰的影响，大量涉禽可以在储灰池中间的小岛上长时间的停歇。

图2.4 鸭绿江西水道，同时显示中朝分界线。
Fig. 2.4 The Yalu River West. The international border between China and North Korea is also shown.

保护区

1号点位于保护区最东部的边缘地带。在保护区2007年范围调整后，该点位已经划出保护区范围，虽然附近大东港及华能电厂对鸟类的停歇造成一定程度的干扰，该区域仍有鸟类在此停歇。

2号点(二道沟)南边的潮间带是保护区最宽阔的滩涂，在低潮期潮间带宽度可达5－7公里。这个点位附近的滩涂是鸭绿江口保护区沿海最高的滩涂，也是在高潮到来时最后被淹没的滩涂，当潮水高度达到6米时，涉禽仍到该区域的潮间带滩涂休息。这个区域的涉禽数量和物种多样性都是保护区内较高的，为保护区内较好的观鸟场所。该处有隐匿的观鸟屋及当地政府修建的观鸟屋，作为观鸟爱好者的观鸟场所。此前在其中一个养殖塘内还有一个人工建造的鸟类栖息地，砺鹬曾在此人工岛上繁殖。2007年保护区调整的同时也对该点位以西地区加强了管理，将2号点与3号点之间至6号点附近的区域的潮间带调整为保护区核心区，作为重点保护区域，面积3335公顷。

3号点位于2号点以西4.5公里处，靠近一条小河的入海口。在潮水涨到5.8米的时候，该处滩涂会全部被从西边涌入的潮水淹没，通常涉禽会在潮水的驱赶下逐步向东移到2号点。2008至2009年间，在第2和3号点之间的滩涂上计划修建一处景观带，目前该工程已停工，仅剩750米长的人工海堤，并在2号点附近形成了一块新的地势较高的鸟类休息场所，现在该区域是涉禽在高潮期主要的停歇区。

4号点在3号点西侧4公里处，位于一段平行于海岸线的海防大堤上，堤内为狭长型的人工养殖塘。当潮水涨到6.0－6.1米时，4号点的滩涂会被潮水淹没，所以在大潮期，此处滩涂会被潮水覆盖几个小时，这段时间涉禽会飞去第3和5号点或者直接飞入堤内。但是堤内的人工养殖塘通常已经住满水，并不合适鸟类的栖息。

5号点内有一条河道入海口形成的小河口，河口处有一个小型渔港。河道紧贴着东侧的海堤汇

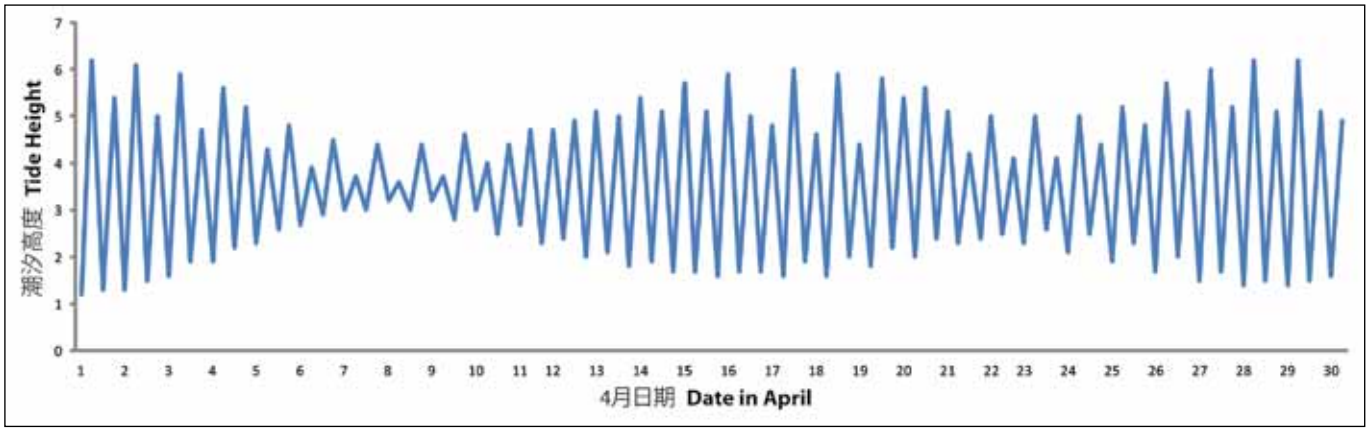


图2. 3 2010年4月潮汐高度变化曲线。
Fig. 2.3 The predicted tidal range over April 2010.

From year to year surveys are planned for tides of similar heights; surveys are not conducted if the tidal height will not regularly reach 6.0m during the day.

2.3 Count Sites in the Reserve

Most of the count sites are approximately 3-4km apart and are located at river outlets or junctions in the seawall. They are generally the locations where the mudflats are locally highest and therefore the place shorebirds congregate on the mud during the incoming tide. Shorebirds rarely roost in the rice paddies further inland, which in April and May are mostly bare soil and would appear to make suitable roost sites but some maybe too far from the coastline for roost sites, while others contain rice stubble making them unsuitable. Ruddy Turnstone and Dunlin do sometimes use the dry rice paddies.

For the purposes of the survey the coastline is divided into 15 sections within the reserve, the key count points are each referred to as a 'Site', (see black dots on Fig. 2.2, the right hand dot being Site 1. For GPS coordinates see Appendix 4). In addition counts are conducted in the reedbeds, and outside the reserve at the River.

The River

The river referred to here is the western branch of the Yalu Jiang (River) running between the Chinese mainland and the North Korean island of Sin Do (Fig. 2.4). At high tide a narrow channel runs up the middle of the river providing access to two small fishing ports. Although not in the reserve the River is a vital part of the whole region's tidalflat ecosystem and shorebirds move freely between the eastern end of the reserve and the River.

At its widest point the estuary is 2.5km across. The estuary tapers to 1.2km wide about 8km upstream. The estuary continues to narrow for a further 3km and many birds have been seen flying up this stretch of the river. A large area of mudflats are exposed on most high tides this far up the river allowing shorebirds somewhere to roost. In addition, some birds roost in the ash storage pools of the nearby power station.

图2. 5 1, 2和3号点。卫片拍摄于2005年，当时1号点处的大型开发工程还未进行。
Fig. 2.5 Sites 1, 2 and 3. The image is from 2005, before the large developments began at Site 1.

入大海，在河道与西侧海堤之间有一块高程较相对高的区域，当潮水淹没了保护区大部分的滩涂时，涉禽可以在此区域觅食和休息。在海堤前有一大块隆起的沙地是涉禽最常利用的休息场所，当潮水高达6.6米时，该沙地仍可被鸟类利用。

6号点位于靠近一座小山以南稍微突出的海防大堤上，是一个视野良好的观测点。该处滩涂高程很低，至少在高潮平潮两小时前，潮水就可以快速到达这里的海堤，迫使鸟类离开，飞到海堤内或是3.7公里外的5号点。

7号点内有两条河道的入海口，该区域有纵横交错的水渠和一些小型土丘(图2.7)。最初7和8号点连起来是一个小型的海湾，涉禽可以在这些地点自由移动。

8号点在新7号点的西边2公里处，毗邻一个排水渠的出海口。该调查点的滩涂上没有可供鸟类休息的泥丘，鸟类必须在高潮平潮两个多小时前就离开这里，它们通常会沿着海岸线飞往9和10号点，因此这个区域的鸟类数量相对较少。

再往西3公里的9号点位于黄土坎河河口。与8号点一样，这里的滩涂高程也不是很高，所以至少在高潮平潮两个小时前，在这里觅食的涉禽就要飞到海堤内或是沿海岸线飞到10号点休息。

靠近花坨山的10号点的滩涂是涨潮时最后被潮水淹没的区域之一，涉禽在飞进堤内养殖塘前都会逐渐聚集于此。在小潮期，特别是有比较多的滩涂暴露在外时，鸟类的分布则比较扩散。一条新修的公路沿着海堤直达本调查点。与其他调查点一样，该处的滩涂底质坚硬可以步行，但50米外平行于海岸线有一条泥质淤陷的潮沟。

11号点位于大洋河东岸(如图2.8)，为了方便调查，在河口上部还设立了11a号分点。涉禽会在河两边休息，随着潮水的推进逐渐向上游河岸移动，最后飞入堤内养殖塘。在11和13号点之间的河床中部有一个高程不是很高的小岛，在潮位较低的时候，涉禽可以在此栖息。由于距观测点较远，尽管在天气状况好的时候可以看到鸟，但是很难辨识种类和计数。现在本调查点旁有一条公路经过，并且已经开始修建大鹿岛客运新港。

在大洋河西边有一条小河由北向南并在海堤外1.8公里处和大洋河并流。两个河口之间有一条东西走向的海防大堤，海堤和两条河道形成的三角洲(底为1.2公里，高为1.8公里)是滩涂高程最高的区域，直到潮水涨到6.8米时，这个区域才会被完全淹没。涉禽喜欢在靠近水线的地方休息，通常会距离海堤超过1公里远，所以辨识种类和计数会比较困难，特别是当调查人员需要朝南逆光观察的时候。在12号点调查时较为理想的潮汐高度为6.3－6.5米，这时三角洲地区还有足够的裸地给所有涉禽休息，而涉禽也会较为靠近海堤，有利于在海堤上进行辨识种类和调查。此时，调查者还需要确认涉禽是从其他调查点飞过来的还是一直在本地栖息，以免造

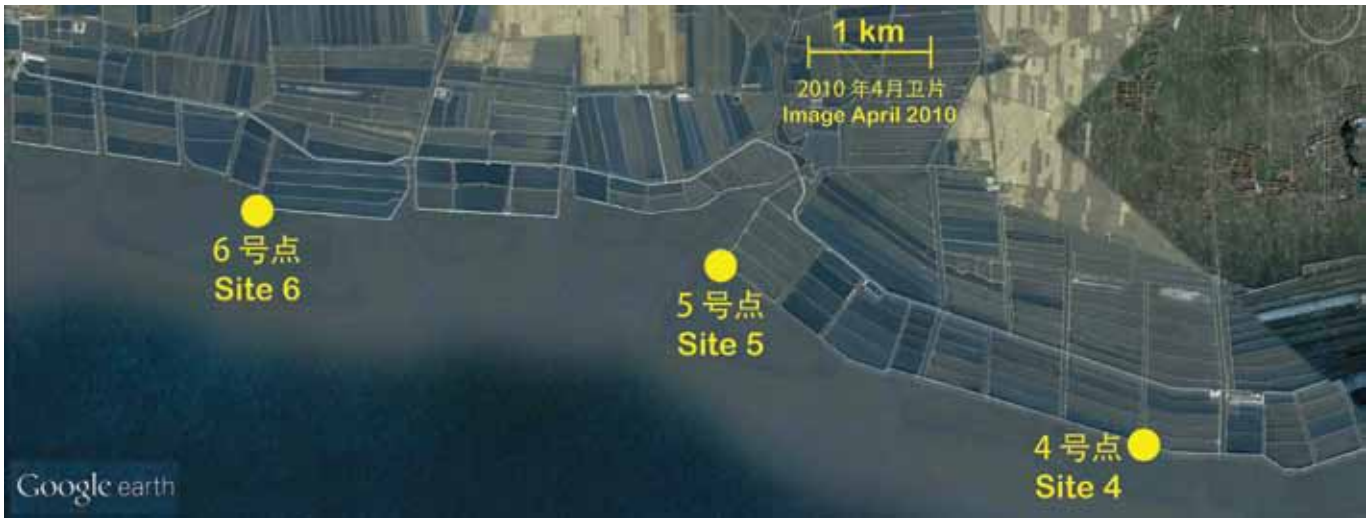


图2.6　4,5和6号点位置图。4和6号点位于与海岸线平行的人工海堤段，在高潮平潮前两个小时这两个地点的滩涂就会被潮水淹没。5号点有一个呈喇叭状凹进内陆的小河口，那里高程较高的区域可供涉禽在高潮期间较长时间休息。

Fig. 2.6　Sites 4, 5 and 6. Sites 4 and 6 are along straight sections of coast, here the mudflats can be covered up to two hours before high tide. Site 5 has an inlet and its higher mud is available for longer.

Oystercatchers have been found breeding in the reedbeds in the low water level area in the ash storage pools. Since these areas are not influenced by the tide, shorebirds can roost on small islands in the ash storage pools.

The Reserve

Site 1 is located on the eastern most edge of the reserve. The boundary of the reserve was adjusted in 2007 by order of the State Council to exclude Site 1. Although there is a certain degree of distrubance from the Da Dong Harbour and Huangneng Electric Power Station, some birds still use this area for roosting.

The mudflats in front of **Site 2** (Er Doa Gou) are the most extensive in the reserve, extending between five and seven kilometres seaward at low tide. This site also has some of the highest mudflats in the reserve, which are therefore the last to be covered by the rising tide. Birds can stay on the mud up to about a 6.0m tide and will do so. This is the area of the reserve with the highest shorebird numbers and highest species diversity. It is also the best bird watching area in the reserve. There were some birdwatching hides built by the local government for the birdwatchers (now removed). At one time there was an artificial roost island in one of the ponds. Oystercatchers have bred on the island. During the reserve scope adjustment in 2007, the mangement of the areas west of Site 2 were strengthened, and the intertidal zone between the middle of Site 2 and Site 3 through to Site 6 were added to the core area of the reserve, which means this 3,335 ha area is the key protected area of the reserve.

Site 3 is 4.5km west of Site 2 along the seawall and close to a small tidal channel. On tides above 5.8m the mudflats are covered by the tide from a westerly direction usually making the birds move to the east often ending up at Site 2. Between the 2008 and 2009 surveys, a Landscape Belt was planned to be built seaward, between Sites 2 and 3, but the project has been stopped. A seawall 750m long remains and has created a new high point towards Site 2 and this is now the main roost site.

Site 5 consists of a small estuary fed by a river outlet; a small fishing fleet operates out of this rivermouth. The river channel flows close to the eastern wall and between the channel and the western seawall is a slightly raised area that birds use for feeding and roosting once the main mudflat is covered. A large sandflat, higher than most of the surrounding mudflats in front of the seawall is favoured by the birds and affords a useful roost on tides up to about 6.6m.

Close to a small hill the seawall juts out slightly at **Site 6**, providing a useful vantage point. The mudflats are quite low, the tide therefore reaches the seawall at least two hours prior to high tide, quickly forcing the birds to move off. They will either fly inland or move towards Site 5, 3.7km to the east.

Two rivers enter the sea at **Site** 7 and form a complex set of channels and small mud banks (Fig. 2.7). Sites 7 and 8 formed a sort of bay and birds moved freely between these sites. Situated a further 2km west is **Site 8,** which sits beside a small creek, more like a drainage channel than a river mouth. The mudflats do not form a bank here and consequently the birds leave the area at least two hours before high tide, usually moving along the coast to Sites 9 and 10. Counts here are therefore fairly low.

A further 3km westward is **Site 9** at the mouth of the Huang Tu Kan River. As with Site 8 the mudflat is not particularly high at this point and is therefore covered at least two hours before high tide sending birds inland to roost or along the coast to Site 10.

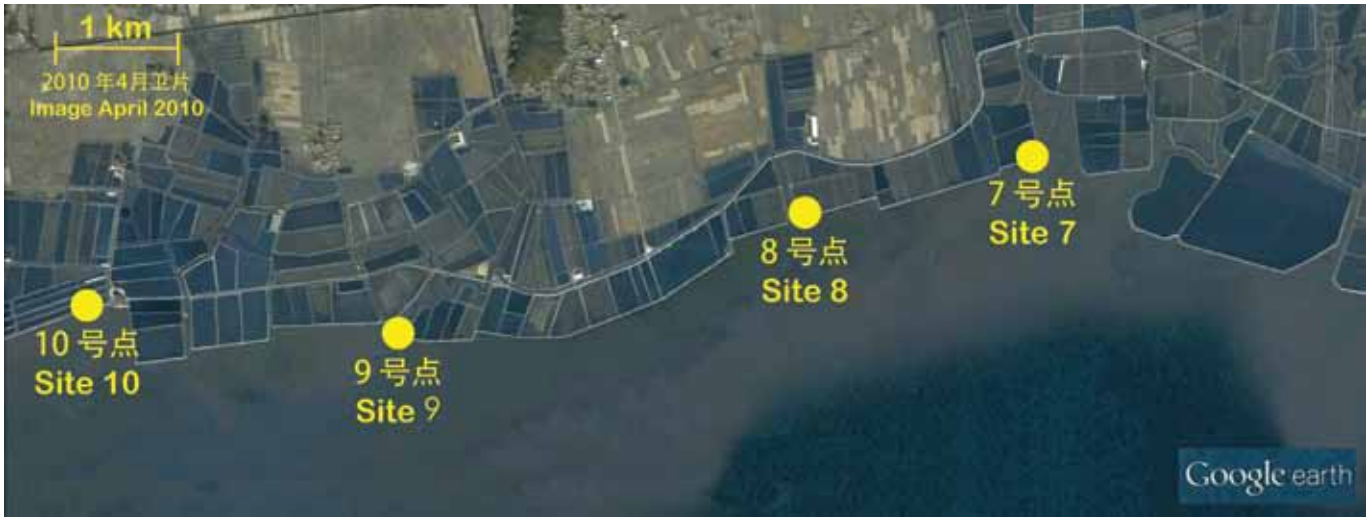


图2. 7　7－10号点位置示意图。
Fig. 2.7 Satellite image showing Sites 7 through 10.

成重复计数。对于可以飞行的鸟而言，13号点与12号距离很近，但是对调查者而言，这段路程还是相当长的。特别是杓鹬会从12号点飞入13号点海堤内的养殖塘中休息，所以这也是在调查计数中需要留意的。12号点是继2号点后，保护区内鸟类数量最多的调查点。

在孤山管理站和12号点之间有约25－30平方公里的芦苇荡，自上世纪七、八十年代起这片芦苇荡就是当地造纸厂的原料基地。冬季地上的芦苇植株被收割后，部分芦苇地里的水会被排干，并烧掉一些地面残余的凋落物。这处芦苇荡主要依靠人工灌溉水渠进行灌溉，水源来自于大洋河。在我们进行调查的大部分时段，芦苇地的土壤还很干燥且鸟类较少，但是随着灌水后土壤被浸没，在地下潜伏越冬昆虫幼虫爬到地面，一些涉禽便会飞入芦苇地觅食。

接近礁石海岸的13号点内有一些面积较大但是鸟类很少的人工养殖塘。这里的滩涂非常淤陷，甚至一些涉禽也无法在滩上行走。本调查点的滩涂在每次涨潮初期就会被水淹没，通常当调查者达到该调查点时鸟类已经离开，飞去12号点或是邻近的养殖塘内。一条南北走向的小路将人工养殖塘划分为两部分，在海堤一侧的养殖塘是杓鹬和灰斑鸻偏好的休息场所。养殖塘间的小型水渠的入海口也形成了一些适宜的休息场所，在大部分潮位，涉禽都可以利用这些地方休息。

14号点位于礁石海岸线带，在这里调查到的鸟类数量非常少，只在堤内的一些养殖塘内有记录到在此休息的鸟类(图2.9)。在2006年之前，14和15号点是合并在一起调查的，但是我们在2005年发现可以到达15号点的路径后，我们便将这两个调查点分开调查。遗憾的是，我们无法将2006年以前这两个点的的数据划分开。

调查区域最西边的15号点，位于鸭绿江口保护区和大连行政区的分界线上。15号点外是一个大型海湾，近5公里长3公里宽，但是2006年起，在大连行政区一侧的滩涂上修建了近2方平公里的人工养殖塘(图2.9)。在15号点北方有一系列形状不规则的养殖塘，在调查期间，一些养殖塘内已有较浅的水位，但是大部分养殖塘还是枯塘，为鸟类提供了良好的休息场所。这里的涉禽有时会在潮水淹没它们觅食地前至少1小时就离开，它们一般会飞越山头，估计是飞去12号点休息。

2.4 调查日期

每次调查的日期见图2.10。在4－5月内还有几段时间段我们从未进行过调查。因为调查只能在潮汐高度介于6.0－6.5米之间进行，所以若要满足潮汐条件，还需要几年的时间才能完成对这些剩余时间段的调查。对整个迁徙期的调查是非常重要的，因为有些物种的过境停歇时间非常短。较之用一年一次的监测数据比较年际差异，对每年不同迁徙时间段进行的调查同样重要。

在正式的调查时期外，在保护区内进行了几次计划外的局部的调查，这些计划外的调查结果

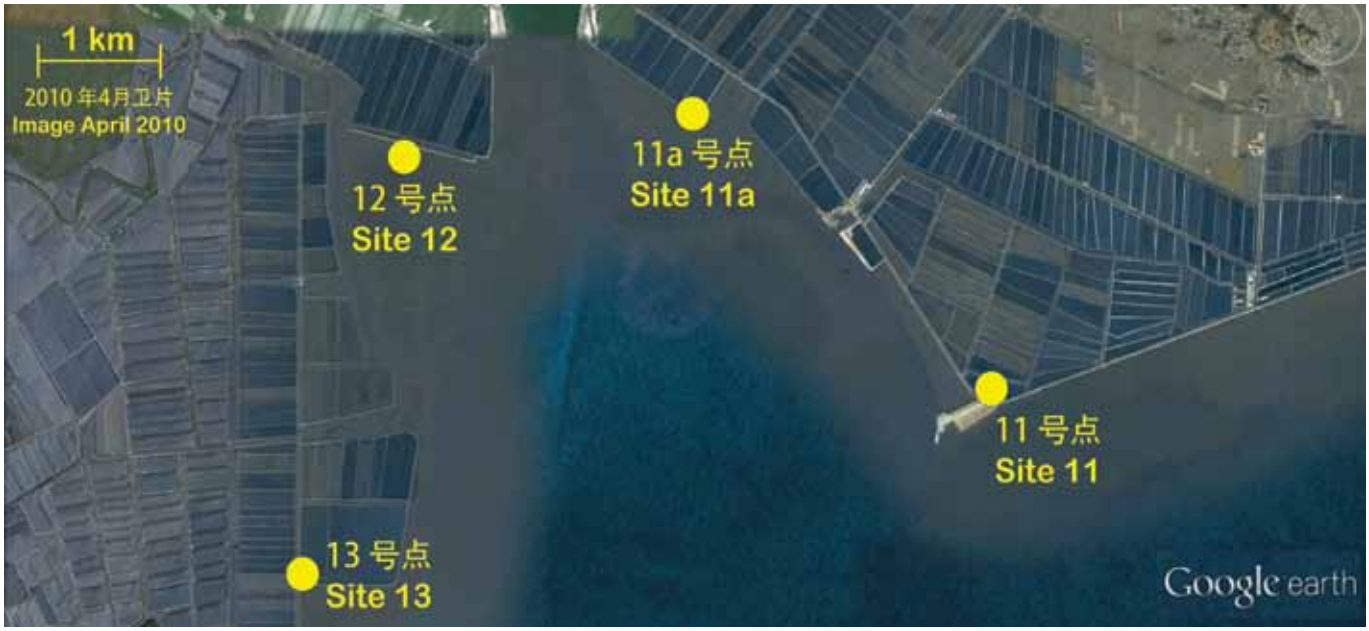


图2.8 卫片所示为大洋河口及11、12和13号点的位置。11号点距13号点直线距离约为5公里。
Fig. 2.8 Satellite image showing the estuary of the Da Yang He and Sites 11, 12 and 13. Sites 11 and 13 are approximately 5km apart.

At **Site 10** the mudflats closest to the hill known as Hua Tuoshan are the last in the area to be covered by the tide and birds gradually gather at this point before leaving for the ponds. On smaller tides birds can be very spread out, particularly when mud remains exposed. A new road runs directly along the seawall at this site. Like most sites the mud is firm enough to walk on although a soft muddy creek runs parallel to the shore some 50m out.

Site 11 is situated on the eastern bank of the Da Yang He (Fig. 2.8), and can be counted from two points, 11 and 11a. Birds roost along the river edge then move upstream with the tide before departing for the ponds. A low island in the river channel between Sites 11 and 13 is used by shorebirds on lower tides and although on clear days it is possible to see birds on this island counting is difficult and identifying the species is even harder. The road now runs past this point and a new port has been built at this site for the Dalu Dao passenger ferries.

At **Site 12**, a seawall running east to west in front of the highest part of the mudflat is bordered to the west by a small river, which flows beside a seawall running north to south. Directly to the east of Site 12 is the Da Yang He. These two rivers join about 1.8km south of the seawall and form the borders of a triangular shaped mudflat area about 1.8km by 1.2km. This area is only completely covered on tides of 6.8m and over. The roosting birds prefer to stay close to the water whenever possible and are often more than 1km from the seawall making counting and species identification difficult, particularly as the observers are looking south into the light. The ideal tide to count Site 12 is about 6.3-6.5m when there is still enough mudflat exposed for all the birds to roost but they are close enough to the seawall to aid identification and counting. On such occasions birds come from other sites and this has to be factored into count plans. Site 12 is very close to Site 13 from the birds' point of view but a considerable distance by road. Curlews in particular will move from Site 12 to the ponds at Site 13 to roost and this must be considered during counting. Site 12 holds the second highest numbers of birds in the reserve after Site 2.

Between the Gushan Management Station and Site 12 are some 25-30sq km of reedbeds, which are maintained for commercial use. During the winter these are dry and the stubble is burnt off. They are not naturally wet but rely on water fed from reservoirs inland. During most surveys the reedbeds have been dry and have very few birds but as soon as water is allowed to flood the reedbeds shorebirds arrive to feed on grubs etc. forced from the ground.

Site 13 is accessed via a rocky coastline and a series of large ponds which rarely have any birds. The mud here is very soft and even the shorebirds have trouble walking on it. This bay is inundated very early in the tide cycle and counters usually arrive after birds have left and gone to Site 12 or moved into the adjacent ponds. A long straight track heading north bisects these ponds and the seaward side ponds are favoured as roosts by curlews and Grey Plover. Small tidal inlets between the ponds make a suitable roost on most tides.

The shoreline at **Site 14** is rocky and few birds are found there, in most cases they are found in the few ponds available (Fig. 2.9). Until 2006 Sites 14 and 15 were counted together but they were divided and counted separately when access to Site 15 was found in 2005. Unfortunately the details recorded about where the birds were roosting before 2006 are not sufficient to allow the data to be separated out.

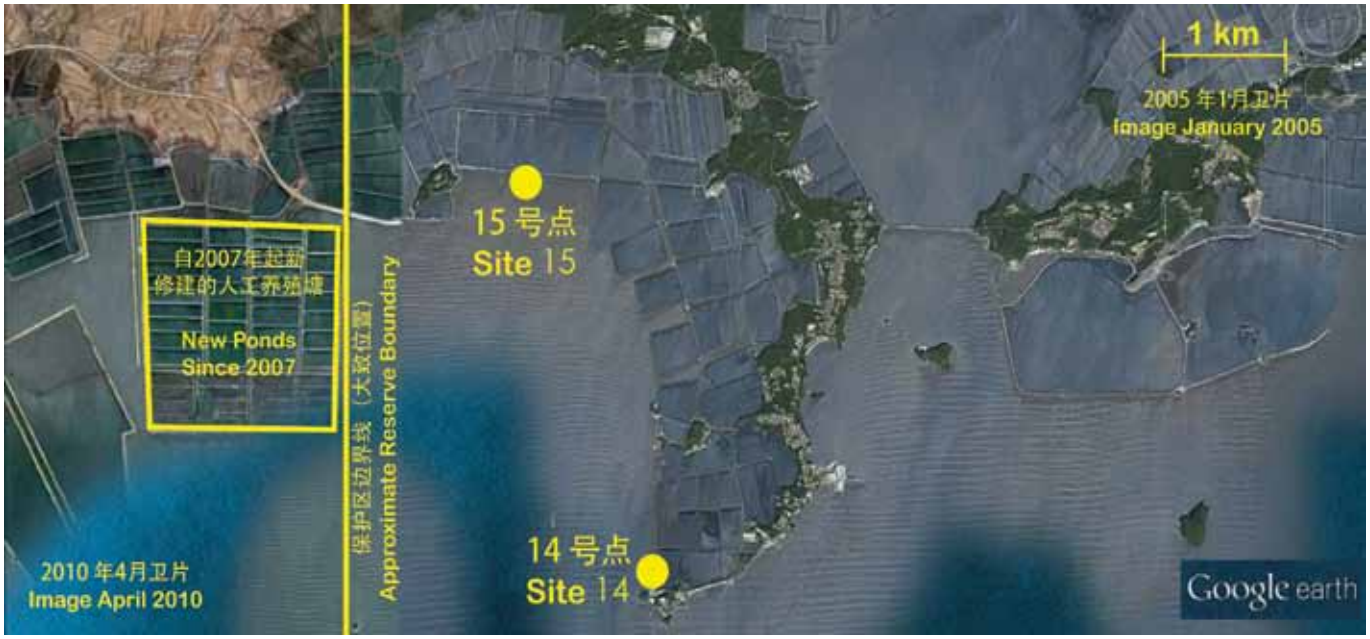


图2. 9 14和15号点位置示意图。本卫片还显示了保护区外新修建养殖塘区。
Fig. 2.9 Sites 14 and 15. This image also shows the development of new ponds outside the reserve.

在本报告内只在合适的时候采用，例如在说明某个调查点的栖息地利用情况时，但是这些数据没有列入本报告对整个鸟类数量的分析中，因为这些不完整的数据可能会因为重复计数或是不够全面对结果产生曲解。

2.5 调查方法及其准确性

调查方法

在大潮期的高潮时候，潮水一般都可以到达鸭绿江口的海防大堤，这时在滩涂觅食的涉禽会被潮水驱赶而飞入堤内的人工养殖塘休息。而小潮期的高潮，涉禽可以留在水线边的滩涂上，但有时会距离海堤太远，无法进行调查。因此，我们只在潮水高度到达6米及以上时进行调查。

我们的调查主要在潮水将大部分的滩涂淹没，涉禽聚集在仅有的几个近海堤的裸露滩地时进行。调查人员需要在潮前至少2个小时到达这些地点，并且监测逐渐靠近海堤的鸟类活动。但是有时涨潮速度太快，潮水很快到达海堤，我们来不及进行详尽的调查。

潮水到达海堤前，鸟类仍聚集在滩涂上时是调查的最好时机，因为涉禽一旦离开滩涂就会分散飞到数个养殖塘中去，特别是有些养殖塘很难在短时间内到达。在调查时，对同一群鸟会进行多次计数，以提高准确率。为了防止重复计数，当鸟类离开调查地点时，记录鸟类的飞行方向并估计它们可能移动到的下一个休息场所。有一些涉禽会在潮水刚退时就回到最初露出水面的滩涂，但是大部分涉禽会在潮水已经退到很远的时候返回滩涂，而那时它们离海堤距离太远，无法进行调查。

调查方法的局限性

涉禽的调查主要是在沿着鸭绿江口保护区60公里海岸线的15个调查点进行。选择这些调查点是因为这些地方都有大群的涉禽聚集，但还是会遗漏掉一些个体。特别是一些在高潮时不喜欢集群的物种的数量在调查中可能会被低估。

调查人员计数的误差也很难完全避免(Rappoldt *et al.* 1985)，特别是有15,000 – 70,000只鸟的大集群是很难精确计数的。所以在调查数量较大的集群时，会至少有1名经验丰富的调查员在场以尽量降小误差。我们还采取了另外一些改进的方法，包括使用数码照片，尽管照片上鸟类过于密集使得这个方法也不是很可靠。

涨潮时涉禽可能会从一个调查点飞去另一调查点。尽管鸟类表现出一定的栖息地忠诚度，我们根据鸟类可能移动的范围将调查调查点分组，同组的调查点会在同一天进行调查。鸟类的数量、起飞离开的时间和飞行方向都被记录下来用于确认它们是否飞到另一个调查点去，这样可以避免重复计数。

调查点的间隔大致为3 – 4公里，当天气晴朗的时候可以从一个调查点看到相邻的调查点，然而调查期间天气状况并不是一直都很好，而且高潮时鸟类东西走向的移动距离很难估计。

调查尽量安排在潮水最高的几天，以减少鸟类东西方向的移动，特别是安排在高潮的高度既可以让涉禽聚集到靠近海堤的滩涂，但又不会高到将它们驱赶出滩涂的日期。

在保护区内觅食但是高潮期飞到保护区界外(不包括西水道港区)的涉禽不在计数范围内。例如，在朝鲜薪岛干扰较少的天然海岸滩涂上记录到了一些在鸭绿江口保护区内觅食的涉禽。

在最早几年的调查中，前往大多数的调查点的交通都很不方便，所以有时无法及时到达调查

Adrian Riegen

Site 15 is the most western site counted and sits on the boundary of the reserve and Dalian County. Site 15 was a large bay approximately 5km by 3km but new ponds covering about 2sq km have been built on the mudflats in Dalian County since 2006 (Fig. 2.9). A series of irregularly shaped ponds lie behind Site 15, some with shallow water but most are dry during the survey period and make good roost sites. Birds will sometimes leave the Site 15 mudflats an hour or more before they need to, on these occasions they generally fly over the hills, presumably to roost at Site 12.

2.4 Survey Dates

The dates of each survey are outlined in Figure 2.10. There are several time periods during April and May that have yet to be surveyed. As the surveys must be done when the tides are between 6.0 and 6.5m it may be several years before the tide cycle allows these remaining periods to be covered. It is important to survey the whole migration period as some species may move through the reserve very quickly. It is also important to survey each time period more than once to monitor year to year variability.

Outside the formal survey periods there have been several partial counts of the reserve. These results are used where appropriate, for example looking at the use of a site, but are not included in analyses that look at overall numbers as they are incomplete and would skew any results.

2.5 Counting Techniques and Accuracy

Techniques

During spring tides, most high tides reach the seawall at the Yalu Jiang Estuary forcing the birds to leave the mudflats and roost within the aquaculture ponds over the high tide period. During neap tides birds can remain on the mudflats along the water's edge often some distance from the seawall, making counting difficult. Therefore counts are planned to coincide with tides of about 6m and above.

Shorebirds gather on the last remaining mudflats to be covered by the high tide and it is at this time that the birds are counted. Counters aim to reach these sites on the rising tide, at least two hours before high tide and monitor the movements of birds as they approach the seawall. On particularly high tides the sea reaches the seawall very quickly making accurate counting difficult.

Counting just prior to the tide reaching the seawall is considered the optimum time, as once the birds have moved from the mud they scatter to numerous ponds, some of which are difficult to reach in the time available. Birds are constantly recounted during this period to ensure the best possible accuracy. As birds leave the count site they are observed, to check for possible movement to other count sites so that they are not counted more than once. Some birds return to the mudflats as soon as the first mud is exposed on the dropping tide, however, others only return once the tide has receded significantly and by then they are too far away to count.

Limitations of counting techniques

The counts are based at 15 points along the reserve's 60km coastline and at the Yalu River West. While these sites have been chosen as the areas with the largest flocks of birds it is likely that some individuals are missed in the counts. In particular, species that do not always gather into large flocks at high tide are likely to be undercounted.

Problems do arise with known observer errors in counting (Rappoldt *et al.* 1985), the largest flocks containing 15-70,000 birds are particularly difficult to count accurately. This problem is minimised by ensuring that at least one experienced counter is available to count the largest flocks. Other methods of improving these counts are being considered, including the use of digital photos although the sheer number of tightly packed birds makes even this method problematic.

Birds may move from one count site to another as the tide rises. Although birds appear to be reasonably site faithful, the survey is planned so groups of sites where birds may move from one to the other during the count period are counted on the same day. Departure times and flight directions as well as bird numbers are recorded for departing flocks so that they can be identified if they arrive at other sites, thus preventing the same birds being counted twice. Count sites

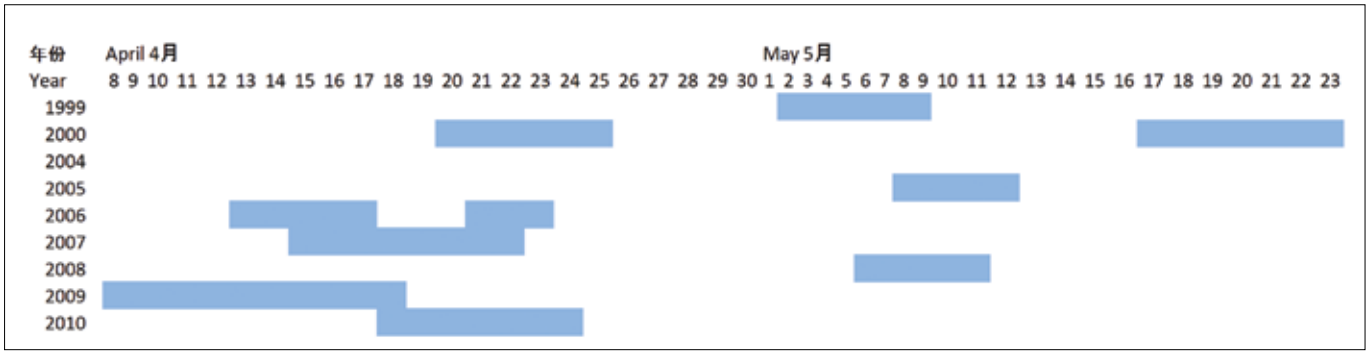


图2. 10 蓝色区域所示为1999年至2010年在鸭绿江口保护区内已完成的涉禽调查时间段。
Fig. 2.10 Dates of each complete shorebird survey of the YJNNR between 1999 and 2010, outlined in blue.

点并取得满意的数据，但是近几年沿海公路的通车，使所有的调查点都可以方便到达。

2.6 环志和旗标

金属环和旗标是近年在涉禽环志中被广泛采用的两种标记物。旗标是用具有可塑性的彩色材料制成的脚标，每种颜色或色彩组合代表鸟类迁徙路线上的某个特定地点(图2.11, 图2.12)。在环志时环志者会将旗标固定于鸟的下肢，旗标可以修剪成不同的形状，还可以在旗面上刻上字母和数字进行编码。通过不同颜色的旗标及金属环的组合，我们就可以获知每只鸟的信息；这些信息可以是很普遍的，如环志的地区；也可以是很具体的，如这只鸟的年龄、性别等。在迁徙路线上的大多数国家和地区都已采用旗标标记涉禽，而最近几年在新西兰和澳大利亚还给被环志的涉禽佩戴了彩环。2010年4月，复旦大学由马志军博士带领的研究小组在鸭绿江口保护区捕捉了29只斑尾塍鹬，并给它们佩戴了彩环(见附录2)。

根据涉禽佩戴的旗标颜色，我们可以知道这只鸟是在哪个地区被环志的。为了特别的研究目的，一些鸟类个体是用刻有字母或数字的编码旗标或是唯一的彩色脚环组合标记的(图2.11和2.12)。本报告目的在于了解涉禽的迁徙路线和对中途停歇地的利用情况，所以对于大多数旗标和彩环目击记录，我们只需要确定该鸟被环志的国家或地区即可。

Jimmy Choi 蔡志扬

图2.11 这只斑尾塍鹬佩戴了代表鸭绿江口的上绿下橙组合旗标和彩环以便未来的观察者识别个体 。
Fig. 2.11 Bar-tailed Godwit colour banded with green and orange flags of the Yalu Jiang Estuary and four colour bands.

在鸭绿江口保护区及其他涉禽的非繁殖地如新西兰、澳大利亚和东南亚都有针对旗标和彩环的鸟类调查。但是在涉禽的繁殖地，由于地处偏远难以到达，这类调查工作相对较少，仅在美国阿拉斯加有一些记录报道。

2.7 数据分析

在统计迁徙期利用某个迁徙补给地的鸟类数量时，遇到的最大问题就是这些鸟到达和离开的时间并不一致；所以任何一个时间段内的调查并不能涵盖整个迁徙期经过的所有鸟类。为了尽可能解决这个问题，对于那些数量较多的物种，记录每一次调查时每个物种的总数量，并分析出它们的到达时间、离开时间及过境高峰期。然后尝试通过种群内个体的迁徙周转率建模来估计迁徙种群的大小。若以上方法难以实现，则采用最大计数法；最大计数法的值可能低于真实值，但是在一定程度上仍可以反映出鸭绿江口保护区的重要性，并且可以和其他迁徙补给地进行比较。

迁徙种群估计

有7个物种的数据较为完善并适合建模。最佳模型可以拟合迁徙周期中不同时间鸟类的数量。统计方法详见 Rogers *et al.* (2010)。

迁徙涉禽对迁徙补给地的利用情况可用以下3种基本模型拟合。到达时间：从某个物种第一批个体开始到达迁徙补给地直至最后一批个体到达的时间；启程时间：从从某个物种第一批个体开始离开迁徙补给地直至最后一批个体离开的时间)。

标准模型—所有鸟类在积累了足够的能量后离开。也就是说所有鸟在迁徙补给地的停留时间是等长的；既然如此，它们到达和启程时间的标准差应该相同。

快速启程模型—一些物种会选择天气状况良好的情况下启程，早达到的迁徙补给地的个体会拖延它们的停留时间，并和晚到的个体在适宜的时机一起离开。因此，整个种群的离开时间

are approximately 3-4km apart, which on good days means one site is just visible from another, however, conditions are not always favourable and observing how far birds move east and west at high tide can be difficult to determine.

Counts are planned for days with maximum tide heights that minimise movement of birds east and west and are ideally planned for days when birds are not forced from the mudflats.

Any birds that use the reserve for feeding but which move outside the boundaries of the reserve (except those that use the River) at high tide are not counted. For example birds feeding in the reserve have been observed crossing to Sin Do in North Korea, where there is a more natural coastline and probably little disturbance.

Access to most sites was difficult in the early years so that sites were not always reached in time to achieve good counts; however, with the new road running through the reserve close to the shoreline, access to all sites is now very easy.

2.6 Flagging and Banding

Many shorebirds are now marked with flags and bands - small pieces of coloured plastic placed around the bird's legs which can be plain, cut in different shapes or engraved with numbers and letters. The combination of these flags and bands provides information about individual birds; this information can range from quite general to individually specific. While flagging is done in many countries along the flyway, until recently colour banding had only been taking place in New Zealand and Australia. In April 2010, 29 Bar-tailed Godwits were caught and colourbanded at the Yalu Jiang Estuary by a team from Fudan University, Shanghai, led by Dr Ma Zhijun. Details of the different flag colours showing the various places where birds were banded are outlined in Appendix 2.

If a flag is present on a shorebird's leg it will indicate where that bird was banded. For specific studies a few birds have been individually marked either by numbers and letters engraved into the flag or individual combinations of coloured leg bands. For the purposes of this report most flag and band sightings have been taken back only to the banding region to trace migration paths and stopover sites.

Flags and bands are searched for using telescopes both at the reserve and at the non-breeding grounds in New Zealand, Australia and Southeast Asia. Very little searching for flags and bands is done on the breeding grounds due to access difficulties, however, there are some records, particularly from Alaska.

2.7 Analysis

The big problem in working out how many shorebirds are using a staging site over a migration period is that they arrive and leave at different times; at any given time large numbers of them are not present to be counted. To solve this problem it is possible, for the more numerous species, to take all of the counts for each species at all of the count times and work out when they start to arrive and depart as well as peak numbers. It may then be possible to model migration turnover of individual birds that produce this pattern and estimate the migrating population. Where it is not possible to do this, maximum counts are used; even though they are likely to be lower than the true numbers they still give an indication of the importance of the reserve and allow it to be compared to other staging sites.

Migrating population estimates

Migration models are presented for the seven species for which the data are sufficient and suitable for modelling. The best model is fitted to the counts of birds made at different times in the migration cycle. The statistical methodology used is described in Rogers *et al.* (2010).

Adrian Riegen

图2. 12　佩戴崇明岛上黑下白组合旗标的斑尾塍鹬，其中白色旗标为编码旗标（白色旗标上面显示的编码为1A 。

Fig. 2.12　Bar-tailed Godwit with plain black flag and engraved white flag (1A) from Chongming Dao, China.

相对较短，且启程时间的标准差小于达到日期的标准差。

快速到达模型——一种相反的情况也可能发生，即所有的鸟都在很短的时间内到达(这种情况的发生可能是因为在上一个迁徙补给地因为天气状况不好而导致鸟类的启程被延迟)，而它们启程时间却拖得很长。这种模型也可以用来估计本地越冬鸟的启程时间。

2.8 迁徙路线种群数量估计及它们的重要性

对迁徙路线上涉禽种群大小的估计一般是通过在越冬地进行调查来估计，因为在越冬期，种群中所有的个体都会在越冬地停留较长时间，因此种群数量较为稳定。本报告主要参考了Bamford *et al.* (2008) 及 Delany和Scott (2006)的研究中所报道的种群数据。但是这些研究的结果主要基于上世纪80和90年代的调查数据，而从那时起，本迁徙路线上涉禽的数量就一直在下降。因此，我们还尽可能采用较新和较全面的参考信息。

本报告还用到了一些物种数量的最大计数值，之所以不采用所有调查结果的平均值是因为可能在有些调查时期某物种还没全部到达鸭绿江口保护区或是部分个体已经离开鸭绿江口前往繁殖地，这会导致该物种的平均值低于实际数量。

Keith Woodley

Adrian Riegen

There are three basic models which describe how migrating waders can use a staging site:

Standard model. All birds feed and fatten up and leave when they are ready. Effectively this means that all birds stay for the same length of time; this being so, standard deviations of arrival and departure days will be the same.

Fast Departure Model. Some staging species may only leave when weather conditions are suitable and earlier arrivals will delay their departure to coincide with that of later arrivals. Consequently, departures take place over a relatively short period with the standard deviations of departure days being substantially smaller than that of arrival days.

Fast Arrival Model. A mirror-image situation could arise if all birds arrived at a site in a short period (as might happen if departures from sites earlier in the migration are delayed until conditions are suitable) with departures being spread over a longer period. This model could also be used for estimating departure times of resident species.

2.8 Flyway population estimates and their significance

The total populations of migratory waders using the flyway are determined by counts made in their non-breeding sites as all of the birds are present there at one time. Bamford *et al.* (2008) and Delany & Scott (2006) are the main source of population data used in the report, however much of the data in these references is based on counts that occurred in the 1980s and 1990s. More recent information is therefore used whenever possible to take into account new discoveries, better information, and population declines since that time.

In this report maximum counts are used regularly, as averages from every count would include time periods where a species may have either not started its northern migration or have left the reserve for its breeding grounds.

Keith Woodley

3 结果

3.1 鸭绿江口保护区内被环志鸟类的调查记录

到2010年10月为止，在鸭绿江口保护区和附近的河口地区共记录到了1079笔佩带旗标和彩环的鸟类回收记录，其中一些是在计划外的调查中记录到的。尽管如此，这并非包括所有的收回记录数据，因为科研人员记录到的另外几百个记录仍还在分析之中。在1079笔记录中，从1035笔记录可以获悉鸟类被环志的地区。这些地区包括来自8个国家19个地区(表3.1，图3.1,3.2和3.3)。因为从非编码旗标我们只能知道该鸟被环志的地区，无法确认个体，所有有些记录可能是对同一只个体的重复记录。但是从带有编码旗标和彩环组合的个体的较低的重复记录率看来，对于只带有非编码旗标的个体的重复记录的可能性不会很高。

迄今为止，在鸭绿江口共记录到了11种被环志的涉禽。记录最多的种类是斑尾塍鹬和大滨鹬，这既反映了在非繁殖地这两个物种的环志工作的成果，也表明在迁徙过程中这两个物种有大量的个体会在鸭绿江口停歇(表3.2)。

在记录到的1035笔可知来源地的旗标记录中有637笔是只有普通旗标的记录，所以我们只能知道它们的被环志地区。265笔被彩环标记记录中117只鸟的149笔记录是完整的(如图2.11)，另外116笔是不完全的记录。还有133笔是编码旗标(如图2.12)，但是只有73只鸟的83笔记录可以读清编码，而另外的50笔因为距离太远或是褪色无法看清全部编码。仅有在澳大利亚西北

图3.1 在鸭绿江口记录到的被环志鸟类的来源地。
Fig. 3.1 Banding regions of all marked birds sighted at the Yalu Jiang Estuary showing the number of sightings from each region.

图3.2 除斑尾塍鹬和大滨鹬外，鸭绿江口回收记录到来自东亚-澳大利西亚迁徙路上不同环志地区的其他涉禽数量。
Fig. 3.2 Species flagged on the EAAF and seen at the Yalu Jiang Estuary excluding Bar-tailed Godwit and Great Knot.

3. Results

3.1 Marked birds recorded in the reserve

This report identifies 1,079 flag and band sightings recorded at YJNNR and the nearby river mouth to October 2010. Some of these birds were recorded outside the survey periods. However, this is by no means a complete record of sightings, as researchers have recorded hundreds more flags and colour bands which await analysis. Of the 1,079 marked birds seen at the Yalu Jiang Estuary, enough detail was seen to identify the banding region of 1,035 birds. These have come from 19 banding regions in eight countries, (Table 3.1, Figs. 3.1, 3.2 & 3.3). Some of these sightings may be of a single bird marked with a regional code, seen more than once. However, there is a low resighting rate of the individually recognisable birds carrying unique combinations of colour bands or engraved flags; from this it can be inferred that many of the regionally marked birds are likely to be individuals, rather than the same bird seen numerous times.

To date flags and bands have been recorded on 11 species. The majority of the flags seen have been on Bar-tailed Godwits and Great Knots, reflecting both the effort that goes into banding these species at their non-breeding sites and the high numbers of both species that use the Yalu Jiang Estuary as a staging site (Table 3.2).

Of the 1,035 sightings of known origin marked birds, 637 were of plain flags alone, indicating only the region where they were banded. Sightings of 265 colour banded birds have been recorded. 149 were read in full relating to 117 individual birds, while 116 were incompletely read. 133 sightings were of engraved leg flags, of which only 83 were read in full and they represent 73 individual birds, while 50 could not be read fully, due to either distance or colour fading.

图3. 3 鸭绿江口回收记录到来自不同环志地区的斑尾塍鹬的数量。
Fig. 3.3 Banding regions of Bar-tailed Godwit that have been sighted at the Yalu Jiang Estuary.

图3. 4 回收记录到来自鸭绿江口的涉禽的地区。
Fig. 3.4 Sighting of Yalu Jiang Estuary banded shorebirds up to October 2010.

部环志的大滨鹬和新西兰北岛、南岛及澳大利亚西北部环志的斑尾塍鹬有佩戴彩环，因为在这些地区对着两个物种有较为深入的研究。

同样的，在迁飞路线上的其他停歇地也发现了鸭绿江口湿地环志的涉禽（图3.4）。

在鸭绿江口被环志的涉禽是以上绿下橙的旗标组合标记的。表3.3列出了这些鸟类在迁徙路线上的回收记录情况。数据还包括了2010年4月在鸭绿江口保护区内用彩环标记的29只斑尾塍鹬。

每个物种的环志回收记录情况详见下一部分(3.2)。

蛎鹬 *Far Eastern Oystercatcher* - 柳明玉 *Ming-Yu Liu*

表3.1　在鸭绿江口记录到的来自各地区的被环志鸟类的数量。包括本报告计划外的调查中记录到的数据。
Table 3.1 Number of marked birds seen at YJNNR that can be identified back to the banding region. This includes some sightings outside the survey periods.

Location	国家	Country	地区	Region	数量 Number of Sightings
越冬地	新西兰	New Zealand	北岛	North Island	209
（非繁殖地）			南岛	South Island	109
Non-breeding			不确定	Unknown	37
	澳大利亚	Australia	塔斯马尼亚岛	Tasmania	1
			澳大利亚西南部	SW Australia	1
			澳大利亚南部	South Australia	2
			维多利亚州	Victoria	147
			新南威尔士州	New South Wales	1
			昆士兰东南部	SE Queensland	14
			澳大利亚的西北部	NW Australia	415
	印度尼西亚	Indonesia	苏门答腊岛	Sumatra	1
	泰国	Thailand	泰国 内湾	Inner Gulf	1
			泰国半岛	Thai Peninsula	3
迁徙停歇地	中国	China	香港	Hong Kong	1
Staging Sites			崇明岛	Chongming Dao	62
			鸭绿江口	Yalu Jiang Estuary	27
			台湾	Taiwan	1
	韩国	South Korea	韩国	South Korea	1
	日本	Japan	北海道	Hokkaido	2
繁殖地 Breeding Grounds	俄罗斯	Russia	堪察加半岛	Kamchatka	3
不确定 Unknown					4
合计 Totals					1,079

表3. 2 在鸭绿江口记录到的被环志鸟类的种类和数量。

Table 3.2 Number of marked birds seen at YJNNR .

物种	Species	Total 数量
斑尾塍鹬	Bar-tailed Godwit	816
大滨鹬	Great Knot	219
灰斑鸻	Grey Plover	13
红腹滨鹬	Red Knot	9
红腰杓鹬	Eastern Curlew	8
黑腹滨鹬	Dunlin	4
红颈滨鹬	Red-necked Stint	3
杓鹬类	Curlew species	2
尖尾滨鹬	Sharp-tailed Sandpiper	2
翻石鹬	Terek Sandpiper	1
翘嘴鹬	Ruddy Turnstone	1
弯嘴滨鹬	Curlew Sandpiper	1
合计	Grand Total	1,079

Colour bands have only been recorded on Great Knot from Northwest Australia and Bar-tailed Godwit from New Zealand's North and South Islands and Northwest Australia, areas where these species are being studied intensively.

Similarly those shorebirds marked at the Yalu Jiang Estuary are seen in other parts of the flyway (Fig. 3.4).

Species have been marked at the Yalu Jiang Estuary with the combination of green over orange flags. Re-sightings of these birds, shown in Table 3.3, complement the records of birds marked elsewhere. This includes the resightings of 29 Bar-tailed Godwits colour-banded in the reserve in April 2010.

Band records for each species are presented in the Species Accounts.

表3. 3 回收记录到来自鸭绿江口涉禽的地区和个体数（包括对同一个体的重复记录）。

Table 3.3 Regions where birds flagged at YJNNR have been seen and the number of sightings (these include repeat sightings of the same individual bird).

	国家 Country	地区 Region	斑尾塍鹬 Bar-tailed Godwit	大滨鹬 Great Knot	尖尾滨鹬 Sharp-tailed Sandpiper	黑腹滨鹬 Dunlin	灰斑鸻 Grey Plover
越冬地	新西兰	南岛 South Island	58				
（非繁殖地）	New Zealand	北岛 North Island	274				
Non-breeding	澳大利亚 Australia	昆士兰州 Queensland	17				
		新南威尔士州 New South Wales	3	1			
		澳大利亚西北部 Northwest Australia		1			
越冬地（非繁殖地）或迁徙停歇地	印度尼西亚 Indonesia			1			
Staging or non-breeding	菲律宾 Philippines						1
迁徙停歇地	日本 Japan		1				
Staging	中国 China	台湾 Taiwan					1
		天津 Tianjin			1		
		鸭绿江口 YJNNR	3				
繁殖地 Breeding	美国 USA	阿拉斯加 Alaska	23			1	

3.2 鸭绿江口的主要涉禽种类

在鸭绿江口的调查中共记录到涉禽41种(详见附录1)。在此我们将其分为4类：

- 第一类：经常出现，且其种群数量常常占迁徙路线或全球种群1%或更多(即国际重要意义标准)(8种)
- 第二类：种群数量至少有一次达到或超过了迁徙路线或全球种群的1%(7种)
- 第三类：经常出现，但是种群数量较少(8种)
- 第四类：迷鸟，罕见或出现无规律(18种)。

我们用占迁徙路线种群的1%作为分类准则是因为《拉姆萨尔湿地公约》的第6条标准规定：如果一块湿地定期栖息着一个水禽物种或亚种某一种群1%的个体，就应被认为具有国际重要意义。

3.2.1 第一类

共有6种涉禽在每次调查时其数量都达到国际重要意义标准，另外还有两种涉禽的数量经常达到国际重要意义标准(表3.4)。

斑尾塍鹬

在鸭绿江口区域调查到的斑尾塍鹬数量一直都很高，最少调查记录为26,169只，最多调查记录为93,000只。种群模型计算结果显示，在调查期间，不包括鸭绿江口其他地区，仅在保护区内的斑尾塍鹬种群数量为70,000只(表3.5)。而在整个鸭绿江口地区，斑尾塍鹬的种群数量高达93,411只。在调查中我们并没有分别记录斑尾塍鹬的两个亚种 *menzbieri* 和 *baueri* 的数量或是比例。这两个亚种的迁徙时间稍有不同，

表3.4 北迁时期在鸭绿江口保护区及河口区域记录到达到国际重要意义标准的种类。其中砺鹬的最大种群数量是在本报告计划外的调查中记录到的。

Table 3.4 Species seen in internationally important numbers, at Yalu Jiang Estuary Wetland National Nature Reserve and the River during northward migration. The Far Eastern Ostercatcher count is from outside the survey period.

物种	Species	最大种群数量 Highest Count	迁徙路线或全球种群的1%/国际重要意义标准 1% of flyway population - Internationally Important Criterion.	数量达到国际重要意义标准的调查次数（共9次调查） The number of surveys where the international criterion is reached (out of 9)	国际重要意义标准和调查到的最大种群数量的幅度差 Magnitude of difference between the Internationally significant criterion and the highest count.
第一类	**Group One**				
斑尾塍鹬	Bar-tailed Godwit	93,411	2,400[+] or 3,000[$]	9	38.9[+] or 31.1[$]
红腰杓鹬	Eastern Curlew	6,818	380	9	17.9
大滨鹬	Great Knot	55,178	2,900*	9	19.0
黑腹滨鹬	Dunlin	45,761	6,500^	9	7.0
灰斑鸻	Grey Plover	9,253	1,250	9	7.4
白腰杓鹬	Eurasian Curlew	13,136	1000^	8	13.1
砺鹬	Far Eastern Oystercatcher	1,068[M]	100	8	10.6
小青脚鹬	Spotted Greenshank	24	10	4	2.4
第二类	**Group Two**				
红腹滨鹬	Red Knot	1,499	1,200	1	1.5
环颈鸻	Kentish Plover	1,485	1,000	3	
阔嘴鹬	Broad-billed Sandpiper	729	250[$]	2	2.9
鹤鹬	Spotted Redshank	838	250[$]	1	3.4
青脚鹬	Common Greenshank	712	550[$]	1	1.3
翻石鹬	Ruddy Turnstone	419	310	1	1.4
蒙古沙鸻	Lesser Sandplover	A647	600	1	1.1

注：[$] Bamford *et al.* 2008; ^ Cao *et al.* 2009; *IUCN 2010a; [+] Southey 2009 and AWSG 未发表数据 unpublished data；[M]Melville *et al.* in press 个人通讯；除以上特别标识的数据外，其他数据均参考自Delaney & Scott 2006. (as defined by Delaney & Scott 2006 except as indicated).

3.2 Species Accounts

Forty one species of shorebird have been recorded during the YJNNR surveys. These have been divided into four groups. (Scientific and Chinese names are found in Appendix 1).

- **Group one**: Those species that have been regularly recorded in internationally important numbers of at least 1% of the flyway population (8 species)
- **Group two**: Those that have occurred at least once in internationally important numbers (7 species)
- **Group three:** Those that occur regularly in small numbers (9 species)
- **Group four:** Those that are vagrant, occur rarely or erratically (16 species).

The 1% of the flyway population mark has been used as it matches Criterion 6 of the Ramsar convention which states that "A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird".

3.2.1 Group One

Six species have occurred during all surveys in internationally important numbers and two others have regularly occurred in internationally important numbers. See Table 3.4.

Bar-tailed Godwit

At the Yalu Jiang Estuary, counts of Bar-tailed Godwits are consistently high, ranging from 26,169 up to 93,411 birds. The population models suggest that about 70,000 birds should occur in the reserve and River over the survey period (Table 3.5 - see page 68). This does not include the count data from the river sites. Hence the population estimate for the reserve and river must be the high count of 93,411. Counts did not identify numbers or proportions of the subspecies *menzbieri* and *baueri* (see below). These two subspecies are known to migrate at slightly different times, with *baueri* arriving earlier and leaving earlier than *menzbieri*. As the total number of both subspecies are unlikely to all be in the reserve at one time it is likely that more individauls use the reserve than can be counted at any one time.

The curve fitted to the count data indicates that a "fast arrival model" can be fitted appropriately to the data. Counts show a rapid build up in numbers to reach a peak in mid-April but with birds' departures spread over a longer period as some birds stay in the reserve longer than others.

There are two subspecies of Bar-tailed Godwit known to be using the reserve: the eastern Siberian-breeding form, *menzbieri*, which migrates to Northwest Australia and the Alaskan-breeding form, *baueri*, which migrates to southern and eastern Australia and New Zealand (Barter 1989). A third form breeding on the Anadyr Lowlands of Siberia, *anadyrensis*, has only recently been described (Engelmoer & Roselaar 1998; Tomkovich 2010), and also uses the EAAF but little is known about it at present. The Siberian form is slightly smaller and differently marked than the Alaskan subspecies, however, they are difficult to tell apart in the field. Anecdotal observations of birds in the field, combined with records of marked birds and satellite tracking data suggest that in the first part of April *baueri* are the most common subspecies present, the middle of April is a mixed group and the *menzbieri* subspecies is dominant later in the migration

斑尾塍鹬 *Bar-tailed Godwit - Phil Battley*

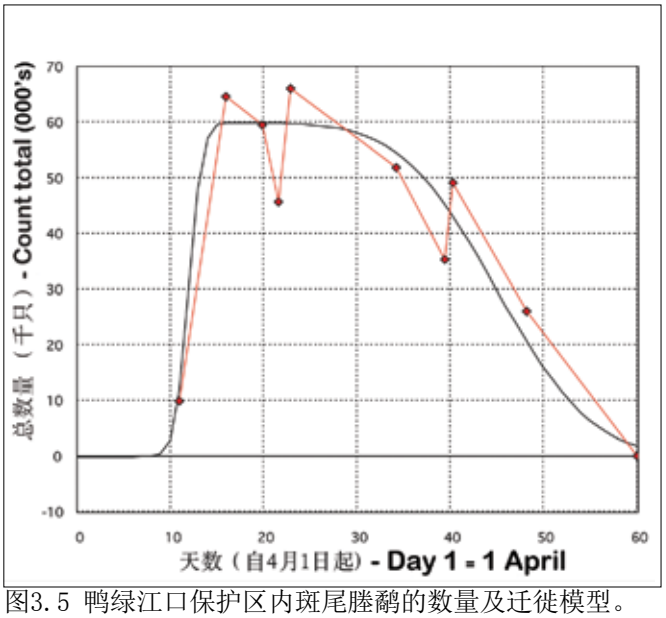


图3. 5 鸭绿江口保护区内斑尾塍鹬的数量及迁徙模型。（红线：数量；蓝线：模型预测）

Fig. 3.5 Population model and counts of Bar-tailed Godwit using the Yalu Jiang Estuary on northern migration. (Red line = counts; blue line = model predictions).

亚种 *baueri* 比 *menzbieri* 早到达也早离开鸭绿江口。因此，这两个亚种中，经过鸭绿江口的所有个体不可能在同一时间出现，而在任一时间调查到的群种数量都低于实际利用鸭绿江口的斑尾塍鹬的总数量。

种群拟合曲线表明斑尾塍鹬采用的是快速到达模型的迁徙模式。数据显示斑尾塍鹬的数量在4月中旬快速达到顶峰，但由于部分个体在保护区停留的时间比其他个体久，所以它们的启程时间比较长。

已知斑尾塍鹬有两个亚种在迁徙时经过鸭绿江口：在西伯利亚东部繁殖并在澳大利亚西北部越冬的 *menzbieri* 亚种和在阿拉斯加繁殖并在新西兰及澳大利亚南部和东部越冬的*baueri*亚种(Barter 1989)。最新的研究还确定了东亚–澳大利西亚迁徙路线上的第3个亚种——在西伯利亚阿纳德尔低地(Anadyr Lowlands)繁殖的 *anadyrensis* 亚种(Engelmoer & Roselaar 1998, Tomkovich 2010)，但是我们对这个亚种的了解还非常少。*menzbieri* 亚种的体型比 *baueri* 亚种稍小一些，它们在外观上也有明显的差异，但是在野外仍然很难区分。通过长期的野外观察并结合环志鸟类回收记录及卫星跟踪鸟类的数据，我们发现在4月上旬鸭绿江口大部分的斑尾塍鹬为*baueri* 亚种，中旬是两个亚种的混群，而在之后的迁徙季节里 *menzbieri* 亚种的数量占优势。另外，回收记录到的来自澳大利亚西北部和来自新西兰及澳大利亚其他地区的旗标的相对比例也证实了这一点(图3. 6)。这可能反映了鸟类的迁徙策略与两个繁殖地冰封期时间有关系。两个亚种对鸭绿江口保护区利用的研究现在已经在进行当中。

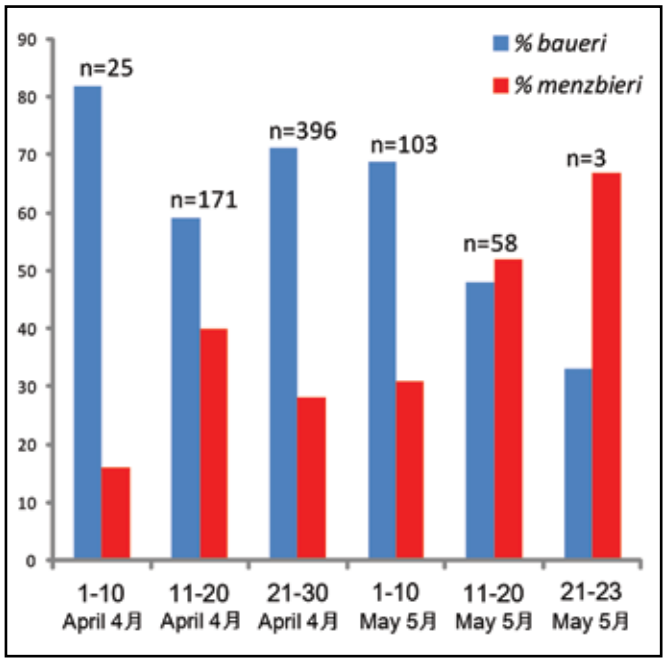


图3. 6 北迁时期戴有越冬地标记的两个斑尾塍鹬亚种*menzbieri*（在澳大利亚西北部和西南部越冬） 和 *baueri*（在澳大利亚其他地区及新西兰越冬）在鸭绿江口被回收记录到的相对百分比。

Fig. 3.6 Relative frequency of band sightings of birds that have been banded in the non-breeding range of *menzbieri* (Northwest and Southwest Australia), and *baueri* (all other Australian and New Zealand banding regions).

在鸭绿江口斑尾塍鹬十分常见且分布较广，但是斑尾塍鹬最偏好的区域是位于东边的2和3号点及西水道港区。除了4号点外，在1至7号点内都分别至少有1次超过11, 000只斑尾塍鹬的调查记录，而保护区西边的调查区域只有12号点有如此之多的斑尾塍鹬栖息。从佩带了卫星跟踪器的斑尾塍鹬获得的数据可知，有9只斑尾塍鹬从新西兰起飞后来到黄海区域，其中6只在鸭绿江口停歇的斑尾塍鹬都主要在保护区的东边活动，仅有1只曾在保护区西边短暂出现过。10只从澳大利亚西北部起飞后来到黄海区的斑尾塍鹬中只有3只在鸭绿江停歇，其中两只在保护区东边活动，1只在西边活动(Battley *et al.* in review, 图3. 7)。

我们的调查尽量安排在鸟类不会在调查点间来回移动时进行，当潮水不超过6. 0米的时候，2号点是最佳的调查地点。因为当潮水把保护区内的大部分滩涂都淹没时，大部分的涉禽都会聚集在2号点前的滩涂上，然后再转移到西水道港区休息。2008年4月26日进行了1次计划外的调查，当日最高潮为6. 3米，我们记录到近50, 000只斑尾塍鹬在西水道港区休息，比计划内调查发现的20, 000只多得多。2号点和西水道港区作为斑尾塍鹬高潮时休息场所的重要性可能比本报告表格中所建议的高得多。

Bamford *et al.* (2008)估计斑尾塍鹬在东亚–澳大利西亚迁徙路线上的种群数量约有300, 000只，但根据近期的调查结果，我们认为这个估计值较高，保守估计斑尾塍鹬的数量可能接近240, 000只(Southey 2009; AWSG 未发表数据)。在新西兰，每年大约有占当地总数量近9%的斑尾塍鹬个体不迁徙(Southey 2009)，如果澳大利亚的情况与新西兰类似的话，那么每年沿东亚–澳大利西亚迁徙路线前往繁殖地的斑尾塍鹬可能有218, 000只。根据1个迁徙期内共记录到93, 411只斑尾塍鹬的数据，北迁时，鸭绿江口至少支持着东亚–澳大利西亚迁徙路线上的41%的斑尾塍鹬种群(Southey 2009)。

卫星跟踪和光敏定位仪(datalogger)研究的结果显示，在阿拉斯加繁殖的*baueri*亚种经过鸭绿江

图3. 7 阴影区域为2007 – 2008年佩带卫星跟踪器的斑尾塍鹬在鸭绿江口保护区及西水道港区的主要活动区域。

Fig. 3.7 Shading shows general areas where satellite tagged Bar-tailed Godwit were recorded in the YJNNR and 'River' during 2007-2008.

period. The relative frequency of birds banded in Northwest Australia versus those banded in New Zealand and other parts of Australia seems to support this (Fig. 3.6). This probably reflects different migration strategies related to the normal duration of snow cover on their different breeding sites. Detailed work on how the two subspecies use the reserve is currently being undertaken.

Bar-tailed Godwits are particularly common and widespread in the reserve but favour the eastern end with high numbers using Sites 2, 3 and the River. All sites from 1-7, except Site 4, have recorded at least one count of more than 11,000 godwits; the only site further west to have counts this high is Site 12. Details from satellite tracking show that of nine satellite tagged birds from New Zealand known to have reached the Yellow Sea, six staged at the Yalu Jiang Estuary, all at the eastern end with one of these also occuring briefly in the west. Of ten satellite tagged birds from Northwest Australia known to have staged in the Yellow Sea, only three staged at the Yalu Jiang Estuary with two in the east and one in the west (Battley *et al.* 2012) (Fig. 3.7).

The surveys are planned in a way that minimises bird movement between sites. This also means that the numbers counted at Site 2 are effectively minimised, with the site counted on a tide no higher than 6.0m. On higher tides the mudflats are covered early in much of the reserve and more individuals will move into the Site 2 mudflats and then the River, to roost. A count on 26/4/2008, a day with a tide height of 6.3m and outside the survey period, showed up to 50,000 godwits roosting at the River, much higher than the 20,000 shown in the survey results. The importance of Site 2 and the River as roost sites for Bar-tailed Godwits is therefore greater than the figures in this report suggest.

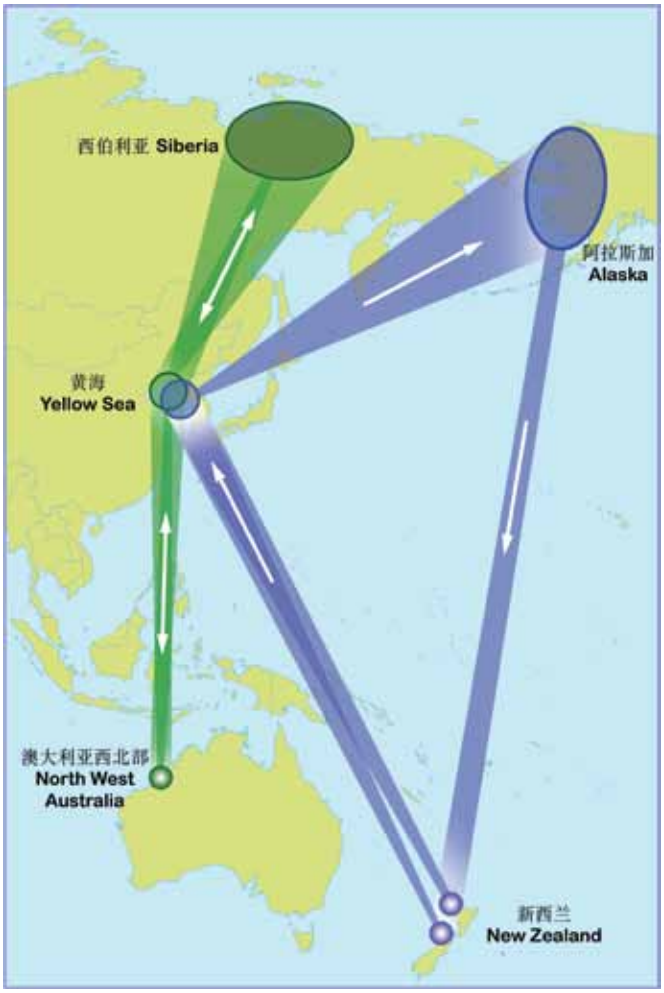


图3. 8 在澳大利亚西北部和新西兰佩戴卫星跟踪器的斑尾塍鹬经过黄海地区的大致路线。

Fig. 3.8 General flight paths of satellite tagged Bar-tailed Godwit from Northwest Australia and New Zealand passing through the Yellow Sea.

口保护区的比例比在西伯利亚繁殖的*menzbieri*亚种高。在新西兰被卫星跟踪器和光敏定位仪标记的斑尾塍鹬中有70%在鸭绿江口停歇，而在澳大利亚西北部被标记的个体中有30%在此停歇(Battley *et al.* 2012)。因此，鸭绿江口保护区对这两个亚种都非常重要，特别是 *baueri* 亚种，鸭绿江口是它们迁徙途中最关键的能量补给地。

环志鸟类的回收记录显示，除了鸭绿江口地区，斑尾塍鹬还会其他迁徙停歇地停留，其中在崇明岛记录到26笔记录，韩国记录到1笔，中国台湾记录到1笔，日本北海道1笔。而在鸭绿江口保护区内回收记录到的被环志个体也不仅来自于新西兰和澳大利亚，还有来自印度尼西亚苏门答腊、泰国和俄罗斯堪察加半岛的。

上世纪90年代，在东亚–澳大利西亚迁徙路线上的多个迁徙停歇地都有数量较高的斑尾塍鹬记录，但是现在其中几个重要的迁徙补给地已经被破坏了，此后最大计数超过20,000只斑尾塍鹬的记录就仅有一笔，即2004年5月10日在中国山东省莱州湾记录到的25,961只斑尾塍鹬(Bamford *et al.* 2008)。

卫星跟踪的数据也清晰的显示出黄海地区对来自新西兰的*baueri*亚种及来自澳大利西西北部的*menzbieri*亚种的重要性。所有佩带卫星跟踪器的个体都在黄海地区停歇(图3.8)，但是*menzbieri*亚种的迁徙补给地较为靠西，而*baueri*亚种的迁徙补给地较为靠东。

大滨鹬 *Great Knot - Jan van der Kam*

大滨鹬

北迁季节，在鸭绿江口数量第二多的涉禽为大滨鹬，在1999年的1次计数就超过了55,000只。在我们的调查时期，估计有70,000到80,000只大滨鹬在迁徙时在鸭绿江口保护区停歇(表3.5)。

在4月上旬，鸭绿江口保护区内已经有少量的大滨鹬，且随时间推移数量逐渐增加，到5月上旬大滨鹬数量值达到最大值，之后随着鸟类开始继续向北迁徙而数量减少(图3.9)。

大滨鹬在鸭绿江口区域的分布并不平均，在调查中几乎没有发现它们会在西水道港区休息，它们主要出现在1至5号点，在10和12号点内也有一定数量的分布。大滨鹬是以小型双壳类为主要食物，它们会把贝壳整个吞下并用肌胃将壳压碎。由于这些双壳类在潮间带滩涂上的分布并不均匀(van de Kam *et al.* 2004)，从小尺度上看双壳类的分布会影响大滨鹬对保护区内不同区域的利用，从大尺度上看双壳类的分布还限制了迁徙途中可以利用的潜在迁徙补给地的数量(Piersma *et al.* 1996)。

在横穿韩国万顷湾(Mangyeung)和东津湾(Dongjin)的新万锦海堤竣工前，东亚–澳大利西亚迁徙路线上的大滨鹬估计有380,000只(Delaney & Scott 2006)。于2006年4月竣工的新万锦工程围垦了41,000公顷的潮间带滩涂和浅海区域，而这些区域曾是黄海地区涉禽在北迁时最重要的迁徙补给地。在新万锦涉禽监测项目。

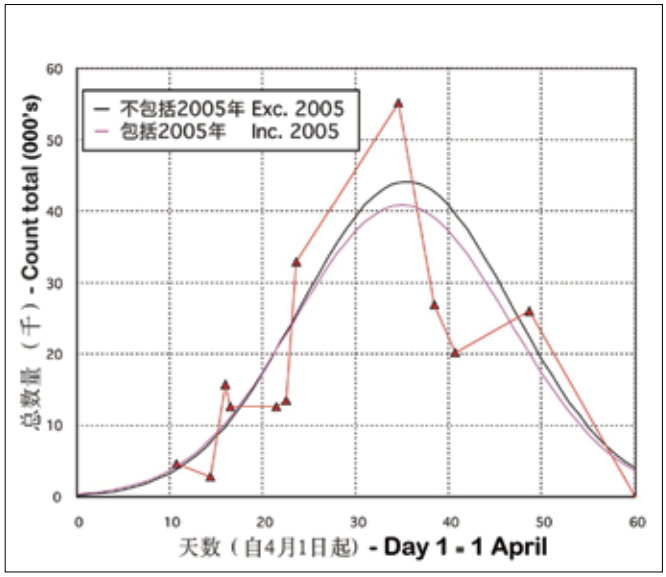


图3.9 北迁时期鸭绿江口保护区内大滨鹬的种群动态模型及数量。

Fig. 3.9 Population model and counts of Great Knot using the Yalu Jiang Estuary on northward migration.

A population estimate of 300,000 Bar-tailed Godwits (Bamford *et al.* 2008) appears to be too high based on more recent counts and the numbers are probably closer to 240,000 (Southey 2009; AWSG unpublished census data). In New Zealand approximately 9% of the population does not migrate each year (Southey 2009). If this figure is also valid in Australia it would suggest that about 218,000 godwits migrate north within the EAAF each year. With up to 93,411 being counted during one survey period, the Yalu Jiang Estuary is supporting at least 41% based on Southey (2009), of the total Bar-tailed Godwit population of the EAAF during its northward migration.

Details from tracking studies show a higher proportion of Alaskan godwits may be using the reserve than Siberian godwits with up to 70% of satellite and datalogger tracked birds from New Zealand using the YJNNR region, compared to 30% of those from Northwest Australia (Battley *et al.* 2012). This makes the reserve critical for the Alaskan subspecies of godwit but it is also very important for the Siberian birds.

Marked bird sightings show that some Bar-tailed Godwits that use the Yalu Jiang Estuary also use other staging sites, with 26 flag records from Chongming Dao, China, one from South Korea and one from Taiwan, China and one from Hokkaido, Japan. In the reserve there are records of banded birds from not only every banding region in New Zealand and Australia, but also Sumatra, Indonesia, Thailand and Kamchatka, Russia.

Large numbers of Bar-tailed Godwit have been recorded at other EAAF staging sites but much of the available data are from the 1990s and several key sites have been destroyed since then. Peak counts of more than 20,000 birds have only been recorded at Laizhou Wan, Shandong, China, with a count of 25,961 on 10/5/2004 (Bamford *et al*. 2008).

Satellite tracking shows clearly the importance of the Yellow Sea for staging *menzbieri* godwits from Northwest Australia and *baueri* godwits from New Zealand. All satellite tagged birds staged within the Yellow Sea (Fig. 3.8), with *menzbieri* generally more to the west and *baueri* to the east.

Great Knot

The second-most numerous species of shorebird at the Yalu Jiang Estuary during the northward migration is the Great Knot, with one count of over 55,000 in 1999. During the survey period it is estimated that between 70,000 and 80,000 birds use YJNNR (Table 3.5).

During the earliest counts at the start of April low numbers of Great Knot are found in the reserve but the numbers build up to a peak in early May before dropping away again as birds leave on migration (Fig. 3.9).

Great Knots are not uniformly spread through the survey area. They were virtually absent from the River during the surveys when the river was visited, but are present in their highest numbers from Sites 1-5, with smaller peaks at Site 10 and 12. They are specialist feeders preferring small bivalves, which are swallowed whole and crushed in the gizzard. These bivalves do not generally occur evenly over tidal flat areas, (van de Kam *et al.* 2004) and it is likely that this will influence their use of different areas in the reserve, and also restricts the number of staging sites that they could potentially use at a flyway level (Piersma *et al.* 1996).

The flyway population of Great Knots was estimated at 380,000 by Delaney & Scott (2006). This was based on data collected before the completion of the Saemangeum seawall across the Dongjin and Mangyeung Estuaries in South Korea. This seawall was completed in April 2006 enclosing 41,000 hectares of intertidal mudflats and shallow sea that had been the most important staging site of shorebirds on northward migration in the Yellow Sea. The Saemangeum Shorebird Monitoring Project (SSMP), with an international team of shorebird biologists and birdwatchers, surveyed the effects of this seawall closure over three years between

图3. 10 在鸭绿江口记录到的不同地区环志的大滨鹬数量。

Fig. 3.10 Number of Great Knot sightings at the Yalu Jiang Estuary from different banding regions.

黑腹滨鹬 *Dunlin - Jan van der Kam*

(Saemangeum Shorebird Monitoring Project SSMP) 的组织下，一个由鸟类学家和观鸟者组成的国际调查队于2006至2008年3年间对围垦工程的影响进行了调查。结合2008年在韩国的鸟类调查及澳大利亚越冬地的调查结果都显示自2006年新万锦海堤竣工后整条迁徙路线上大滨鹬的数量下降了超过90,000只，而这主要是由于围垦后滩涂被破坏造成的(Moores *et al.* 2008)。最新的调查数据显示现在大滨鹬目前的种群数量可能不超过290,000只，而且甚至会更低(IUCN 2009)。

在新万锦工程所处的栖息地还未被破坏以前，在黄海地区只有万顷湾和东津湾形成的河口生态系统所支持的大滨鹬数量比鸭绿江口的高。北迁时期在鸭绿江口保护区栖息的大滨鹬约有70,000至80,000只，接近全球种群总数的25%。现在，鸭绿江口是大滨鹬在全球范围内最重要的迁徙补给地，而且由于这个物种只沿东亚–澳大利西亚迁徙路线分布，所以可以说大滨鹬是鸭绿江保护区内最重要的物种。

大滨鹬的越冬区域几乎遍布整个澳大利亚，但在澳大利亚北部数量最多，所以在鸭绿江保护区回收记录到的带旗标的219只大滨鹬中大部分(157只)都是来自澳大利亚西北部的。另外还有12笔记录来自于澳大利亚其他地区，其余的记录来自于迁徙停歇地和繁殖地，包括1笔来自印度尼西亚苏门答腊，34笔来自崇明岛，2笔来自于俄罗斯堪察加半岛和13笔未知地区(图3.10)。

韩国新万锦涉禽监测项目调查到的大滨鹬旗标来源地的组成比例却是完全不同于鸭绿江口的。在那里，有297笔旗标记录来自于澳大利亚西北部，197笔旗标记录来自于迁徙停歇地崇明岛，两个地区的记录的比率为66%。与之相反，在鸭绿江口来自这两个地区的旗标记录的比率只有22%。这说明北迁时会在靠南的迁徙补给地崇明岛停歇的大滨鹬出现在鸭绿江口的概率较韩国低。关于这一发现是否会有更广泛的意义，这一点是未知的。

黑腹滨鹬

在整个迁徙季节，鸭绿江口黑腹滨鹬的数量都相对较高，最多记录到43,875只(2006年4月下旬)，最少记录也有22,482只(2000年5月下旬)(图3.11)。这种在停歇地数量一直很稳定的迁徙模式较为少见，且很难用迁徙模型模拟并估计出迁徙种群数量。所以最大记录值43,875可能是最合适的估计值。然而，如果不止1个亚种迁徙时经过鸭绿江口，且每一亚种的迁徙时间不同，这就能够解释黑腹滨鹬的数量一直较高的原因。同时，实际利用鸭绿江口的黑腹滨鹬总数量可能高于这一数值。另一个原因可能是因为大多数黑腹滨鹬刚达到鸭绿江口的时候还没有开始换繁殖羽，所以在这里它们不仅要补给下一站迁徙飞行时所需能量，还需要换繁殖羽，所以比起其他涉禽，黑腹滨鹬在鸭绿江口停留的时间要长一些。

在鸭绿江口这个时间或地理位置上，尽管黑腹滨鹬在迁徙季节的数量较多，但它们的迁徙策略还不是很清楚。因为我们并未发现任何被标记的个体在迁徙季节的前中末期都有出现，所以在整个迁徙期所有个体都一直停留在鸭绿江口的可能性并不大(这与Goede等(1990)提出并被 Engelmoer等(2006)证实的在瓦登海 (Wadden Sea) 有两个黑腹滨鹬种群的情况很相似)。

在鸭绿江口保护区内一共只回收到4笔黑腹滨鹬的旗标记录，而这些鸟全部都是在当地环志的。2012年11月，在台湾也曾经发现鸭绿江口环志的黑腹滨鹬。黑腹滨鹬是短距离迁徙的鸟类，在东南亚较为少见且在澳大利亚和新西兰极其罕见，所以没有来自这些地区的旗标记录是合理的，但是在鸭绿江口理应可以记录到在亚洲其他地区被环志的黑腹滨鹬。在新万锦涉禽监测项目调查过程中，记录到了119笔旗标回收记录，其中74笔来自于中国台湾，16笔来自崇明岛，14笔来自韩国，14笔来自阿拉斯加，1笔来自楚科塔(Chukotka)(Moores *et al.* 2008)。这可能表明鸭绿这可能表明鸭绿江口的黑腹滨鹬来自于不同的种群或越冬地，那里几乎或没有开展环志记录工作，并且这些黑腹滨鹬沿着不同路线迁飞。

在保护区内，黑腹滨鹬分布较广，且在西水道港区、2号点和10号点数量较多。黑腹滨鹬数量最多的调查点为15号点，但是该调查点其他涉禽的数量都相对较少。

黑腹滨鹬一共有9个亚种，已知在东亚–澳大利西亚迁徙路线上就有4个亚种，它们的总种群数量估计有650,000只(Cao *et al.* 2009)。但是在鸭绿江口的调查中，我们只对其鉴定到种。

2006 and 2008. A national South Korean survey in 2008 and corroborating counts in Australia have all indicated a combined decrease of over 90,000 Great Knots in the flyway since the seawall at Saemangeum was completed and the mudflats there were destoyed in 2006 (Moores *et al.* 2008). These recent counts suggest the population is likely to be no more than 290,000 birds and may be even lower (IUCN 2010a).

Prior to the habitat destruction at Saemangeum the two estuaries that made up that ecosystem were the only Yellow Sea sites with counts higher than those at the Yalu Jiang Estuary. The number of Great Knots using the reserve during northward migration, estimated at 70,000-80,000, is close to 25% of the entire world population. The Yalu Jiang Estuary is now the most important staging site for Great Knots in the world, and as this species is confined to the EAAF, arguably it is the most important species at YJNNR.

The known non-breeding range of Great Knot is almost entirely within Australia, especially the northern parts, and it is therefore no surprise that the majority of the Great Knot flag and band sightings in the reserve (157 of 219) come from Northwest Australia. A further 12 records come from other Australian banding regions and the remainder from staging and breeding sites. There is one record of a bird banded in Sumatra, 34 from Chongming Dao, 2 records of birds flagged in Kamchatka, Russia and 13 of unknown origin (Fig. 3.10). The proportion of flag sightings during the SSMP project in Korea was quite different. There, 297 Great Knots marked in Northwest Australia were recorded, and 197 from the staging site of Chongming Dao, a ratio of 66%. In contrast the ratio of these two sites at the Yalu Jiang Estuary is 22%. This suggests that fewer of the Great Knots using the Yalu Jiang Estuary are passing through the southern site of Chongming Dao than those that were staging in South Korea. Whether this has any wider significance, or not, is at this point unknown.

Dunlin

Numbers of Dunlin at the Yalu Jiang Estuary are consistently high throughout the migration period and have ranged from 43,875 in late-April 2006 to 22,482 in late-May 2000 (Fig. 3.11). This pattern is unusual and prevents successful modelling of the migration and migrating population size. The high count of 43,875 is therefore the best current population estimate. If more than one subspecies is using the reserve however, and they each migrate at different times, it could explain the consistently high counts and means that the total numbers of Dunlins using the reserve may be substantially higher than this. Alternatively, most are arriving in non-breeding plumage, indicating they are using this area not only to refuel but for moulting into breeding plumage, so they may have a longer period of residence than some of the other species.

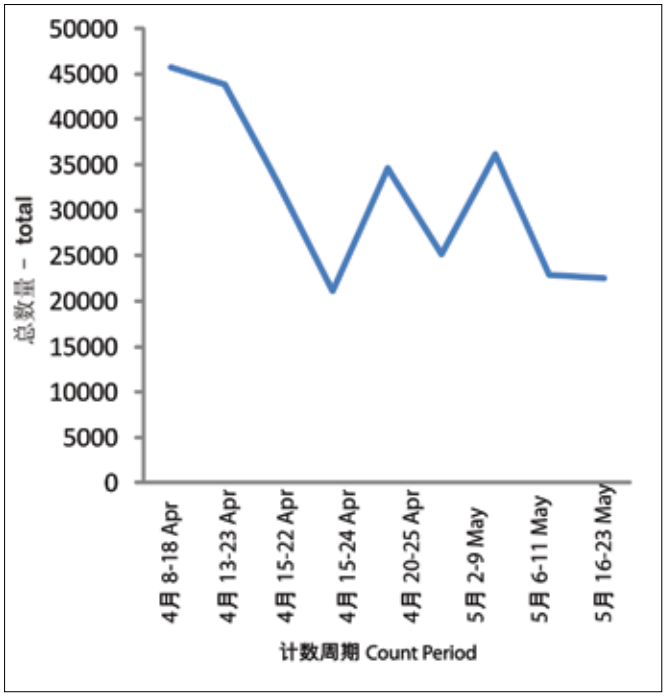


图3. 11 调查期间黑腹滨鹬的数量变化。4月上旬的数量最多，但是到达和离开时的趋势却不明显。X轴坐标的日期是按调查第1天的日期顺序排列，并非日历顺序。

Fig. 3.11 Numbers of Dunlin counted in each survey period. While numbers are highest in early April no clear pattern of arrival or departure is evident. The dates on the x-axis are in the order of the first day of that survey, not a calendar date sequence.

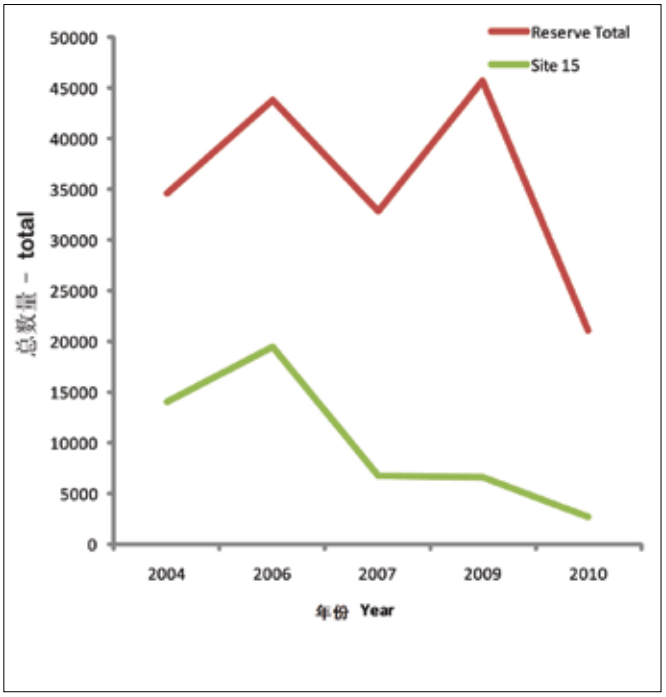


图3. 12 2004年至2010年鸭绿江口保护区4月中旬黑腹滨鹬的数量。15号点数据主要调查于每年4月14日至21日。

Fig. 3.12 Dunlin numbers in mid-April. The count dates at Site 15 are similar, ranging from 14 April to 21 April.

在东亚-澳大利西亚迁徙路线上只有两个地区的黑腹滨鹬数量比鸭绿江口多：2001年4月在中国江苏省盐城国家级珍禽自然保护区记录到57,867只；1999年4月在韩国万顷湾(新万锦的一部分)记录到47,650只(Bamford *et al.* 2008)，但是位于韩国的这个地点已经被围垦了。据最新的数据显示，鸭绿江口是黑腹滨鹬在东亚-澳大利西亚迁徙路线上第二重要的迁徙补给地。

从2006年起，在每年4月中旬(4月14日至21日)的调查记录表明，15号点内黑腹滨鹬的数量在持续下降中(图3.12)。这可能是由于保护区旁的围垦工程和渔港的发展造成的，而这个渔港已经使得本地区近230公顷的潮间带栖息地消失。2010年4月中旬的调查数据是历史的最低点，而那些“消失”的黑腹滨鹬是转移去了其他地方还是已经死亡也不得而知。在未来几年的调查中，黑腹滨鹬需受到更多的重视，并藉此明确其种群的变化趋势。

灰斑鸻

在鸭绿江口，灰斑鸻的数量主要在3001只(2010年4月数据)至7232只(2008年5月下旬数据)间波动。整个迁徙期，灰斑鸻种群估计有8500 - 10,500只。

从迁徙初期开始，灰斑鸻的数量缓慢增加，到5月下旬达到数量的高峰，是典型的“快速启程”迁徙模式(图3.13)。拖沓的到达时间也表明大部分或是全部的个体会在大部队启程前达到鸭绿江口。调查中还发现当这些鸟刚从越冬地飞到鸭绿江口的时候，只带有少量的繁殖羽，之后它们会在这里完成全部换羽。一旦开始启程，整个种群会在很短的时间内离开。

灰斑鸻 *Grey Plover - Jan van der Kam*

在鸭绿江口保护区内和西水道港区，灰斑鸻的分布较为平均，仅在2号点的数量相对较高。但是在14号点和15号点，灰斑鸻并不常见。

灰斑鸻有3个已确认的亚种(Engelmoer & Roselaar 1998)：在阿拉斯加和俄罗斯繁殖、分布较广的*squatarola*亚种，只在兰格耳岛(Wrangel Island)繁殖的*tomkovichi*亚种，及可能在加拿大繁殖的*cynosurae*亚种(Chandler 2009)，其中*squatarola*亚种和*tomkovichi*亚种都在东亚-澳大利西亚迁徙路线上分布。因为它们外表差异不明显，所以在调查中并没有区分这几个亚种。在东亚-澳大利西亚迁徙路线上灰斑鸻的越冬地从中国东南部一直到延伸到澳大利西亚地区。

尽管在鸭绿江口保护区内一共只回收记录到13笔灰斑鸻的旗标，但它们来自五个不同的地区，其中包括越冬地泰国、澳大利亚西北部和维多利亚州，迁徙停歇地及越冬地香港、崇明岛以及鸭绿江口保护区内环志的一只。尽管鸭绿江口保护区只环志了10只灰斑鸻，在菲律宾和香港已经各记录到了一笔回收记录。

在东亚-澳大利西亚迁徙路线上，灰斑鸻的种群数量估计有125,000只(Bamford *et al.* 2008)，而其中7%的个体在迁徙时会在鸭绿江口停歇。在黄海地区，灰斑鸻数量最高的记录为1997年4月21日在中国山东省黄河三角洲国家级自然保护区记录到的14,899只。另外2004年4月12日在渤海湾西北部记录到 6493只，2004年5月10日在山东省莱州湾记录到 5801只，2001年4月28日在江苏省盐城国家级珍禽自然保护区记录到 5295只。

杓鹬

由于红腰杓鹬和白腰杓鹬在体型和羽色上非常相似，加之它们生性警惕，当野外调查环境不理想的时候是很难将这两个物种分辨开。两种杓鹬的混群在整个鸭绿江口保护区和西水道港区都有分布，两个物种在混群中的比例变动很大且无规律可循。尽管在调查时我们已经尽力将两个物种区分开，但是每次的调查结果中还是有大量的未识别杓鹬出现，所以这两个物种在保护区的实际数量都是高于报告中所显示的

It is unclear what the migration strategy of Dunlin is at this point in time or geographic location, although they are present in large numbers throughout the migration period. It seems unlikely that all birds would stay for the entire period, which would indicate different individuals are present at the start and end of the period. (This is similar to the pattern found by Goede *et al.* (1990) when they suggested two populations of Dunlin were using the Wadden Sea (since confirmed (Engelmoer *et al.* 2006)).

There have been only four sightings of flagged Dunlins at the Yalu Jiang Estuary, and all of them were marked on the reserve. (Update: One Dunlin banded in the reserve was seen in Taiwan, China in November 2012). Dunlins are relatively short distance migrants and rare in Southeast Asia and extremely rare in Australia and New Zealand, so no band sightings from these areas are possible. Some are marked at other Asian sites so it is possible that flagged Dunlin from Asian banding regions could be seen at YJNNR. By comparison, during the SSMP, 119 flagged Dunlin were recorded, 74 from Taiwan, China, 16 from Chongming Dao, 14 from South Korea, 14 from Alaska and 1 from Chukotka, Russia (Moores *et al.* 2008). This could indicate that the Dunlin coming to the Yalu Jiang Estuary are from different populations or non-breeding regions, where little or no banding is taking place and migrating along different routes.

Dunlins are found throughout the reserve and at the River with peaks at Site 2 and Site 10, but they are at their highest numbers at Site 15, a site where few other species are abundant.

At least nine subspecies of Dunlin are recognised with four currently known to use the EAAF, their total population estimate is 650,000 birds (Cao *et al.* 2009). During the surveys at YJNNR, identification has been to species level only.

Only two counts of Dunlin higher than those from the YJNNR have been recorded on the EAAF; Yancheng NNR, Jiangsu, China recorded 57,867 in April 2001 and the Mangyeung Estuary, South Korea (part of Saemangeum) recorded 47,650 in April 1999 (Bamford *et al.* 2008), but the Korean site has been destroyed by reclamation. Based on current data the Yalu Jiang Estuary is the second-most important staging site for Dunlin on the EAAF.

Dunlin numbers at Site 15 are dropping, with counts on similar days in mid-April showing a steady decline since 2006 (Fig. 3.12). This is possibly due to reclamation (outside the reserve) and development of the port facility which has resulted in the loss of some 230 ha of intertidal habitat in this area. Whether the individuals displaced from this site have moved to other sites, or whether they have been lost is unknown; the Dunlin count in 2010 was the lowest mid-April count to date. Counts of this species deserve close attention in the next few years to determine if any pattern is present.

Grey Plover

Total numbers of Grey Plovers counted at the Yalu Jiang Estuary ranged from 3,001 in April 2010 to 7,232 in late May 2008. The estimates of the total numbers migrating through the site range from 8,500 to 10,500 birds.

Numbers of Grey Plovers build up slowly to a peak in late-May and a "fast departure model" is appropriate for this species (Fig. 3.13). The prolonged arrival period suggests most if not all of migrants have arrived before departures start. Observations show that they arrive at the Yalu Jiang Estuary from their wintering grounds with little breeding plumage but attain full breeding plumage whilst there. Once started, departure of the complete population is probably rapid.

Grey Plover occur fairly evenly throughout the reserve and the River with peak numbers counted at Site 2. They are not common in the bay between Sites 14 and 15.

Three subspecies of Grey Plover are recognised (Engelmoer & Roselaar 1998): a widespread one breeding in Russia and Alaska (*squatarola*) and another restricted to Wrangel Island (*tomkovichi*), both of which are likely to occur on the EAAF, whereas a third (*cynosurae*), that breeds in Canada, may not (Chandler 2009). All are very similar in appearance and no attempt has been made to distinguish them at the Yalu Jiang Estuary. On the EAAF they winter from southeastern China to Australasia.

Although only 13 marked Grey Plovers have been seen in the YJNNR, they come from five different banding regions, including sightings of birds marked at non-breeding sites

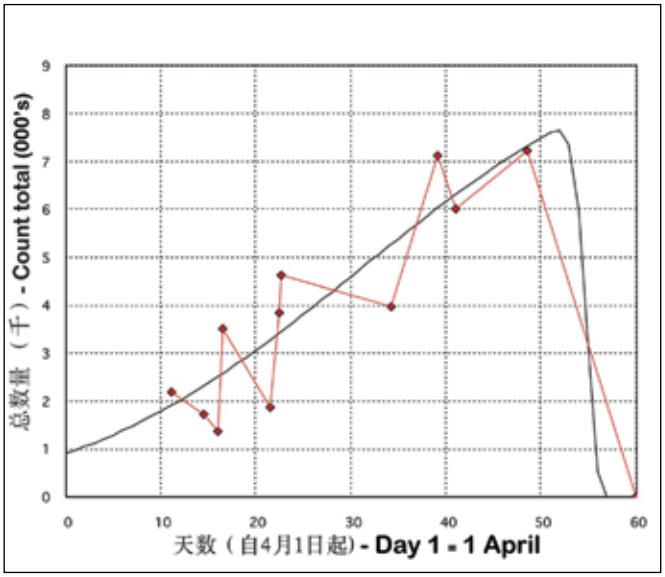


图3. 13北迁时期鸭绿江口灰斑鸻的迁徙模型及数量变化 。

Fig. 3.13 Population model and counts of Grey Plover using the Yalu Jiang Estuary on northern migration.

数量。整个调查阶段共记录到 38,821只白腰杓鹬和 23,389只红腰杓鹬及 20,226只未识别杓鹬。因为这三组杓鹬的共同点多于它们之间的差异，我们将它们合并起来进行种群分析。

在鸭绿江口白腰杓鹬的最小和最大计数分别为1999年5月记录到的234只及2004年4月的13,136只；红腰杓鹬的最小和最大计数分别为2000年5月下旬记录到的731只及2009年4月上旬的 6818只，未识别的杓鹬的数量范围为20只至5930只。所以，在北迁时期，一共有 22,000只杓鹬在鸭绿江口停歇(表3.5)。

杓鹬的种群动态模型是“快速到达模型”，在我们进行调查前，大部分的个体已经达到了鸭绿江口。其中一些杓鹬是在鸭绿江口越冬的，但是越冬种群的数量还不清楚，很可能都是白腰杓鹬(调查中发现在鸭绿江口红腰杓鹬启程的日期要普遍晚于白腰杓鹬，但是还需要更多的数据支持论证)。

10号和12号点的杓鹬数量最多，紧接着是2号点。在高潮期，杓鹬是最后离开滩涂的涉禽，它们飞入内陆后常常在人工养殖塘的塘埂上休息。

白腰杓鹬

白腰杓鹬已被确认的亚种有三个，在东亚-澳大利西亚迁徙路线上只有*orientalis*亚种。该亚种在蒙古北部及东西伯利亚南部繁殖，在亚洲越冬。整个越冬种群都分布在赤道以北而其中至

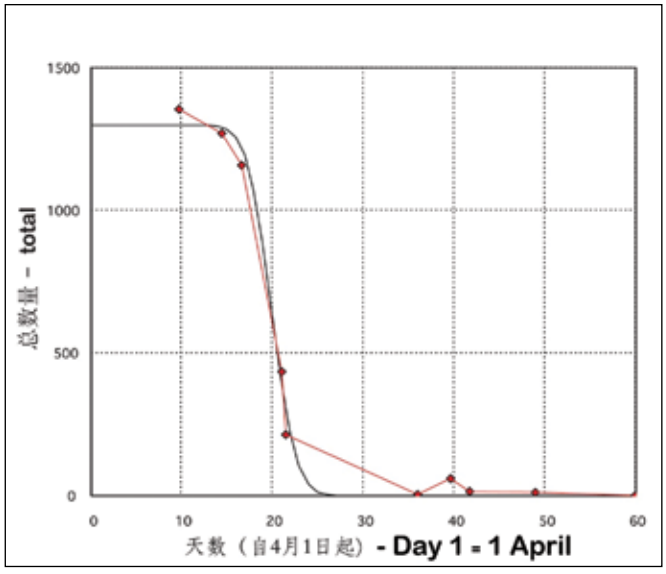


图3.14 14 迁徙期鸭绿江口保护区及西水道港区内杓鹬的数量变化及种群模型。
Fig. 3.14 Population model and counts of all curlews using YJNNR and the river on northward migration.

红腰杓鹬 *Eastern Curlew - Phil Battley*

少有50%的个体在中国及韩国境内越冬(Bamford *et al.* 2008)。由于还没有回收过白腰杓鹬的旗标记录，所以在鸭绿江口的白腰杓鹬来自于哪个或哪几个越冬种群还不是很清楚。

以往的研究估计在东亚-澳大利西亚迁徙路线上的白腰杓鹬只有40,000只(Bamford *et al.* 2008)，但是近期的研究发现了更多的白腰杓鹬，据估计本迁徙路线上共有100,000只(Cao *et al.* 2009)。

Bamford *et al.* (2008) 将2004年在鸭绿江口记录到的13,136只白腰杓鹬误报道为在盐城保护区记录到的。另外只有1999年4月在黄河三角洲保护区的最大计数 9766只最接近鸭绿江口的这个数字。因此，在北迁时期，鸭绿江口是白腰杓鹬在亚洲最为重要的迁徙补给地(Bamford *et al.* 2008)。

红腰杓鹬

红腰杓鹬只在东亚-澳大利西亚迁徙路线上分布，它们在俄罗斯东部及中国北部繁殖，主要在澳大利亚越冬。在鸭绿江口保护区内共回收记录到8笔红腰杓鹬旗标。这些旗标都来自澳大利亚一些重要的越冬地(Bamford *et al.* 2008)，其中有4笔来自维多利亚州，另外两部来自澳大利亚西北部。

从上世纪80年代和90年代的数据来看，红腰杓鹬的种群数量估计为38,000只(Bamford *et al.* 2008)。但是近年来的调查发现在许多越冬地红腰杓鹬的数量都有明显的下降，估计现在的种群数量只有20,000只(Shorebirds 2020)。Bamford *et al.* (2008)指出：在迁徙路线上，没有一个迁徙补

白腰杓鷸 *Eurasian Curlew - Jan van der Kam*

in Thailand, Northwest Australia and Victoria, the staging and non-breeding sites of Hong Kong and Chongming Dao, along with one sighting of a bird previously flagged within the reserve. Of the ten Grey Plover flagged at the Yalu Jiang Estuary one has been recorded in the Philippines and another in Hong Kong.

The population on the EAAF is estimated to be 125,000 birds (Bamford *et al*. 2008). The estimates for the survey area derived from the model suggest that about 7% of the total flyway population uses the survey area. The highest count in the Yellow Sea of this species is at Shandong Yellow River Delta, Huang He NNR, China, with 14,899 on 21/4/1997. Other counts include Northwest Bohai Wan, 6,493 on 12/4/2004, Laizhouwan, Shandong, 5,801 on 10/5/2004 and Jiangsu Yancheng NNR 5,295 on 28/4/2001.

Curlew

Counts of curlews are problematic as the Eurasian Curlew is similar in size and plumage to the Eastern Curlew, both species are very wary and counting conditions do not always allow the two species to be separated in the field. The two species mix freely at all times throughout the Reserve and River but flocks vary widely in the percentages of each. As far as possible each species has been identified and counted separately but each survey has substantial counts of "unidentified curlews" so both species will use the reserve in higher numbers than those recorded. Over the study period a total of 38,821 Eurasian and 23,389 Eastern Curlews were counted, along with 20,226 curlews unidentified to species. As the similarities for the three groups of curlew were greater than were the differences, they have been lumped for population analysis.

Counts of Eurasian Curlew at the Yalu Jiang Estuary have ranged from 234 in May 1999 to 13,136 in April 2004. Numbers of Eastern Curlews counted at the Yalu Jiang Estuary have ranged from 731 in late-May 2000 to 6,818 in early-April 2009. Numbers of unidentified curlew have ranged from 20 to 5,930. In total it is estimated that 22,000 curlews use the reserve as a northward staging site (Table 3.5).

The curve shows a "fast arrival model" with most or all birds present in the area prior to counting. Some curlews are known to overwinter at the Yalu Jiang Estuary although numbers are currently unknown. It is likely that these would be Eurasian Curlew. Counts suggest that Eastern Curlews may on average leave the reserve later than Eurasian Curlews although further data in May are needed to support this.

Most curlews are found at Sites 10 and 12, with Site 2 holding a slightly smaller number. Curlews tend to be the last to leave the mudflats at high tide and will often roost alone on the banks of aquaculture ponds.

Eurasian Curlew

Three subspecies of Eurasian Curlew are recognised, but only one, *orientalis*, is present in the EAAF. They breed in northern Mongolia and southern parts of eastern Siberia and winter in Asia with at least 50% staying in China and Korea during the non-breeding season. Virtually the entire population winters north of the Equator (Bamford *et al*. 2008). As no flags have been seen on Eurasian Curlew there is no indication whether these birds are from one non-breeding area or several.

The estimated population of Eurasian Curlews using the EAAF was 40,000 (Bamford *et al*. 2008). However, recent work by Cao *et al.* (2009) has found that significantly more Eurasian Curlews occur in the EAAF and they estimate the population to be 100,000.

Bamford *et al*. (2008), incorrectly report the Yalu Jiang Estuary count of 13,136 Eurasian Curlews in 2004 as being at the Jiangsu Yancheng NNR. Only Shandong Yellow River Delta, Huang He NNR, with a maximum count of 9,766 in April 1999 (Bamford *et al*. 2008), comes close to this number. The Yalu Jiang Estuary is therefore the most important known staging site in Asia for Eurasian Curlews during northward migration.

Eastern Curlew

Eastern Curlews are only found in the EAAF where they breed in eastern Russia and northern China with almost all of the population wintering in Australia. There have been eight records of flag sightings of Eastern Curlew at the YJNNR. Given that all of the important non-breeding sites known are in Australia (Bamford *et al.* 2008) it is not surprising that four of them come from Victoria and two from Northwest Australia.

蛎鹬 *Far Eastern Oystercatcher - Phil Battley*

小青脚鹬 *Spotted Greenshank - Bai Qingquan* 白清泉

给地记录到过大量的红腰杓鹬，所以鸭绿江保护区可能是该物种在北迁途中最重要的迁徙补给地。2009年调查记录到的 6818只就占了红腰杓鹬种群数量最新估计值的34%。紧接着在东亚地区红腰杓鹬数量较多的地点为韩国的江华岛（Kanghwa Island），1998年5月1日在该地记录到2120只红腰杓鹬。

斫鹬

本报告计划内调查期间在鸭绿江口记录到斫鹬的最大计数是2006年4月中旬的296只。然而，2011年3月26日在6号点 David Melville 记录到1068只斫鹬，此后一直到4月其数量都在下降。另外还有一笔未被证实的记录记载鸭绿江口保护区内发现近 5000只斫鹬，但无法获得其他更详细的信息。由此可见在我们每年的调查开始时，斫鹬的迁徙高峰可能已经结束。在鸭绿江口的斫鹬迁徙种群数量仍难以估计，所以我们选择最大计数数据作为迁徙种群数量的估计值。

另外，有几对斫鹬在鸭绿江口繁殖。它们通常会在4月中旬筑巢。如图3.15所示，在4月斫鹬的数量最多，但它们的启程时间较长，一直持续到5月。5月2-9日的数据是异常值，可能是由于有一群斫鹬没有被调查到。

在鸭绿江口保护区内6和7号点的斫鹬数量最多，但是原因并不清楚，可能和它们的食物分布相关。

在东亚-澳大利西亚迁徙路线的亚洲区域只有斫鹬的*osculans*亚种分布。整个迁徙路线上斫鹬的种群数量估计有10,000只（Bamford *et al.* 2008），鸭绿江口的斫鹬数量占总数量的3%，但是自2006年起，这一数字下降到月1.5%。斫鹬在环黄海地区的中国、韩国及日本等地越冬，并在三个不同的区域繁殖：环黄海地区、海参威北起的俄罗斯海岸及堪察加半岛（Bamford *et al.* 2008）。第4个繁殖种群可能在中国东北的内陆地区（Melville *et al.* 2013, in press）。

斫鹬的最大越冬种群是2001年1月在韩国锦江口记录到的 5700只，同时，锦江口可能也是斫鹬在这条迁徙路线上最主要的迁徙补给地。在中国辽宁双台河口国家级自然保护区也有多达500只斫鹬的记录，盐城保护区和黄河三角洲保护区调查到的斫鹬数量和鸭绿江口差不多（Bamford *et al.* 2008）。

小青脚鹬

小青脚鹬是全球濒危物种且极为罕见，但是在鸭绿江口保护区内经常会出现一小群小青脚鹬。虽然不是每次调查都能记录到，但是由于该物种数量较少且较为难识别，所以被遗漏或是识别错误的可能性很高（图3.16）。

以现有的数据还无法分析出小青脚鹬的迁徙格局，但可以说明在整个调查阶段鸭绿江口都有小青脚鹬的出现。

小青脚鹬只沿东亚-澳大利西亚分布，其种群数量为1000只或更少（Bamford *et al.* 2008），因此，任何有超过10只该物种的栖息地都达到国际重要湿地的标准。现有数据显示，每年在北迁时期鸭绿江口承载了占全球2-3%种群数量的小青脚鹬。

小青脚鹬在库页岛及俄罗斯东部临近的海岸繁殖，但是在这些繁殖地由于石油探测和林业

The Eastern Curlew population estimate of 38,000 is based almost entirely on data from the 1980s and 1990s (Bamford *et al.* 2008). The species has clearly declined since then at many non-breeding sites and so the population is now lower and is currently estimated to be 20,000 birds (Shorebirds 2020). Bamford *et al.* (2008) show no staging site with a higher number of Eastern Curlew present in the flyway so the Yalu Jiang Estuary is easily the most important site for this species during northward migration. The 6,818 Eastern Curlews counted in 2009 amounts to 34% of the newly estimated population. The next-ranked East Asian site was Kanghwa Island, South Korea, with 2,120 on 1 May 1998.

Far Eastern Oystercatcher

The maximum count of Far Eastern Oystercatchers recorded on the survey at the Yalu Jiang Estuary was 296 in mid-April, 2006. (Update: However, in 2011, 1,068 were recorded at Site 6 on 26 March, with numbers then declining into April David Melville pers. comm.) There is an unconfirmed record of up to 5,000 oystercatchers in the reserve; at this time no further details are known. It appears the main migration of this species may therefore be happening before the survey periods begin. No migrating population estimate for the Yalu Jiang Estuary is available. The data are too ambiguous and therefore the high count is treated as the best available population estimate.

A few pairs of oystercatchers breed in the Yalu Jiang Estuary and these are usually nesting by mid-April. Higher numbers are present in April; it appears that they depart slowly through May. The low count on 2-9 May is an outlier; it seems likely that part of the flock was unseen (Fig. 3.15).

Oystercatchers appear to favour the Site 6 and 7 part of the reserve but why is unknown, although it is likely to be food related.

The Far Eastern Oystercatcher subspecies *osculans* is the only oystercatcher occurring in the Asian part of the EAAF. The flyway population is estimated at 10,000 (Bamford *et al.* 2008) and the Yalu Jiang Estuary population was about 3% of this total but appears to be about 1.5% since 2006. They winter around the Yellow Sea in China, Korea and Japan and breed in three distinct regions: around the Yellow Sea, the Russian coast from Vladivostok north, and on the Kamchatka Peninsula (Bamford *et al.* 2008). A fourth population may breed in inland, northeast China (Melville *et al.* 2013 in press).

The largest winter counts of oystercatchers have been at the Geum Estuary, South Korea, where 5,700 were recorded in January 2001; this also appears to be their main staging area on the flyway. Up to 500 have been recorded at the Shuangtai Estuarine Wetland NNR, Liaoning, and similar numbers to those present at the Yalu Jiang Estuary have been recorded at the Jiangsu Yancheng NNR and Shandong Yellow River Delta NNR (Bamford *et al.* 2008).

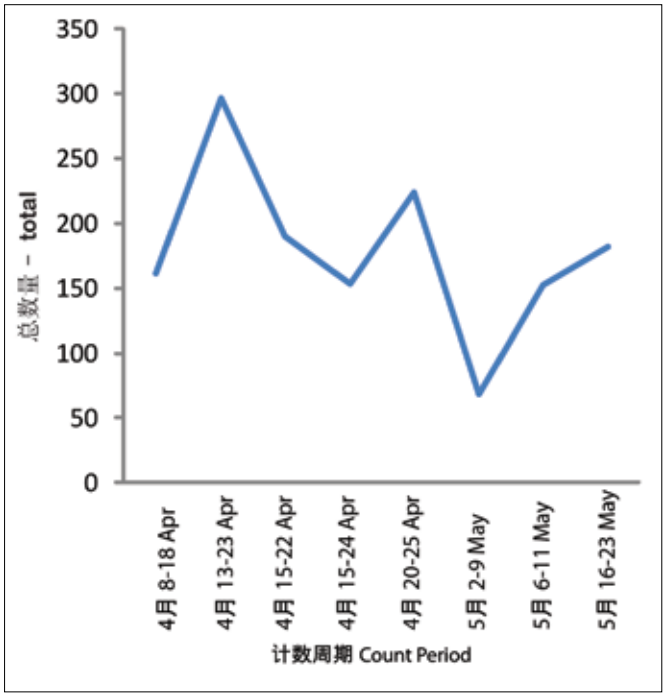


图3. 15 迁徙期每一阶段砺鹬的数量。
Fig. 3.15 Counts of Far Eastern Oystercatcher in each survey period.

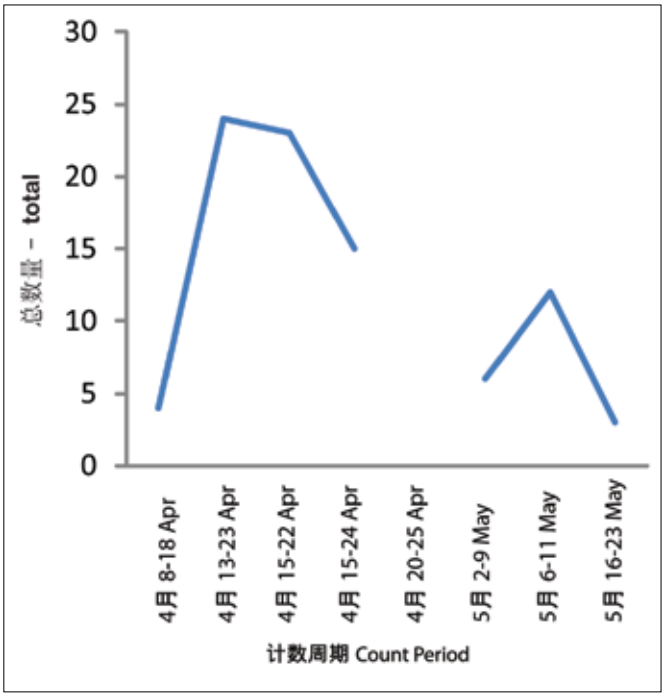


图3. 16 迁徙期不同阶段小青脚鹬的数量。由于该物种的每个记录都很重要，所以本图所示数据包括2005年5月6日–11日在保护区内的计划外调查数据。
Fig. 3.16 Numbers of Spotted Greenshank counted in each survey period. The data from the 2005 partial reserve count (6-11 May) are included as every record of this species is important.

环颈鸻 *Kentish Plover - Jan van der Kam*

蒙古沙鸻 *Lesser Sandplover - Jan van der Kam*

开发，大面积的栖息地已经开始消失(Blokhin 1998)。它们在东南亚及南亚越冬，同样的，这些越冬地也受到了巨大的环境压力。北迁时期，在韩国有6个河口被列入小青脚鹬最重要的栖息地(Bamford *et al.* 2008)，但是这些地方也已经受到工业发展带来的极大影响。每年都有20-30只小青脚鹬栖息的鸭绿江口也成为该物种北迁时最关键的迁徙补给地之一。

3.2.2 第二类

第二类物种是指种群数量至少有一次达到或超过了迁徙路线种群1%标准的物种(表3.4)。在鸭绿江口栖息的涉禽归入这一类的原因有如下几点：

- 较为常见但是数量不多，偶尔达到全数种群的1%，如环颈鸻。
- 不常见，可能因为这些物种的迁徙高峰期并不在调查时期内，例如蒙古沙鸻和阔嘴鹬。在迁徙期的后期它们可能会常常出现并且数量会达到国际重要意义标准。
- 在一些物种偏好的栖息地内进行的调查较少，例如青脚鹬和鹤鹬，它们都喜欢淡水和咸淡水混合区域。
- 迷鸟，可能是由于迁徙时遇到突发事件而进行临时停歇，例如红腹滨鹬和翻石鹬。

环颈鸻

在调查区域环颈鸻的最小和最大计数分别为1999年5月记录到的12只及2004年4月的1485只。该物种在鸭绿江口停歇种群数量估计为1300只(表3.5)。

环颈鸻到达鸭绿江口的时间较早，且大部分个体都在4月底启程飞往繁殖地(图3.17)。还有一些个体到了5月仍会留在鸭绿江口，并在此地繁殖。当地有环颈鸻在4月中旬筑巢的记录。10、11和12号点内环颈鸻的数量相对较多，但是保护区东西两边数量非常少。

环颈鸻在北美、欧洲和亚洲温带繁殖，在南美、非洲和南亚越冬。全球确认的亚种有6个，其中有3个亚种(*alexandrinus, dealbatus*和*nihonensis*)在东亚-澳大利西亚迁徙路线上有分布。在鸭绿江口的调查中并没有区分这几个亚种。

在东亚-澳大利西亚迁徙路线上，估计有100,000只环颈鸻越冬及迁徙经过(Bamford *et al.* 2008)。Barter (2002)认为在北迁时期，迁徙路线上近90%的环颈鸻都会途经黄海地区。在鸭绿江口停歇的环颈鸻数量时常会接近迁徙路线总数量的1%，并有三次调查时的数量超过了1%标准。

蒙古沙鸻

在鸭绿江口记录到的蒙古沙鸻的数量范围为从4月少于10只到5月底647只(图3.18)。

与环颈鸻相比，蒙古沙鸻迁徙经过鸭绿江口的时间非常晚，其迁徙高峰期要到5月下旬。而今后这个时间段的调查工作将有助于我们了解鸭绿江口保护区蒙古沙鸻的确切数量，以及它们的数量达到国际重要意义标准的频率。

当环颈鸻都离开鸭绿江口保护区时蒙古沙鸻才刚到达。蒙古沙鸻主要分布在保护区的东部，其中西水道港区、2和3号点的数量较多。另外第11和12号点也有一小部分蒙古沙鸻分布，而8、9及13至15号点很少有蒙古沙鸻的记录。

蒙古沙鸻全球已被确认的有5个亚种，其中有

Spotted (Nordmann's) Greenshank

Sightings of small numbers of this critically endangered species occur regularly in the reserve (Fig. 3.16). Whilst not recorded on every survey at the Yalu Jiang Estuary they may well be overlooked due to both small numbers and identification difficulties.

No migration patterns can be drawn from the data available, except to note they are apparently present in the reserve for the entire survey period.

Spotted Greenshank is confined to the EAAF and has a population of 1,000 or less (Bamford *et al.* 2008), therefore, sites that hold just 10 are considered important. The Yalu Jiang Estuary appears to support 2-3% of the population annually during northward migration.

Spotted Greenshanks breed on Sakhalin Island and adjoining coastal areas of eastern Russia where considerable habitat loss is occurring due to oil exploration and forestry (Blokhin 1998). They winter in southeast and southern Asia, where there are also huge environmental pressures. During northward migration six South Korean estuaries were identified as being particularly important for Spotted Greenshanks (Bamford *et al.* 2008) all of which have been affected to various degrees by industrial developments. The 20 to 30 at the Yalu Jiang Estuary each year therefore makes it one of the key known sites during northward migration.

3.2.2 Group Two

Group Two species have all occurred at least once in internationally important numbers (Table 3.4). Species can be in this group for several reasons. They may be:

- well known and only present in low numbers, occasionally breaking the 1% threshold, for example Kentish Plover.
- not well known, as survey periods may not have covered the period of their peak migration, for example Lesser Sandplover and Broad-billed Sandpiper. When the later part of the migration period is better known these species may prove to be regularly present in internationally significant numbers.
- using habitats that have not been well surveyed for example Greenshank and Spotted Redshank which favour fresh and brackish water areas.
- vagrants to the reserve, having stopped due to unusual circumstances on migration it seems likely that Red Knot and Ruddy Turnstone fit into this category.

Kentish Plover

Counts of Kentish Plovers in the survey area range from just 12 birds in May 1999 to 1,485 in April 2004. The population estimate for this species at the YJNNR is 1,300 (Table 3.5).

They arrive in the reserve early, and most have left for the breeding grounds by the end of April (Fig. 3.17). Some of those that remain into May use the reserve as a breeding area, with nests noted from mid-April. This species is most common at Sites 10, 11 and 12, and is rare at either end of the reserve.

Kentish Plover breed in temperate parts of North America, Europe and Asia and winter in South America, Africa and southern Asia. Six subspecies are recognised worldwide with three migrant subspecies, *alexandrinus, dealbatus* and *nihonensis* occurring in the EAAF. No attempts have been made to identify the subspecies using the reserve during the surveys.

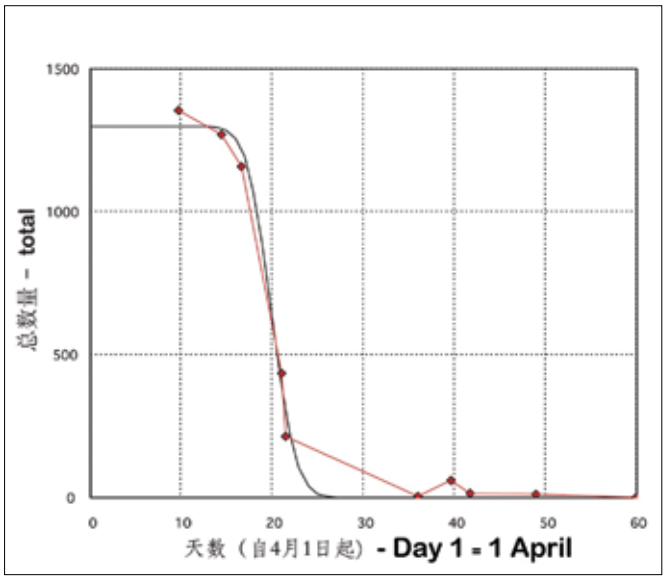


图3. 17 迁徙期鸭绿江口环颈鸻的数量变化及种群模型。

Fig. 3.17 Population model and counts of Kentish Plover using the Yalu Jiang Estuary on northern migration.

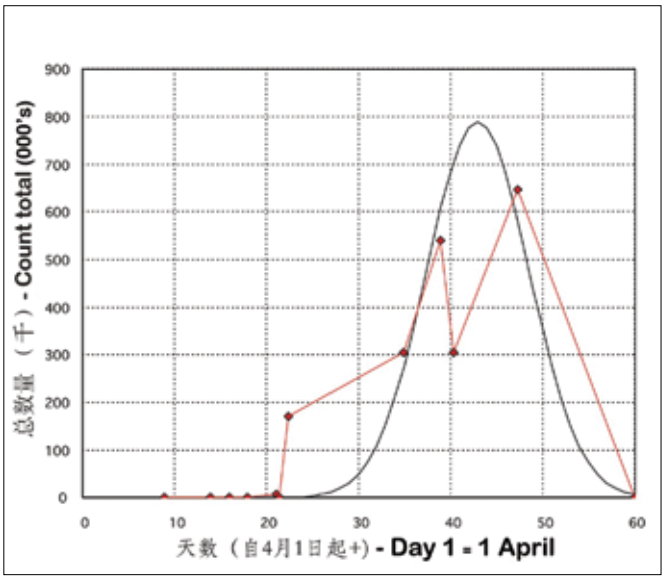


图3. 18 迁徙期鸭绿江口蒙古沙鸻的数量变化及种群模型。

Fig. 3.18 Population model and counts of Lesser Sand Plover using the Yalu Jiang Estuary on northern migration.

青脚鹬 *Greenshank - Jan van der Kam*

4个亚种在东亚–澳大利西亚迁徙路线上有分布，本路线上最新的种群数量估计为130, 000只(Bamford *et al.* 2008)。然而只有*mongolus*亚种和*stegmanni* 亚种会出现在黄海地区，这两个亚种的总种群数量为60, 000只(Bamford *et al.* 2008)。在鸭绿江口有两次调查记录到的蒙古沙鸻数量刚达到其总数量的1%即600只。在黄海地区共有9个地点的蒙古沙鸻数量达到了国际重要意义标准。

青脚鹬

在鸭绿江口保护区青脚鹬的最大计数是2008年5月上旬记录到的712只，最小计数是4月上旬的18只。由于迁徙期后期大量青脚鹬到达时，我们当年的调查已结束，而且多数青脚鹬都在人工养殖塘内栖息而非我们调查的滩涂区域，因此我们无法估计这个物种的种群大小，且其最大的记录值也不足以代表在保护区内栖息的青脚鹬总种群数量。

在迁徙前期，鸭绿江口保护区内几乎没有青脚鹬，随后数量逐渐增加，到5月达到最大值(图3. 19)。因此今后需要在5月进行进一步的调查以了解这个物种在保护区的栖息情况。

除了6号点的数量较多以外，青脚鹬在保护区内的分布较为平均，但是由于这个物种并不主要依赖于潮间带滩涂，还会在人工养殖塘和水渠边栖息，所以对这个物种的调查可能不够全面。2000年 Barter 和 Riegen (2004)估计在5月底几乎平均每一个养殖塘内都有1只青脚鹬分布。鸭绿江口大概有近千个养殖塘，所以这个物种的种群数量可能远高于之前的调查值。

图3. 19 迁徙期鸭绿江口青脚鹬的数量变化。
Fig. 3.19 Greenshank numbers throughout the reserve.

欧亚大陆的青脚鹬并没有分出亚种，在东亚–澳大利西亚迁徙路线上的种群数量约有60, 000 只(Bamford *et al.* 2008)，而在鸭绿江保护区内，青脚鹬的数量已经超过了国际重要意义标准的600只 (Bamford *et al.* 2008)。

红腹滨鹬

在鸭绿江口红腹滨鹬的最大计数为1999年5月上旬的 1499只。但是这个数据很异常，因为第二多的记录是2008年5月上旬的112只，而有两年的调查只发现1只红腹滨鹬，在2009年甚至连一只都没有记录到。

红腹滨鹬在渤海湾停歇的时间为4月至5月(Rogers *et al.* 2010)，所以我们的调查时间应该已经涵盖了红腹滨鹬经过鸭绿江口的高峰期，所以那群1499只的记录在鸭绿江口并不具有代表性。

在东亚–澳大利西亚迁徙路线上，红腹滨鹬已被确认的亚种有两个：*rogersi* 和*piersmai*. Bamford *et al.* (2008)估计红腹滨鹬种群数量220, 000只，但近期发表的研究证实这个值远高于实际值，现在在这条迁徙路线上可能只有不到120, 000只(Rogers *et al.* 2010)。

与大滨鹬一样，红腹滨鹬是以小型双壳类为主要食物，他们会将贝壳整个吞下并用胃肌将其压碎。但是在鸭绿江口大滨鹬较为常见而红腹滨鹬非常罕见的原因并不清楚，但估计是和食

It is estimated that 100,000 birds spend their non-breeding season on the EAAF (Bamford *et al.* 2008). Barter (2002), suggests that during northward migration 90% of the flyway population pass through the Yellow Sea. The numbers in the YJNNR are regularly close to 1% of this number, exceeding it in three surveys.

Lesser Sandplover

Numbers of Lesser Sandplovers counted in the YJNNR range from less than 10 in April to 647 in late-May (Fig. 3.18).

In contrast to the Kentish Plover the Lesser Sandplovers pass through the reserve quite late with peak numbers counted in late-May. More work at this time would allow a much better idea of how many birds are using the reserve, and how often they are present in internationally important numbers.

Lesser Sandplovers come into the reserve as the Kentish Plovers are leaving. However, this species is concentrated at the eastern end of the reserve, with high counts at the River, Site 2 and Site 3. Another small peak occurs at Sites 11 and 12, with almost none at Sites 8 and 9 and 13 to 15.

There are five recognised subspecies, four of which occur on the EAAF. The latest flyway population estimate for the species is 130,000 (Bamford *et al.* 2008). However, only two subspecies, *mongolus* and, *stegmanni* are likely to occur in the Yellow Sea and the estimated population for these two subspecies is 60,000 (Bamford *et al.* 2008). This gives a 1% threshold of 600, which has been met on two occasions at the Yalu Jiang Estuary. Nine Yellow Sea sites have in the past recorded internationally important numbers (Barter 2002).

Common Greenshank

The maximum number of Common Greenshank recorded in the reserve is 712 in early May 2008; the minimum was only 18 in early April. No population estimate is available for this species and the maximum count may not be an adequate estimate of the numbers of Common Greenshanks using the reserve for two reasons: the later part of the migration period when most Common Greenshanks occur has not been well surveyed, so higher numbers could be present, and large numbers of birds are found using the aquaculture ponds but are not present on the count sites.

Early in the migration season Common Greenshanks are nearly absent from the reserve but numbers pick up and peak in May (Fig. 3.19). Further surveys in May would allow a better understanding of how this species migrates through the reserve.

Except for a single large count at Site 6, Common Greenshanks are relatively evenly distributed throughout the reserve, however, as this species is not dependant on mudflats, occurring in the aquaculture ponds as well as along channels and on mudflats, birds could therefore easily be overlooked. In 2000 Barter and Riegen (2004) estimated that in late May there was on average almost one bird per pond in the ponds observed. With approximately 1,000 ponds the number using the reserve could be considerably higher than counts indicate.

Found from Western Europe to eastern Russia the Common Greenshank has no recognised subspecies. The flyway population estimate stands at 60,000 (Bamford *et al.* 2008); a single count at YJNNR has met the internationally significant criteria of more than 600 birds.

Red Knot

The highest count of Red Knot recorded at the Yalu Jiang Estuary was 1,499 in early-May 1999. However, this was an exceptional count. The next highest total is 112 in early May 2008, two counts had only a single bird present while the species was absent entirely in 2009.

Given that the migration period for this species through Bohai Bay is in April and May (Rogers *et al.* 2010), and therefore falls within the period that has been best surveyed, the flock of 1,499 is not typical for this species at this site.

Two subspecies of Red Knot are recognised as migrating through the EAAF, *rogersi* and *piersmai*. Recent reviews of the population estimates suggest that the 220,000 birds estimated by Bamford *et al.* (2008) is much too high and currently there appear to be no more than about 120,000 birds (Rogers *et al.* 2010).

Like Great Knots, Red Knots are specialist feeders preferring small bivalve molluscs, which are swallowed whole and

红腹滨鹬 *Red Knot - Phil Battley*

阔嘴鹬 *Broad-billed Sandpiper - Jimmy Choi* 蔡志扬

物及滩涂底质结构有关。

一直以来北迁时期红腹滨鹬的重要迁徙补给地在哪里都不为人所知，直到最近在渤海湾北部才发现了红腹滨鹬一个主要的迁徙补给地，并记录到约 40,000只红腹滨鹬(Rogers et al. 2010)。尽管在上海崇明岛也有红腹滨鹬的迁徙停歇地，但是那里并不是该物种主要的能量补给地(Barter *et al.* 1997)。

阔嘴鹬

在鸭绿江口阔嘴鹬的最小和最大调查数量分别为4月的0只及1999年5月上旬的729只。这个物种在东南亚及澳大利亚越冬，到达鸭绿江口的时间较晚，直到4月底才会有它们的记录(图3.20)。在5月进行的一些计划外调查中我们发现在这个时期阔嘴鹬较为常见，且有时数量很多。同时，超过700只的记录也证实了这个物种在保护区内为常见种。

在保护区内2号的阔嘴鹬数量最多，占总数近84%的个体是在此被记录到的。在3号点及西水道港区也有小群阔嘴鹬的出现，而在其他调查点只是偶尔会调查到1-2只。

阔嘴鹬一共有2个亚种，但只有*sibirica*亚种在东亚-澳大利西亚迁徙路线上分布(Bamford *et al.* 2008)。整个迁徙路线上种群数量估计有 25,000只(Bamford *et al.* 2008)，而鸭绿江口保护区内数量最多的两次计数都接近了迁徙路线种群数量的3%。

鹤鹬

在鸭绿江口鹤鹬的数量并不多，调查到数量范围从2010年4月的8只至2008年5月上旬的838只(图3.21)。然而，最大计数的这次记录是5月的一个正常值还是一个突发性事件仍不是很清楚。

鹤鹬 *Spotted Redshank - Jan van der Kam*

2008年调查到的鹤鹬中有53%的个体是在西水道港区记录到的，在此之前我们没有在西水道港区进行过鸟类调查；另外38%的个体是在1号记录到的，不过这个地点目前已经不再适合涉禽栖息。在11号点也会常常记录到小群的鹤鹬，10号及12号点的数量更少一些，而其他调查点内鹤鹬较为罕见。

在迁徙季节，鹤鹬主要在中国东部沿海及内陆湖泊栖息。由于这个物种的分布较广所以它的种群数量难以确定，而Bamford *et al.*(2008)认为可能有 25,000至 100,000只，Cao *et al.*(2009)提出鹤鹬的实际种群数量可能更接近25,000只。在鸭绿江口的最大计数值则位于总种群数量的0.8%至3%之间，结果取决于计算时选择数据范围的哪一边。

翻石鹬

2008年5月在鸭绿江口记录到翻石鹬399只。除了这次记录外，翻石鹬的数量范围为1至194只(图3.22)。Bamford *et al.*(2008)所报道的2000年5月在鸭绿江口记录到1994只翻石鹬的记录是错误的，实际在那次调查中只记录到了194只。

翻石鹬在迁徙季的后期才会达到鸭绿江口，所以在4月上旬的调查中只记录到不到10只翻石鹬。这个物种可能是较晚开始迁徙的鸟类，所以我们我们对其调查还不够全面，另外一种可能是因为它们在到达鸭绿江口之前已经经过了其他迁徙补给地，在飞往繁殖地的途中遇到恶

crushed in the gizzard. Why Great Knots are common at the Yalu Jiang Estuary but Red Knots are rare is unknown, but could be related to food or sediment.

The important staging sites for Red Knots on northward migration have been a mystery until very recently but now it appears the north Bohai is a major staging site, hosting at least 40,000 birds, (Rogers *et al.* 2010). Although some stage at Chongming Dao near Shanghai, that does not appear to a major refuelling site (Barter *et al.* 1997).

Broad-billed Sandpiper

At the Yalu Jiang Estuary, counts of Broad-billed Sandpipers have ranged from 0 in early April to 729 in early-May 1999. Arriving late from their non-breeding sites in Southeast Asia and Australia they have not been recorded at the Yalu Jiang Estuary before late-April (Fig. 3.20). As much of May is as yet unsurveyed further counts may show that this species is regularly present in these or larger numbers. With counts over 700 in May it seems likely that this species is regularly present in the reserve.

84% of all Broad-billed Sandpipers recorded in the reserve have been recorded at Site 2, which is clearly a favoured site for this species. Smaller numbers have been recorded at Site 3 and the River; one or two birds are occasionally seen at other sites.

Two subspecies are recognised but only *sibirica* is found in the EAAF (Bamford *et al.* 2008). The flyway population has been estimated at 25,000 (Bamford *et al.* 2008) and the two highest counts from the reserve are close to 3% of that number.

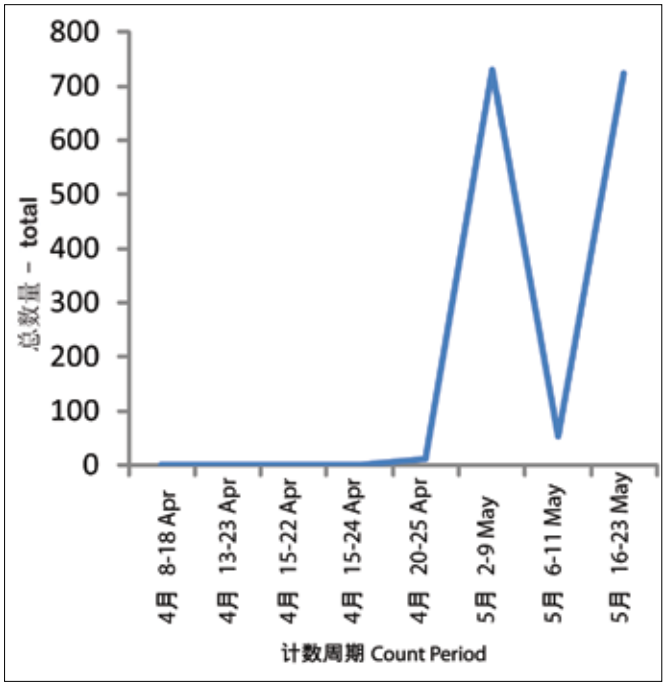


图3. 20 迁徙期不同阶段鸭绿江口阔嘴鹬的数量变化。
Fig. 3.20 Numbers of Broad-billed Sandpipers counted in each survey period.

Spotted Redshank

Small numbers are seen at the Yalu Jiang Estuary, ranging from 8 in April 2010 to 838 in early-May 2008 (Fig. 3.21). It is unknown whether this single high count represents a regular number that visit the reserve in May or whether this was a one off event.

53% of the Spotted Redshanks counted in 2008 were counted at the River, an area not visited in previous surveys, and a further 38% at Site 1, an area no longer available to them. There are regularly small numbers recorded at Site 11, with smaller numbers present at Sites 10 and 12. In the rest of the reserve they are rare.

On migration they occur mostly on the east coast of China or on inland lakes. Because of the species' use of many wetland habitats the total population is difficult to ascertain, but thought to be between 25,000 and 100,000 birds (Bamford *et al.* 2008). Cao *et al.* (2009) suggest that the true population is likely to be closer to 25,000 than 100,000. The highest Yalu Jiang Estuary count is between 0.8% and 3% of the population, depending which extreme is used for the calculation.

Ruddy Turnstone

At the Yalu Jiang Estuary 399 Ruddy Turnstones were recorded in May 2008. Apart from this, numbers have ranged from 1 to 194. (Fig. 3.22) The Bamford *et al.* (2008) record of 1,994 Ruddy Turnstone at the Yalu Jiang Estuary in May 2000 is incorrect; only 194 were recorded during that survey. Ruddy Turnstone appears to be a species that passes through

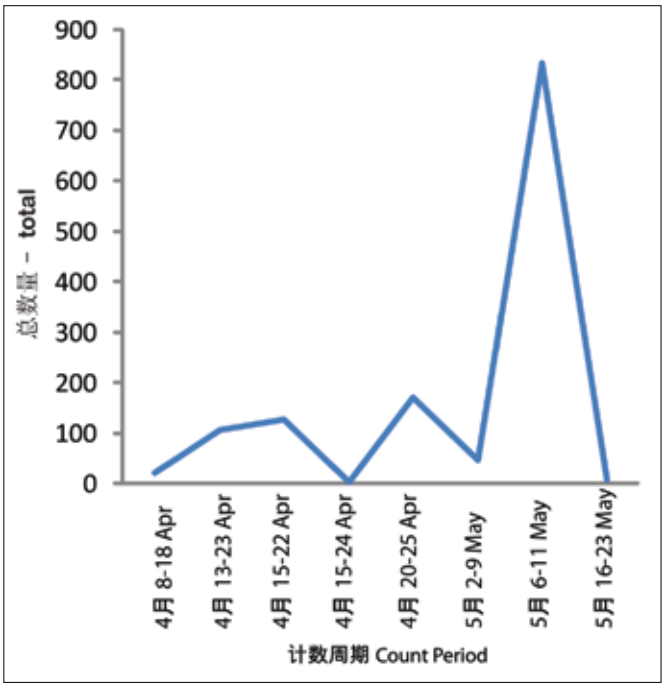


图3. 21 迁徙期不同阶段鸭绿江口鹤鹬的数量变化。
Fig. 3.21 Numbers of Spotted Redshank counted in each survey period.

翻石鹬 *Ruddy Turnstone - Ian Southey*

劣的天气状况才被迫在鸭绿江口临时停歇的。

除了南极洲，翻石鹬的越冬地遍及所有大陆的海岸。这种鸟不但可以在滩涂上栖息，还可以在沙滩和礁石海岸觅食，所以它们的栖息地类型较多且种群散布较广，这也造成该物种的迁徙情况始终不是很清楚。

在北迁时期，中国台湾省及日本是翻石鹬的主要迁徙能量补给区域(Bamford *et al.* 2008; Minton *et al.* 2010)，黄海地区的重要性则相对较低。2008年估计这个物种的种群数量为 20,000只，但根据近期在澳大利亚北部的调查其种群数量可能是38,000只(Bamford *et al.* 2008)。然而，以往的调查数据多是十年前的数据，而在新西兰和澳大利亚南部的最新调查发现翻石鹬的数量下降了很多(Southey 2009, Shorebirds 2020)，因此，该物种实际的种群数量可能会低于 20,000只。五月下旬，翻石鹬在鸭绿江口的数量达到高峰。

3.2.3 第三类

第三类涉禽由8种很常见但是种群数量较少的物种组成。其中，大部分物种都在5月时更为常见，在今后填补了5月份调查的空白期后，这些物种的记录数量会增加。第9种涉禽——极危物种勺嘴鹬，也被归入这一类，尽管这个物种的记录非常少，但是可能它们经常出现，只是由于个体太小且数量太少而没有记录到。

中杓鹬

鸭绿江口的中杓鹬数量较少，其迁徙高峰期为4月下旬至5月上旬，最小及最大计数分别为为26只及4月下旬的414只。

在鸭绿江口，中杓鹬主要在高程较高的滩涂及人工养殖塘内觅食。该物种在保护区内分布较广，但是在西侧滩涂的数量较多。

基于南迁时期在堪察加半岛的莫罗舍奇纳亚河口(Moroshechnaya Estuary)的调查结果，估计在东亚–澳大利西亚迁徙路线上中杓鹬的种群数量为100,000只(Gerasimov & Gerasimov 2002)。但这个估计值高于根据其他调查结果所推算出的种群数量(Bamford *et al.* 2008)。

在迁徙期，中杓鹬的分布较广，因为它们可以栖息在一些小海湾、礁石海岸以及河边，所以还未发现该物种的主要迁徙补给地。中杓鹬在鸭绿江口的数量较少也符合了分布较为分散这一情况。

林鹬

林鹬主要分布在芦苇地中，多年调查的全部记录合计1304只。其中有490只是于1999年5月在芦苇地里记录到的，另外465只记录于2004年4月。在滩涂上这种鸟较为罕见。

红颈滨鹬

鸭绿江口保护区内红颈滨鹬的最大计数为2000年5月下旬记录到的541只，而多年调查的全部记录合计只有1117只。红颈滨鹬的种群数量估计有 325,000只(Bamford *et al.* 2008)，但有证据表明该物种的种群数量有所下降(Shorebirds 2020)。（注：近2000名被认为在2013年5月）。

翘嘴鹬

在东亚–澳大利西亚迁徙路线上翘嘴鹬的种群数量估计有50,000只(Bamford *et al.* 2008)，但是在鸭绿江口记录到的数量很少，其数量范围只有12至358只。4月时保护区内只有不到50只翘嘴鹬，5月大概在100只至350只之间。在迁徙期，这个物种在韩国的数量较多。大部分翘嘴鹬在马来西亚、印度尼西亚和巴布亚新几内亚越冬，还有不到一半的种群在澳大利亚越冬。

红脚鹬

红脚鹬在鸭绿江口并不常见，数量范围只有8至77只。但是红脚鹬主要在人工养殖塘内栖息，所以我们可能低估了这个物种在鸭绿江口的种群数量。

在东亚–澳大利西亚迁徙路线上，红脚鹬的种群数量大约为75,000(Bamford *et al.* 2008)。即便该物种在鸭绿江口的总数量可能会被低估，但是鸭绿江口并不可能会是红脚鹬的重要栖息地。红脚鹬的繁殖地非常分散，从中国盐城往北一

later in the season with the early April surveys showing less than 10 recorded. These birds could either be late migrants and not well assessed in counts or they could be moving to their breeding sites after staging elsewhere, then forced down to the Yalu Jiang Estuary by bad weather.

Ruddy Turnstones have a very wide range around the coasts of all continents except Antarctica during the non-breeding season. Their migration is not well understood as their ability to feed on beaches and rocky shores as well as tidal flats means the populations are widely scattered.

During the northward migration Taiwan, China and Japan are major staging regions for this species (Bamford *et al.* 2008; Minton *et al.* 2010), and the Yellow Sea is less important. The estimated population was raised in 2008 from 20,000 to 38,000 based on recent counts in northern Australia (Bamford *et al.* 2008), however, most of these data are at least 10 years old and more recent counts in New Zealand and southern Australia point to a large decline (Southey 2009; Shorebirds 2020), so the lower figure of 20,000 probably remains more accurate. Ruddy Turnsone numbers peak around the end of May.

3.2.3 Group Three

Group three comprises eight species that are regularly recorded on the survey, however, only in small numbers. Many of these species are more common in May and could be more regularly recorded when the gaps in the May surveys are completed. A ninth species, the critically endangered Spoon-billed Sandpiper, is also classified in this group. Given that the species is occasionally recorded in the reserve it may be occurring here more regularly but with such small numbers it could easily be overlooked.

Whimbrel

The Yalu Jiang Estuary supports small numbers of Whimbrel, which appear to peak in late-April and early-May (Fig. 3.23). Numbers ranged from 26 in early April to 414 in late-April.

They feed predominantly on the higher parts of the tidal flats at the Yalu Jiang Estuary and in the aquaculture ponds. They are present throughout the reserve but most common at the western end.

The Flyway population estimate of 100,000 is based largely on southward migration counts through Moroshechnaya Estuary, Kamchatka Peninsula (Gerasimov & Gerasimov 2002). The estimate is larger than most other counts would suggest (Bamford *et al.* 2008). This species has a wide distribution during migration. No major staging sites have been found; instead they appear to be using many small bays, rocky shores, and rivers so they are difficult to count. The numbers at the Yalu Jiang Estuary reflect this pattern.

Wood Sandpiper

This species is mostly seen in the reedbeds with a total count of 1,304 in all years. 490 were counted in the reedbeds in May 1999 and 465 in April 2004. They are very rarely recorded on the mudflats.

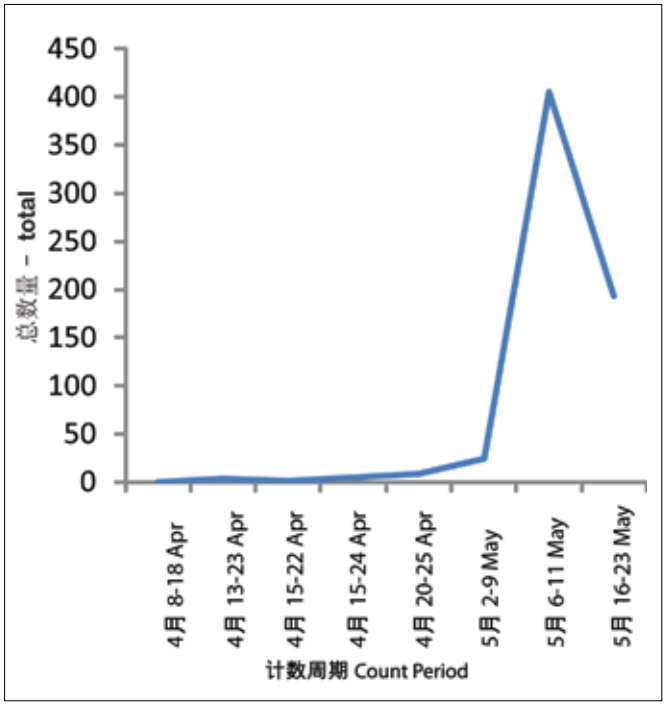


图3. 22 迁徙期各阶段鸭绿江口翻石鹬的数量变化。
Fig. 3.22 Numbers of Ruddy Turnstone counted during each survey period.

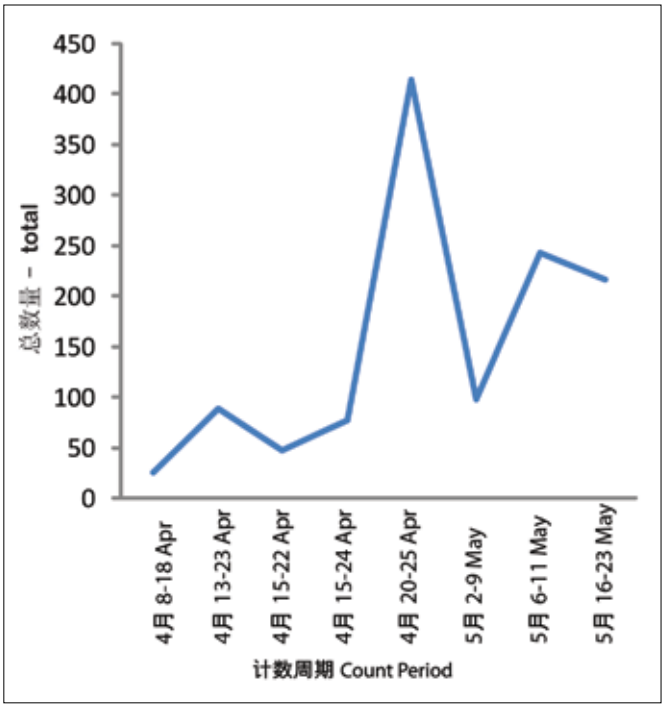


图3. 23 迁徙期各阶段鸭绿江口中杓鹬的数量变化。
Fig. 3.23 Numbers of Whimbrel counted during each survey period.

直到俄罗斯远东地区都有繁殖记录。在鸭绿江口记录到的红脚鹬可能是在黄海西部停歇，然后到俄罗斯东部繁殖，不过在鸭绿江口也曾有过红脚鹬的繁殖记录。

尖尾滨鹬

在鸭绿江口，尖尾滨鹬的最大计数是2000年5月下旬记录到的97只。由于尖尾滨鹬经常栖息于季节性的湿地中，所以调查的难度大一些。4月时在鸭绿江口尖尾滨鹬十分罕见，到了5月下旬数量会有所增加，灌水后的芦苇地为尖尾滨鹬提高了适宜的栖息地。

尖尾滨鹬只沿东亚-澳大利西亚迁徙路线分布，且有近90%的种群在澳大利亚越冬。其总种群数量估计为160,000只(Bamford *et al.* 2008)，但是从近几年在澳大利亚的调查数据来看，它们的数量已经有所下降。已知的尖尾滨鹬的重要迁徙补给地非常少，且主要分布在黄海地区南部及韩国。未来还需要开展更多关于尖尾滨鹬的迁徙情况的研究。

矶鹬

在鸭绿江口，矶鹬的数量非常少，调查记录的范围为2只至23只，其中2000年5月下旬调查到了23只。矶鹬的主要栖息在河岸边，很少出现在滩涂上，仅有的几次调查记录都是在小潮沟的岸边，因此很难估计它们在鸭绿江口的种群大小。在东亚-澳大利西亚迁徙路线上，该物种的种群数量大约为25,000 只至100,000只(Bamford *et al.* 2008)。在黄海地区还未发现这个物种达到国际重要湿地1%标准的栖息地。

灰尾鹬

直到5月份灰尾鹬才会达到鸭绿江口，调查中的最大计数是5月下旬记录到的19只。由它们的迁徙时间可知在鸭绿江口停歇的灰尾鹬可能是来自澳大利亚东部的种群，它们的迁徙时间比澳大利亚西北部的种群晚。在澳大利亚昆士兰州，曾在6月的第1个星期发现一些体重非常重的灰尾鹬，这表明它们已经储备了足够的能量并准备开始迁徙。这也说明了我们的调查时间并没有涵盖灰尾鹬的迁徙时间，所以灰尾鹬在鸭绿江口的种群数量可能要比我们调查到的多。在东亚-澳大利西亚迁徙路线上，灰尾鹬的种群数量大约为50,000只(Bamford *et al.* 2008)。它们在亚洲的迁徙要道是包括中国南部到日本及韩国南部区域(Bamford *et al.* 2008)。

勺嘴鹬

勺嘴鹬在鸭绿江口保护区内有5笔记录，分别是2000年5月6日1只，2004年4月中旬1只及2010年5月26、27和31日在2号点各发现的1只。另外，2010年5月28、30及31日在西水道港区内也各有1笔1只勺嘴鹬的记录。2010年在2号点内记录到的勺嘴鹬已经换了部分的繁殖羽，而西水道港区那只个体还只有冬羽，所以可以确定这两只不是同一只个体(Bai Qingquan pers. comm.)。2012与2013年有多笔勺嘴鹬记录。2013年在1号点附近，拍摄到勺嘴鹬的照片。勺嘴鹬和红颈滨鹬在一起，很难识别。

勺嘴鹬是全球最濒危的涉禽之一，该物种的数量一直在急剧下降。越冬区及迁徙路线上栖息地的丧失和非法捕猎是造成它们数量下降的主要原因(Zockler *et al.* 2010)。现在全球仅存200－300只勺嘴鹬，只要某地点有2-3只勺嘴鹬的记录就已达国际重要意义标准；所以鸭绿江口也是对勺嘴鹬有国际重要意义的栖息地。

3.2.4 第四类

这一类的涉禽都在鸭绿江口出现过，但是并不常见。这些物种在潮间带湿地较为罕见，它们通常都栖息于远离潮间带的淡水或是咸淡水混合的湿地，甚至晒盐场。

小杓鹬是这一类鸟中唯一一种多年调查内记录到的总数量超过100只的物种，但是这种鸟只出现过两次。一次是2004年，在刚灌水的芦苇地内记录到 1169只。小杓鹬一般偏好栖息于草地(Higgins & Davies 1996)，所以它们只是机会性的利用这块栖息地。但是这个记录也恰好揭示了这个物种迁徙时会途经保护区，甚至有时会在此地停歇。另外20个个体的记录是2005年在12号点记录到的。

三趾滨鹬喜欢开阔的沙质海滩，其主要迁徙路线偏东一些，在日本的数量较多(Barter 2002)。在鸭绿江口总共调查到三趾滨鹬60只。

长趾滨鹬并不只在潮间带滩涂栖息，它们更偏好淡水湿地和水稻田，因此在5月下旬，灌水后的水稻田可能可以记录到该物种。在鸭绿江口总共调查到长趾滨鹬34只。

泽鹬主要栖息于盐沼及晒盐场，北迁时期，该物种主要集中出现在渤海湾。在渤海湾有数量众多的晒盐场(Bamford *et al.* 2008)，但是鸭绿江口并没有这一类型的栖息地。在鸭绿江口总共调查到泽鹬26只。

Red-necked Stint

Only 1,117 Red-necked Stints were counted during all surveys combined, with a maximum count of 541 in late-May 2000. With an estimated population of 325,000 (Bamford *et al.* 2008), this may not be an important site for the species, even with evidence of a population decline (Shorebirds 2020). (Update: Almost 2,000 were seen in May 2013).

Terek Sandpiper

The population estimate for Terek Sandpiper stands at 50,000 (Bamford *et al.* 2008), but only small numbers have been recorded at the Yalu Jiang Estuary. Counts range from 12 to 358 with less than 50 in April and 100–350 in May. This species is more numerous in South Korea on migration. Most of the population winters in Malaysia, Indonesia and Papua New Guinea, with less than half the total in Australia.

Common Redshank

Common Redshanks are not common at YJNNR; counts have ranged from 8 to 77. As with Common Greenshank this is a species that may be underestimated at the Yalu Jiang Estuary due to its preference for ponds over tidal flats.

The flyway population estimate of Common Redshank is 75,000 (Bamford *et al.* 2008). Even if the totals are undercounted it is unlikely that this is an important site for this species.

Common Redshank have a fragmented breeding range, from Yancheng, China, northwards and far eastern Russia. Those seen at the Yalu Jiang Estuary are probably heading to eastern Russia. They are known to stage in the western Yellow Sea (Barter 2002) and have been recorded breeding at the Yalu Jiang Estuary.

Sharp-tailed Sandpiper

The highest count of 97 was recorded in late-May 2000. This species can be difficult to count, as they often inhabit ephemeral wetlands. Sharp-tailed Sandpipers are rare at the Yalu Jiang Estuary in April with a few more in late-May when the reedbeds are flooded making suitable habitat available.

Sharp-tailed Sandpipers are confined to the EAAF and Australia is believed to hold 90% of the non-breeding population. The population estimate is 160,000 (Bamford *et al.* 2008) but declines seen in Australian counts in recent years may affect that total. There are very few known sites of international importance and they are mostly in the southern Yellow Sea and South Korea. More needs to be known about the requirements of this species on migration.

Common Sandpiper

Common Sandpipers are seen each year in very small numbers, ranging from 2 to 23 with 23 seen in late-May 2000. Almost always on banks of small creeks this species prefers riverbanks and is very rare on mudflats, which makes population assessment difficult but between 25,000 and 100,000 are believed to occur on the EAAF (Bamford *et al.* 2008). Nowhere in the Yellow Sea is known to hold internationally important numbers of this species.

Grey-tailed Tattler

Grey-tailed Tattlers have not been recorded during April and the high count of 19 was seen in late-May. This timing suggests they may be associated with the eastern Australian tattler population that migrates later than the Northwest Australian population. Some tattlers caught in Queensland, Australia in the first week of June were carrying enough weight to indicate they were about to leave on migration. This would imply they are migrating well outside the survey period and therefore Grey-tailed Tattlers may be more common in the reserve than counts suggest. Confined to EAAF the population estimate is 50,000. The migration stronghold for this species is from South China to Japan and southern South Korea (Branson *et al.* 2010).

Spoon-billed Sandpiper

There are only three records at the Yalu Jiang Estuary during the surveys, one on 16/5/2000, one during mid-April 2004, and one on 26, 27 and 31 May 2010 at Site 2. There are also at least three records of two individual Spoon-billed Sandpipers on the 'River' outside the survey periods (Bai Qingquan, pers comm.). (Update: There are several records from the Yalu Jiang Estuary in 2012 and 2013).

Spoon-billed Sandpipers often assosiate with the very similar looking Red-necked Stint making them difficult to identify.

The world's most endangered shorebird, Spoon-billed Sandpipers are in serious decline. Habitat loss in non-breeding and staging grounds and hunting are considered major threats (Zockler, *et al.* 2010). It is now thought that only 2-300 exist, so just 2-3 birds makes a site internationally important; YJNNR could become internationally significant for this species with just one more record.

勺嘴鹬 *Spoon-billed Sandpiper - Liu Mingyu* 柳明玉

铁嘴沙鸻在内陆的草地繁殖，黄海地区内的数量较少。在鸭绿江口总共调查到铁嘴沙鸻25只。

黑尾塍鹬偏好在内陆湿地及水稻田内栖息，而鸭绿江口没有其适宜的栖息地。尽管鸭绿江口区域有大面积的水稻田，但是由于这些水稻田直到5月下旬才会灌水，可能已经错过了黑尾塍鹬的主要迁徙期。在鸭绿江口总共调查到黑尾塍鹬24只。

弯嘴滨鹬主要在沿海湿地栖息，但是这个物种迁徙途经亚洲时，路线偏西，主要停歇于香港、盐城及渤海湾地区，在鸭绿江口并不常见。在鸭绿江口总共调查到弯嘴滨鹬18只。

白腰草鹬主要在内陆湿地栖息，黄海地区的沿海湿地并不是这个物种的重要栖息地。在鸭绿江口总共调查到白腰草鹬5只。

东方鸻出现在黄海地区沿海湿地的可能性很小，它们可能是从澳大利亚北部的越冬地直接飞到中国东北部的繁殖地的，尽管会飞越黄海地区，但是停歇概率不大(Bamford *et al.* 2008)。在鸭绿江口总共调查到东方鸻4只。

在黄海地区的流苏鹬为罕见鸟。尽管这个物种的繁殖地横跨整个西伯利亚，但是它们大部分都在印度以西的欧、亚、非大陆越冬。在鸭绿江口总共调查到流苏鹬3只。

金眶鸻在欧亚大陆的分布较为广泛，但是在黄海地区并不常见。在迁徙期，他们主要出现在内陆淡水湿地、渤海湾及日本。在鸭绿江口总共调查到金眶鸻3只。

扇尾沙锥主要栖息于淡水湿地及水稻田，它们生性隐秘，不易观察，在鸭绿江口的芦苇地中记录到几次。它们偶尔也会出现在人工养殖塘边长满植被的堤坝上。所有目击到的沙锥都很难鉴定到种。在鸭绿江口总共调查到2只。

在东亚-澳大利西亚迁徙路线出现的剑鸻为迷鸟。尽管这个物种的繁殖地横跨整个西伯利亚，但是它们主要欧洲和非洲越冬。在鸭绿江口总共调查到剑鸻2只。

青脚滨鹬是淡水物种，很少出现在潮间带滩涂。这个物种的繁殖地横跨整个西伯利亚并在东南亚至非洲大陆越冬。在鸭绿江口总共调查到青脚滨鹬1只。

普通燕鸻主要在草地栖息，迁徙季节在东亚-澳大利西亚迁徙路线的沿海地区极为罕见。在鸭绿江口总共调查到普通燕鸻1只。

在计划内调查中并没有反嘴鹬的记录，但是有一小群反嘴鹬曾在西水道港区出现，另外在12号点还记录到一次。通常这个物种的分布靠迁徙路线的西侧，并在渤海湾繁殖。

杓鹬类 *Curlews - Jesse Conklin*

3.2.4 Group Four

This group is made up of those species which have been recorded in YJNNR but are not regularly seen. Species in this group generally prefer fresh or brackish water and occur away from tidal flats, in other types of wetlands including saltworks.

Little Curlew was recorded just twice in the surveys, but totalled over 1,000 birds. In 2004, 1,169 were counted in the newly flooded reedbeds. Little Curlews generally prefer grasslands (Higgins & Davies 1996) so they may have been opportunistically exploiting this habitat. This record is interesting as it indicates that there are some species that may pass over the reserve, stopping only occasionally. A further 20 were seen in 2005 at Site 12.

Sanderlings prefer open coasts with sandy beaches and occur more to the east in Japan on northward migration (Barter 2002). Total count 60.

Long-toed Stints prefer freshwater wetland including rice paddies so may occur in the Yalu Jiang Estuary in late-May when paddies are flooded, but they are not mudflat dependant. Total count 34.

Marsh Sandpipers are found more in saltmarsh habitat and saltworks, and the largest concentrations on northward migration appear to be in the Bohai Sea where there are extensive saltworks (Bamford *et al.* 2008). This habitat does not exist in the Yalu Jiang Estuary. Total count 26.

Greater Sandplovers breed on inland grasslands and rarely occur in the Yellow Sea. Total count 25.

Black-tailed Godwit prefers inland wetlands, and rice paddies and so the Yalu Jiang Estuary is mostly unsuitable for this species. Although there are large areas of rice paddies in the area, they are not flooded until late May, probably after the main migration period. Total count 24.

Curlew Sandpiper is a coastal species which migrates further west through Asia, with good numbers seen in Hong Kong, Yancheng and the Bohai but is uncommon in the Yellow Sea (Bamford *et al.* 2008). Total count 18.

Green Sandpiper is typically found in inland wetlands; the Yellow Sea is not thought to be important to this species. Total count 5.

Oriental Plover does not seem to occur on the shores of the Yellow Sea, and is thought to fly direct from the non-breeding grounds in northern Australia to the breeding grounds in northeast China, although some must overfly the region (Bamford *et al.* 2008). Total count 4.

Ruff is a straggler to the Yellow Sea. Although they breed across Siberia most winter from India to Africa (Bamford *et al.* 2008). Total count 3.

Little Ringed Plover is a wide-ranging species in Eurasia but is not common in the Yellow Sea. It does occur more in freshwater wetlands in the Bohai and Japan on migration. Total count 3.

Common Snipe is a secretive species of freshwater wetlands and rice paddies with a few seen in the Yalu Jiang Estuary Reedbeds and occasionally around vegetated banks of aquaculture ponds. Both snipe seen were not positively identified to species level, but were thought to be Common Snipe . Total count 2.

Ringed Plover is another straggler to the EAAF, although they breed right across Siberia, they mainly winter in Europe and Africa. Total count 2.

Temminck's Stint is a species of freshwater wetlands and rarely seen on tidal mudflats. They breed across Siberia and winter from Africa to Southeast Asia. Total count 1.

Oriental Pratincole is a grassland species rarely seen on any coasts in the EAAF during migration. Total count 1.

Pied Avocet has not been counted during surveys but have occurred in the River in very small numbers and were seen once at Site 12. This species is usually found further west but does reach the Bohai, where they breed.

Keith Woodley

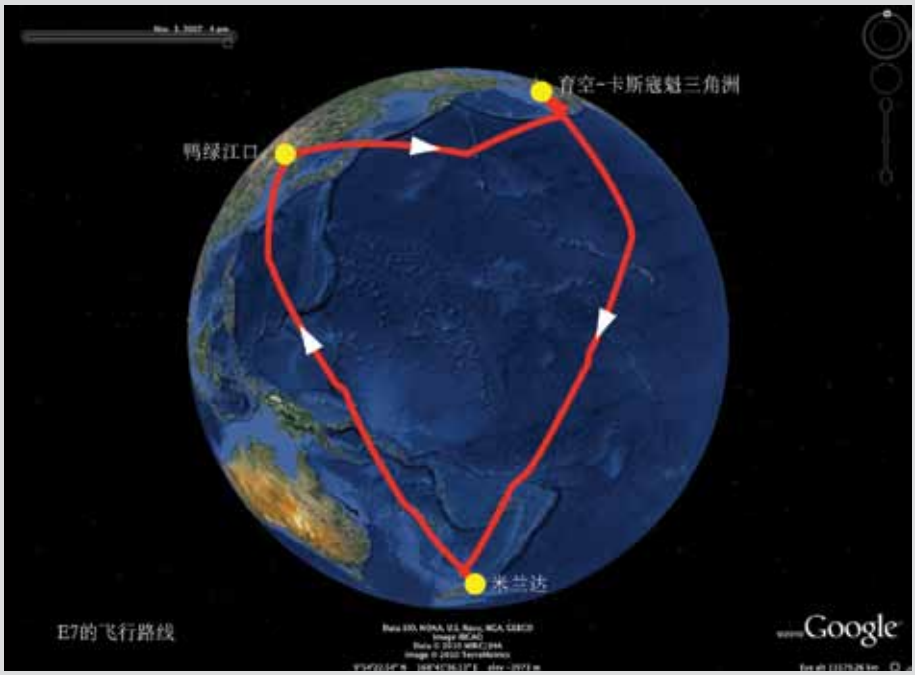
“E7”— 传奇般的斑尾塍鹬

历史上没有过任何一只斑尾塍鹬像“E7”在2007年时一样受到密切的关注，通过安装在她腹部的卫星发射器，她当年全年的飞行路线，从新西兰到鸭绿江口再到阿拉斯加，然后返回新西兰的飞行轨迹被完整的描绘出来。在此之前，很少人相信斑尾塍鹬能够不停歇的飞行如此漫长的距离，它们的忍耐力以及飞行距离都违背了人类的逻辑，更不用说它们所具备的非凡的导航能力了。

在2007年3月17日，E7从新西兰米兰达出发，经过7日7夜飞抵鸭绿江口，沿途10,200公里不曾终止过飞行。这是陆地鸟类被确认的连续飞行的最长纪录，这显示了斑尾塍鹬不但能直接飞抵东亚，而且能直达黄海北部沿岸。E7在新西兰最后的足迹遗落在泰晤士河口的米兰达，而她下一步的脚印则印在鸭绿江口湿地国家级自然保护区的滩涂上，这两个地方已被姊妹保护区合作关系联系在一起，没有什么比斑尾塍鹬的这段旅程能更好的阐明她们的关系。她这段惊人的旅程让人们意识到，鸭绿江口是斑尾塍鹬在东亚最北端的能量补给地，而她竟轻松略过了南边几个合适的能量补充地。由于斑尾塍鹬对停歇地有高度的忠诚度，所以我们几乎可以肯定鸭绿江口是E7唯一一个经常停歇的迁徙补给地。更让人关注的是，她接下来5个星期都在4号点周边的滩涂活动，在2007年5月1日，E7静静地离开了鸭绿江口，她虽然躲开了来寻找她的人们，但她的行踪却被外太空轨道上运行的卫星监控着。她先往东、再往北，成功避开恶劣天气状况，经过6天时间飞抵阿拉斯加西南部的育空- 库斯科奎姆三角洲。这一次，她又躲开了想一睹其芳容的人们，当中更包括一位一直追随她到阿拉斯加的米兰达人。当时，这些人在她的最终目的地北边只有30公里处，但是他们却无法再进一步接近她的位置。

经过繁殖期，在南迁前夕，E7还在库斯科奎姆沙洲补充了能量(斑尾塍鹬离开阿拉斯加前最重要的迁徙补给地)，而她这段南迁的旅程再一次载入记录本中，这次她连续飞了8日8夜到达米兰达。经过了11,690公里的旅程，着陆后，她静静的躲到一处人们难以到达的海岸边，呆了几个星期且一直没有被人看见。

这段迁徙旅程被世界各地的媒体广泛转载，与其相关的讨论更延续了很多个星期。 当然，E7的旅程仅仅是那千千万万只斑尾塍鹬每年往返繁殖地和越冬地之旅的其中一个例子，但怎又会有人不被E7的故事所感动呢？希望她和她的伙伴能在未来的日子里继续她们精彩的旅程。



斑尾塍鹬 E7 的迁飞路线：从米兰达途径鸭绿江后达到阿拉斯加，之后直接返回米兰达。

‘E7’ - The Legendary Godwit

No godwit in history has commanded as much attention as ‘E7’ did in 2007 when her entire annual flight from New Zealand to the Yalu Jiang Estuary, on to Alaska and back to New Zealand was traced by a satellite transmitter implanted in her abdomen. Until then only a very few people believed Bar-tailed Godwits were capable of such enormous non-stop flights - flights that seemed to defy human logic, in both their endurance and distance covered, to say nothing of the extraordinary navigational skills such birds must possess.

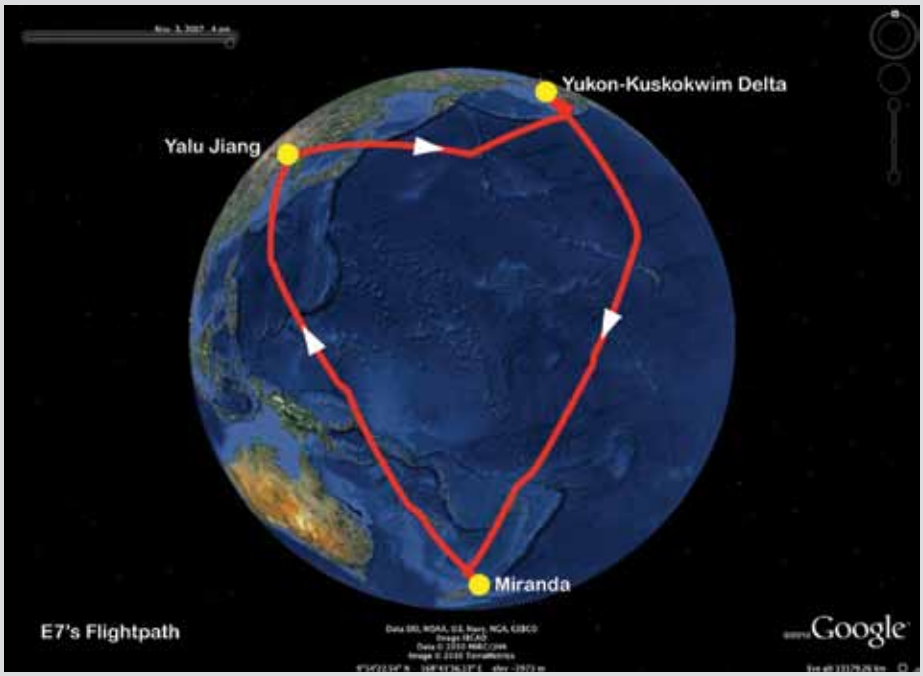
On 17 March 2007, E7 took off from Miranda and after flying for seven days and nights, arrived at the Yalu Jiang Estuary having not stopped flying for one moment on the 10,200km journey. This was the longest confirmed non-stop flight by any land bird and in doing so not only showed godwits could fly non-stop to East Asia but all the way to the northern shores of the Yellow Sea in a single flight. E7’s last footsteps in New Zealand were at Miranda on the Firth of Thames; her next footsteps were in the mud of the YJNNR, two sites already linked with a sister site agreement, and nothing could have illustrated this link better. Her amazing flight was tempered with the concern that the Yalu Jiang Estuary is the most northern refuelling site in East Asia for godwits and that she had bypassed other suitable sites further south. As godwits are known to be very site faithful the Yalu Jiang Estuary is almost certainly E7’s only regular staging site. Even more concerning is the fact she spent the next five weeks in and around Site 4 and the mudflats south of Donggang.

On 1 May 2007, E7 slipped away from the Yalu Jiang Estuary, unseen by the human eyes that had been looking for her, but watched from space by an orbiting satellite. She flew east then north skirting bad weather to reach the Yukon-Kuskokwim Delta in southwest Alaska six days later. Again she eluded humans including one from Miranda who was only 30km to the north of her final destination at the time but was unable to reach her location.

After apparently breeding she refuelled on the Kuskokwim Shoals, (the most important staging site for godwits leaving Alaska), before departing southwards, and once again flew into the record books, this time by flying for eight days and nights non-stop back to Miranda in New Zealand. Here, after 11,690km, she slipped quietly back into a difficult to reach part of the coast and remained there, unseen for several more weeks.

This story was picked up by media around the world and was talked about for many weeks. Of course what E7 did was just one example of what many thousands of godwits do each year as they travel between breeding and non-breeding grounds but surely few people could remain unmoved by E7’s story?

It is hoped that she and her like are able to continue making this remarkable journey for many years to come.



Bar-tailed Godwit E7’s Flight path from Miranda to the Yalu Jiang Estuary, Alaska and back to Miranda.

大滨鹬的警示录

大滨鹬是只沿东亚–澳大利西亚迁徙路线分布的迁徙涉禽，它们在西伯利亚东部繁殖，且大部分个体在澳大利亚北部越冬，但长久以来它们是一种鲜为人知的鸟(Serventy 1976)。

在70年代，大滨鹬种群数量的估计只有10,000 – 20,000只(Barter 1986)，但澳大利亚涉禽研究组于1981年在澳大利北岸的黑德兰港 (Port Hedland) 和布鲁姆(Broome)之间进行鸟类时，发现大滨鹬的数量非常庞大。到了90年代，人们了解到大滨鹬北迁时会在东亚地区停歇，而现在黄海东部沿岸已确认是大滨鹬最主要的迁徙补给地。近几年，Bamford *et al.*(2008)估计大滨鹬在迁徙路线的种群约有380,000只。

大滨鹬在迁徙以及越冬期间的分布带有一定区域性，95%的大滨鹬在澳大利亚越冬，主要沿北部海岸分布，这其中有近45%的个体在80英里海滩越冬(Bamford *et al.* 2008)。Barter(2002)的调查确定了有11个地点在北迁时支持的大滨鹬数量达到国际重要意义标准，其中6个来自中国，5个来自韩国。另外，在朝鲜也很可能有地位相似的重要地点。迁徙期，大滨鹬最重要的3个栖息地分别是韩国的东津湾(最大计数为60,000只)和万顷湾(59,000)以及中国的鸭绿江口(55,000)(Bamford *et al.* 2008)。另外3个位于韩国的重要栖息地分别是牙山湾、南阳湾和锦江口，以及中国的双台河口国家级自然保护区，这些地点都曾经记录到 20,000至 35,000只大滨鹬(Bamford *et al.* 2008)。

大滨鹬是一种主要以小型双壳类软体动物为食的专食者，它们吞下双壳类后可以用肌胃来压碎贝壳(Higgins & Davies 1996)。吞食带有坚硬外壳的食物也有其不利之处，最明显的问题就是不能吞食比喙裂更宽的食物。大滨鹬所寻找的栖息地必须有数量足够多的软体动物，以支持大群大滨鹬的觅食需求。从大滨鹬分布的局限性来看，大多数潜在的迁徙补给地中都无法为大滨鹬提供足够的并合适它们的双壳类软体动物。

从上述那些对大滨鹬起着重要作用的迁徙补给地被发现时起到现在，这些地方的环境都发生了很大的变化，由于栖息地丧失和退化，大滨鹬的数量也受到了的严重打击。韩国东津湾和万顷湾曾经是大滨鹬最重要的两个迁徙补给地，但现已被纳入大型的新万锦发展项目的一部分。在2006年新万锦工程的大堤修建完成后，大滨鹬在东津和万顷湾以及整个韩国的数量出现了大幅下降(Moores *et al.* 2008)。与此同时，中国沿海滩涂湿地也一直在减少，不过有关其丧失程度的相关数据却很少(Cao *et al.* 2009)..

新万锦工程的开发者认为，大滨鹬在失去新万锦的栖息地后。然而，新万锦涉禽监测项目的调查发现开发者的预测并不正确：从2006年到2008年间，大滨鹬在新万锦的河口、锦江口和Gomso湾的数量减少了80%，由116,126只下降到只有26,429只(Moores *et al.* 2008)。

除新万锦及周边区域以外，在1998年在韩国另一个大滨鹬已知的数量最多的地点，曾记录到33,881只大滨鹬。但是为了经济开发而破坏河口湿地的情况很快就在韩国沿海屡屡发生，直至2008年，同一时期在同一地点的调查中只记录到了18,130只大滨鹬，数量减少了53%(Moores *et al.* 2008)。2006年到2008年间大滨鹬在韩国的数量总共减少了至少100,000只。

从2008年的调查结果可以清楚看出，大滨鹬并没有转移去韩国其他的栖息地，同时黄海地区其他的栖息地内大滨鹬的数量也没有非常显著的增长，加上这些消失了的大滨鹬并没有出现在澳大利亚的越冬地，因此，毫无疑问，受到新万锦开发工程影响的大滨鹬已经死亡。根据世界自然保护联盟(2009)提供的最新数据，大滨鹬的数量估计为290,000，甚至更低，因此他们将大滨鹬的受胁级别由“无危”升至“易危”。

大滨鹬在鸭绿江口的数量范围为2006年4月中旬的16268至1999年5月上旬的55,178，数量差异主要视乎调查是在迁徙期的哪个时间段开展的。利用鸭绿江口作迁徙补给地的大滨鹬数量共有70,000 – 80,000只，大概占全球种群数量估计的25%。现有的资料已清楚的表明，鸭绿江口是大滨鹬目前在北迁时亚洲所有迁徙补给地当中最重要的一个，且其重要性远远超过其他迁徙补给地，加上大滨鹬只在东亚–澳大利西亚迁徙路线有分布，大滨鹬无疑是鸭绿江口最重要的物种。

结论

从新万锦迁徙补给地的丧失导致大滨鹬全球数量减少25%的事例，我们可以清楚地认识到，大滨鹬在迁徙时非常容易受到栖息地丧失的影响。由于大滨鹬位于西伯利亚高山苔原的繁殖地人迹罕至，而位于澳大利亚北部的越冬地亦很少有人为干扰，因此迁徙补给地的安全性对大滨鹬的生存状况起着决定性的作用。

成群结队的大滨鹬一同前往休息场所时那充满魅力的飞行表演，是永远无法用上述的事实和数字来传达的，那是一种只有身临其境才能感受到的美丽。丹东周边的很多民众也开始沉醉于这种让人惊叹的奇观，他们还会带自己的孩子来一同感受。

目前来讲，鸭绿江口仍是大滨鹬的一个安全港湾，但当地的经济发展也非常的迅速。人类所带来的问题，也必定要人类自己解决。如果政府和民众渴望或觉得有责任去保护这些令人惊奇的鸟类，那任何发展计划都必须顾及这些鸟类的利益。

韩国大滨鹬数量的大幅下降，用惨痛的教训告诫人们一个物种的受胁等级是如何在短时间内从“无危”升至“易危”，而这种情况也能发生在其他物种身上。大滨鹬其他的栖息地也在发生着改变，对这个物种而言，现在在世界上已经没有一处真正安全的栖息地了。

Great Knot – A Cautionary Tale

Great Knots occur only on the East Asian-Australasian Flyway. They breed in eastern Siberia and most spend the non-breeding season in northern Australia.

For many years they were a poorly known bird (Serventy 1976), and in the 1970s the population was estimated at just 10,000-20,000 individuals (Barter 1986). However, an Australasian Wader Studies Group expedition to the Northwest Australian coast in 1981 revealed them to be very numerous. By the 1990s Great Knots were found staging in East Asia during northward migration and it became clear that the eastern shores of the Yellow Sea were their major staging grounds. Until recently the flyway population estimate was 380,000 (Bamford *et al.* 2008).

Great Knots have a localized distribution during migration and non-breeding periods. About 95% of them spend the non-breeding season in Australia, mostly along the northern coasts with nearly 45% of them on Eighty Mile Beach (Bamford *et al.* 2008). Barter (2002) identified six Chinese and five South Korean sites that supported internationally important numbers on the northward migration. The top three sites were the Dongjin Estuary (c60,000) and Mangyeung Estuary (c59,000) in South Korea and the Yalu Jiang Estuary (c55,000) in China (Bamford *et al.* 2008). Three other important sites in South Korea were Asan and Namyang Bays and the Geum Estuary, and in China the Shuangtai Estuarine Wetland NNR, all with counts between 20,000 and 35,000 (Bamford *et al.* 2008).

Great Knots are specialist feeders, predominantly eating small bivalve molluscs, which are swallowed whole and crushed in the gizzard (Higgins & Davies 1996). Swallowing prey in a rigid shell has its drawbacks, the obvious one being the inability to swallow anything wider than the bird's gape. Great Knots need sites with large enough quantities of suitable sized molluscs to support big flocks. That they are restricted to few sites suggests that suitable shellfish are not common enough at most staging sites.

Major environmental changes have taken place since the discovery of these important sites and Great Knots have suffered greatly from this habitat loss and degradation. In South Korea the Dongjin and Mankyeong Estuaries that were once the two most important staging sites for Great Knots now make up the massive Saemangeum development. Since the seawall was closed in 2006 the number of Great Knots at those sites and in South Korea as a whole has plummeted (Moores *et al.* 2008). In China coastal mudflats are also being lost at an alarming rate (Cao *et al.* 2009), although the effect on Great Knot numbers in China is currently unknown.

Developers suggested that with the loss of habitat at Saemangeum, Great Knots would simply move to other estuaries in South Korea. The Saemangeum Shorebird Monitoring Program found that this did not happen. From 2006 to 2008 there was an 80% decline at the estuaries of Saemangeum, the Geum Estuary and Gomso Bay from 116,126 to just 26,429 (Moores *et al.* 2008).

Outside this region a count at most shorebirds sites in South Korea in 1998 recorded 33,881 Great Knot. Destruction of estuaries for development is occurring quickly around the South Korean coast and a similar survey of the same sites and at the same time of year in 2008, recorded just 18,130, a decrease of 53% (Moores *et al.* 2008). A decrease of at least 100,000 Great Knots occurred in South Korea between 2006 and 2008.

It is clear from the 2008 survey results that Great Knots did not move to other Korean sites as some people had suggested and there is no indication that other sites in the Yellow Sea have seen a dramatic increase in numbers over the same period. The missing birds did not return to Australia either so it is clear that many were affected by the development at Saemangeum and had simply died. The population estimate provided by the IUCN (2010a) is 290,000 or lower. As a result they have changed the threat category of the species from 'Least Concern' to 'Vulnerable'.

Counts of Great Knot at the Yalu Jiang Estuary have ranged from 16,268 in mid-April 2006 to 55,178 in early-May 1999, depending on which part of the migration cycle was surveyed. In total 70,000-80,000 birds are estimated to use the reserve, about 25% of the global population. It is clear from the available information that the Yalu Jiang Estuary is now the most important known site in Asia for Great Knots during northward migration and because this is a species confined to the EAAF arguably the Great Knot is the most important species at the Yalu Jiang Estuary.

Conclusion

It is clear from the loss of over 25% of the world population of Great Knot at Saemangeum when that habitat was destroyed, that they are extremely vulnerable to habitat loss during their migration. The breeding grounds in remote Siberian mountain tundra and the major non-breeding grounds in northern Australia are generally undisturbed. The year-to-year survival of the Great Knot does therefore rely totally on their remaining staging sites being secure

The facts and numbers presented here can never convey the magic and beauty of the aerobatic display performed by a large flock of Great Knots without actually seeing them. It is a sight that many people from Dandong and the surrounding areas now appreciate, and are taking their children to marvel at.

The Yalu Jiang Estuary may be reasonably secure for Great Knot at present but the speed of development today is fast. People cause all the problems and people will have to solve them. If governments and people feel they have the desire to protect these wonderful birds and a responsibility to do so, then their welfare must be considered when any developments are being planned.

The collapse of Great Knots in South Korea highlights just how quickly a species can go from one of 'Least Concern' conservation wise, to 'Vulnerable'; it could happen to other species too. Other sites are changing as well and at present, there is nowhere that is truly safe for Great Knots.

3.3 鸭绿江口保护区内涉禽的总数量

在鸭绿江口保护区内涉禽的最大调查数量为2009年4月记录到的176,535只；最小调查数量为2000年5月下旬记录到的92,990只。

大部分的物种每年在鸭绿江口的停留时间都是固定的，且种群数量随着越来越多个体的到达而逐渐增加，达到数量高峰值后又随着鸟类离开飞往繁殖地后越来越少。一些物种，包括杓鹬、斑尾塍鹬和环颈鸻的在迁徙季节的前期就已达到数量的高峰期。还有一些物种如大滨鹬的数量增加速度较为缓慢，离开的速度也和到达的差不多。另外的物种如灰斑鸻和蒙古沙鸻会在我们调查期的末期才达到迁徙数量的高峰值。

由于不同的物种有不同的迁徙时间，所以迁徙经过鸭绿江口保护区的所有鸟在特定时间都同时出现在保护区内的情况是不会发生的。一些物种在4月上旬达到鸭绿江口，到了5月上旬时它们可能已经离开继续下一阶段的迁徙，而这时另外一些物种可能还没有达到鸭绿江口。

因为所有的鸟无法在同一时间都出现在调查区域，我们只能根据这些物种的种群估计值结合它们的最大计数值来估算利用鸭绿江口的涉禽的最小数量。结果表明，每年在北迁时期，至少有250,000只涉禽在鸭绿江口保护区停歇补给能量。

3.4 各调查点情况分析

在保护区内我们共划分了15个调查点，另外还有西水道港区及芦苇地。每个调查点的环境特征都不相同，所以在每个调查点内调查到的鸟类数量及多样性也不相同(图3.24)。表3.6列出了每个调查点内休息的涉禽种类数和鸟类个体总数量。要说明的是，高潮期休息场所鸟类的分布格局并不能反映这些鸟在保护区内觅食状况。

西水道港区

虽然从2004年起，我们就已知道有涉禽在这个区域栖息，但是直到2008年，我们才意识到了这个区域的重要性，加上前往鸟类调查点的交通越来越方便，自2008年起我们连续3年在西水道港区进行了涉禽的调查。这一区域属于工业用地区，但是由于其在高潮时仍不被水淹没，所以有大量的涉禽在此停歇。

在这个调查点栖息的鸟主要都是斑尾塍鹬。值得注意的是，在3年的调查中西水道港区都没有大滨鹬的记录，具体原因还不是很清楚。

一些计划外的调查中在西水道港区曾有3只勺嘴鹬，5只小青脚鹬和1只青脚滨鹬的记录。在西水道港区的调查通常是在小潮期进行的，而鸟类数量较多的记录都是在潮汐高度超过6.0米时记录到的。

表3.5 用以估算北迁时期利用鸭绿江口保护区涉禽最小数量的数据列表。
Table 3.5 Values used to determine minimum numbers of shorebirds using YJNNR during northward migration.

物种	Species	种群数量估计值 Estimated population moving through	鸭绿江口(保护区及西水道港区)的最大计数 Highest count in the survey (reserve and river)
斑尾塍鹬	Bar-tailed Godwit		93,411
大滨鹬	Great Knot	72,960	
杓鹬	Curlew sp.	22,190	
灰斑鸻	Grey Plover	7,860	
蒙古沙鸻	Lesser Sand Plover	1,770	
环颈鸻	Kentish Plover	1,300	
青脚鹬	Common Greenshank	1,150	
黑腹滨鹬	Dunlin		43,875
红腹滨鹬	Red Knot		1,499
小杓鹬	Little Curlew		1,183
其他	Other		4,205
合计	TOTAL		251,403

3.3 Total Numbers of Shorebirds Using YJNNR

The highest count of shorebirds at the Yalu Jiang Estuary Wetland National Nature Reserve was in April 2009, when 176,535 birds were counted; the lowest count was in late-May 2000 with only 92,990 shorebirds counted. The River was only counted in 2008, 2009 and 2010.

Most shorebird species have a definite period when they are present, with numbers increasing as they begin to arrive, reaching a peak and then declining as they move on toward their breeding grounds. Some species, including the curlews, Bar-tailed Godwit and Kentish Plover, have their peak numbers very early in the migration period. Others such as Great Knot build up more slowly and then leave at about the same rate, while species such as Grey Plover and Lesser Sandplover have peak numbers late in the count period.

These different strategies mean that on no given day will every bird that passes through the YJNNR be present. Some species that arrive by early April could well be gone by early May, whilst others do not arrive until May.

As not all birds are present in the study area at the same time the minimum number of birds depending on the reserve can be determined by using the population estimates for those species in the survey area where that can be determined combined with the highest count.

This leads to a minimum estimate of 250,000 shorebirds using the YJNNR as a staging ground during the northward migration period (Table 3.5).

3.4 Site Accounts

There are 15 count sites within the reserve, plus the River and the Reedbeds. Each count site has different characteristics, which affect the numbers and diversity of the species using them (Fig. 3.24). Table 3.6 summarises the numbers of species and total birds that roost at each of the sites. It should be noted that the patterns of roosting do not necessarily reflect the way birds feed in the reserve, a study in its own right.

Although known since 2004 the Yalu Jiang West Waterway (River) has only been counted for the three years since 2008 as its significance has been realised and improved access has allowed easier coverage of the area for bird surveys. This area is zoned as industrial use land; however, the presence of high mud banks that are not covered by the high tides is what makes this site attractive to a large numbers of birds.

Bar-tailed Godwits dominate the counts at this site. The lack of Great Knots at this site in the three years of the survey is notable; however the reasons for this remain unknown.

Outside the census dates 5 Spotted Greenshanks, 3 Spoon-billed Sandpipers and a single Temminck's Stint have been recorded at the River. Whilst the River counts are usually done on a lower tide the high numbers of birds are usually recorded at the River on tides higher than 6.0m.

表3. 6 每个调查点内涉禽的物种数和鸟类的总数量。

Table 3.6 A summary of the number of species and total number of birds present at each site.

调查点编号 Site	调查次数 Number of counts	最大计数 High Count	最小计数 Low Count	物种数 Number of species
西水道港区 River	3	25,330	16,946	26
1	6	22,714	0	24
2	9	73,583	18,222	33
3	8	24,015	1,507	27
4	8	27,366	93	27
5	8	17,679	3,883	23
6	9	39,157	3,334	28
7	9	23,236	14	28
8	7	6463	100	22
9	8	12,077	1,080	19
10	9	17,319	6,522	24
11	8	16,400	3,378	23
12	9	23,092	2,391	25
13	7	1,754	744	19
14	7	13,005	1	15
15	6	22,133	3,418	24
芦苇地 Reedbeds	6	1,660	0	16

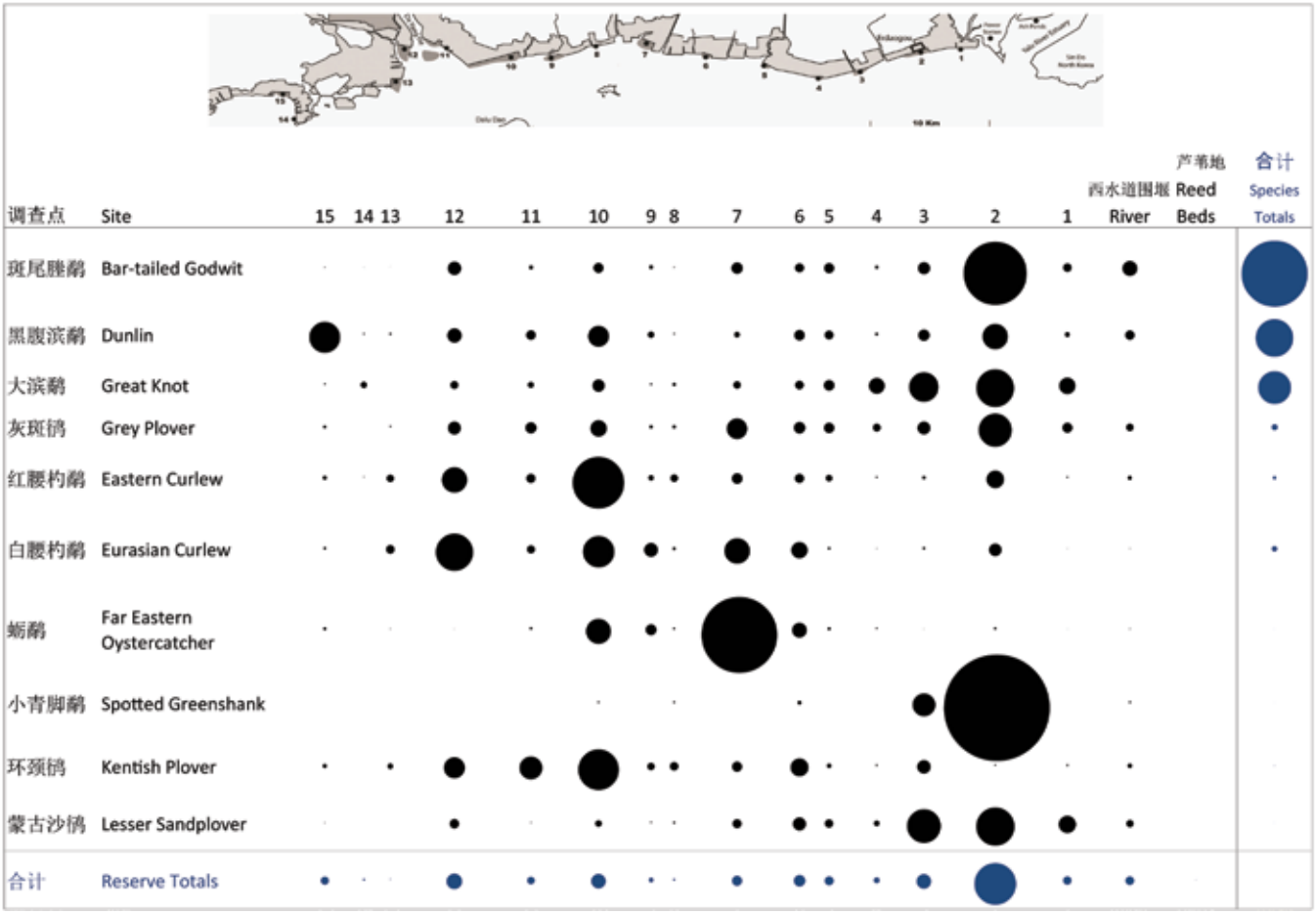


图3. 24 各个物种在每个调查点出现的比例。圆点的大小表示此调查点中该物种数量占所有涉禽总数量的比例。每一行/列都可以看出不同物种对不同调查点的利用情况。每个物种对整个保护区的利用情况归纳在最后一列以供参考。

Fig. 3.24 Proportions of a species present at each site. Size of the circle represents the percentage of the species total count using that site. Examination of the rows shows how different species use the different count sites. Circles in the final column represent the percentage of each species in the total of all counts, circles in the final row represents the proportional useage of each site.

1和2号点

2011年，David Melville在保护区外围的围堰区发现了数量可能高达55, 000只斑尾塍鹬，但是由于该区域已禁止旁人入内，所以无法进行详细计数。

鸭绿江口保护区内鸟类数量最多且物种多样性最高的区域一般是2号点，部分原因是因为这块区域的滩涂地势较周边调查点高，涨潮时最后才被潮水淹没。2号点的物种组成时常会变化，但是大部分时期的优势物种都是斑尾塍鹬。这个调查点也是大滨鹬、灰斑鸻、小青脚鹬和蒙古沙鸻的最主要休息场所，还有一定数量的黑腹滨鹬也在此停歇。

由于优势物种斑尾塍鹬迁徙过境的时间较早，所以到了5月中旬，该调查点的鸟类的数量越来越少(图3. 25)。2009年4月上旬记录到的鸟类数量非常高，是因为调查到的斑尾塍鹬的数量大量增加。与前几年的调查相比不同的是，2009年的这次调查时间比以往早，促使了鸟类数量的增加。值得一提的是，在2号点曾多次记录到濒危物种小青脚鹬(2005年5月10日2只，2006年4月21日21只，2006年4月23日24只，2008年5月11日4只，2010年4月21日9只)。在2000年5月16日还记录到了一只全球极危物种勺嘴鹬。

勺嘴鹬 *Spoon-billed Sandpiper - Bai Qingquan* 白清泉

Sites 1 and 2

The highest number of birds and the most diverse range of species counted in the reserve are usually at Site 2, partly because the mud is elevated more than nearby sites and therefore is the last area to be inundated by the tide. It is regularly dominated by Bar-tailed Godwits, although the species mix does fluctuate and it is also particularly important for Great Knot, Grey Plover, Spotted Greenshank, Lesser Sandplover and to a slightly lesser extent, Dunlin. As godwits are early migrants and the dominant species at this site, it is no surprise that the numbers using this site tail off by mid-May (Fig. 3.25). The 2009 count in early-April seems to be exceptionally high; this was due to a large increase in the count of Bar-tailed Godwits. The difference between this and previous counts is the early survey date, when larger numbers of shorebirds are present. Of particular note at Site 2 are the records of the endangered Spotted Greenshank, 2 on 10/5/2005, 21 on 21/4/2006, 24 on 23/4/2006, 4 on 11/5/2008 and 9 on 21/4/2010. There has also been a single record of the critically endangered Spoon-billed Sandpiper on 16/5/2000.

Update: In 2011 as many as 55,000 birds were roosting in the partially reclaimed areas, which are no longer in the Reserve (Melville pers. comm.). These were unable to be counted as land access was prohibited.

Site 3

The count of only 1,507 birds on 21/4/2007 at Site 3 is an anomaly as counts here usually fluctuate from around 10,000 to nearly 25,000. On this occasion the birds may have moved earlier to Site 2 before counting began. Great Knots are the most common species present, in numbers only slightly lower than at Site 2. These two sites hold 40% of the Great Knots using the reserve. Spotted Greenshank have been recorded at Site 3 on four occasions, with a flock of 3 on 16/5/2000, 1 on 10/5/2008, 4 on 16/4/2009 and 4 on 21/4/2010.

Site 4

In general the counts at Site 4 have been low, varying from 93 to 5,002 with Great Knot being the most common species. The 2010 high count of 27,366 was unusual and coincided with low counts at Site 2 and the River suggesting local movement within the reserve.

Site 5

Site 5 attracts high numbers of birds with Bar-tailed Godwit and Great Knot the dominant species. While not the most important roosting site for either species with counts of up to 17,000 birds it is still a major roost site, and the adjacent mudflats are a major feeding area for shorebirds.

3号点

在3号点，涉禽的数量通常在10,000至25,000只范围内波动，但是较为异常的是在2007年4月21日只调查到了1507只鸟。可能是因为当时在我们的调查开始前，涉禽已经提早飞去2号点。在3号点最常见的物种是大滨鹬，在此调查点栖息的大滨鹬数量仅比2号点低一点。第2和3号点内的大滨鹬数量占了整个保护区总数量的40%。另外在3号点还有小青脚鹬的4笔记录，分别是2000年5月16日3只，2008年5月10日1只，2009年4月16日4只和2010年4月21日4只。

4号点

4号点的涉禽一直都比较少，数量在93只至5002只之间波动，其中常见种为大滨鹬。2010年调查到的27,366只涉禽的记录是非常罕见的，但是在同一时间，2号点及西水道港区的鸟类数量很低，所以可能是由于涉禽在保护区内调查点间的移动造成的。

5号点

5号点内鸟类数量很多，其中斑尾塍鹬和大滨鹬是优势物种。尽管该调查点不是这两个物种最重要的高潮休息场所，但也有高达17,000只鸟的记录，所以也是涉禽主要的休息场所之一，同时附近的低潮滩也是鸟类主要的觅食地。

6号点

在6号点，黑腹滨鹬是继斑尾塍鹬之后最为常见的物种。与4号点一样，6号点2010年的调查数据较为特殊，共记录到 39,157只涉禽，在这之前最高的记录是2005年共记录到的11,046只。年际间数量差异最大的物种是斑尾塍鹬，之前6号点的斑尾塍鹬数量在2000至 3700只间波动，但是2010年记录到了16,300只(图3.26)。而其他物种的数量都变化不大。

7和8号点

第7和8号点内涉禽的数量变化较大(图3.27)。在8号点曾记录到一只小青脚鹬，这个调查点内各种涉禽的数量都相对较少，这主要是因为这个调查点的滩涂地势较低，涨潮时鸟类无法在此停留太久。常见种为大滨鹬。

9号点

9号点内鸟类物种数和总数量都很低，一共只记录到19种涉禽。常见种为斑尾塍鹬和黑腹滨鹬。自2007年后9号点内的砺鹬数量有所增加，其中2008年记录到73只，2010年记录到21只。

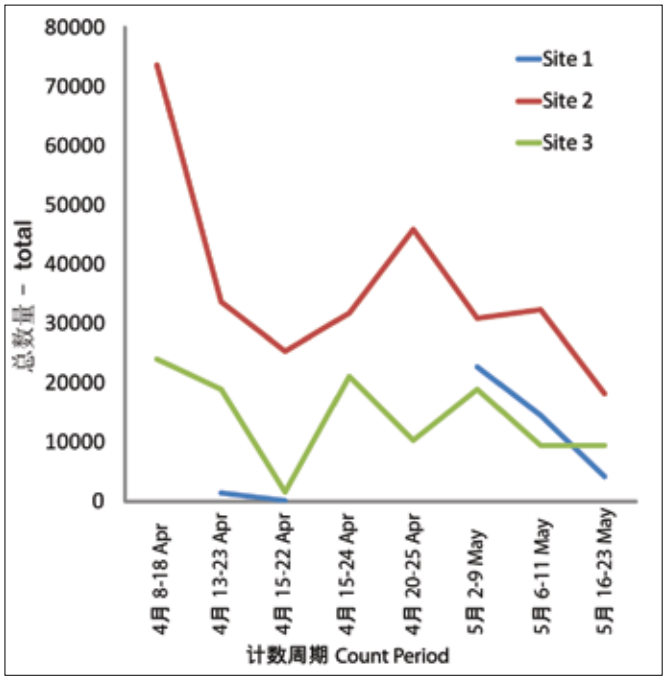


图3.25 迁徙期1、2及3号点内鸟类数量的变化。
Fig. 3.25 Counts at Sites 1, 2 and 3.

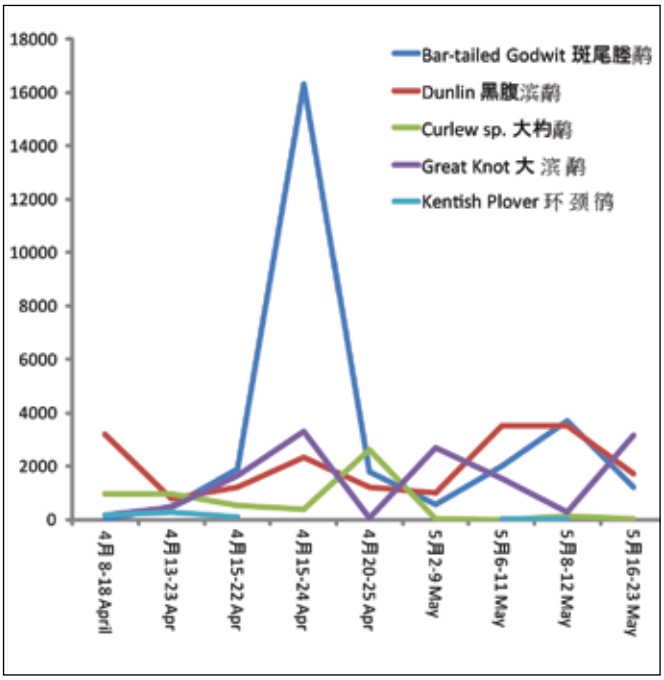


图3.26 2010年迁徙期在6号点调查到的每个物种的数量变化，其中斑尾塍鹬的数量异常的高。
Fig. 3.26 Species-by-species counts at Site 6, showing an unusually high count of Bar-tailed Godwits in 2010.

Site 6

Dunlin is the second most common species at Site 6 after Bar-tailed Godwit. As with Site 4, 2010 was an exceptional year at Site 6, with a total count of 39,157, the previous high total being 11,046 in 2005. The difference was in the numbers of Bar-tailed Godwits, 16,300 rather than the 2,000 to 3,700 that had previously been counted there (Fig. 3.26). Most of the other species show a much more consistent pattern of occurrence.

Sites 7 & 8

Numbers of birds at sites 7 and 8 fluctuate widely (Fig. 3.27). A single Spotted Greenshank has been recorded at Site 8 but other species flock sizes in general tend to be relatively small here as the level of the mud is too low to allow the birds to rest for long on the incoming tide. The most common species is Great Knot.

Site 9

Site 9 also has low total numbers and a low diversity with only 19 shorebird species recorded. The main species are Bar-tailed Godwit and Dunlin. Far Eastern Oystercatchers have increased at Site 9 since 2007 with 73 seen here in 2008 and 21 in 2010.

Sites 10 & 11

At Sites 10 and 11 Dunlin is the most common species. Site 10 also has the greatest numbers of Eastern Curlew in the reserve and high numbers of Eurasian Curlew. Good numbers of Kentish Plovers use both sites. Figure 3.27 shows that the numbers of birds using Site 10, and to a lesser extent Site 11, (Fig. 3.28) remain high in May, indicating this site is important throughout the whole migration period.

Site 12

Counts at Site 12 are highly variable (Fig. 3.28), with counts at this site particularly affected by tide height. Although the most common species are Bar-tailed Godwit, Great Knot and Dunlin, this site, like Site 10, is most important for curlews with good numbers of both Eurasian and Eastern Curlews occurring here. It is also one of the main sites for Kentish Plover.

Site 13

Site 13 is also quickly flooded by the incoming tide and has the lowest numbers of birds counted in the reserve, but as birds are observed flying into the Site 13 ponds from Site 12 it appears to be important as an additional high tide roost site for Site 12 birds. Although the diversity is low with only 19 species recorded it is remarkable as the only site where the two species of curlews rank in the three most consistently abundant species, although numbers are not high. Dunlin is the most common species.

Site 14 & 15

Generally very few birds are found at Site 14 and the species diversity is low, probably because the coast around Site 14 is

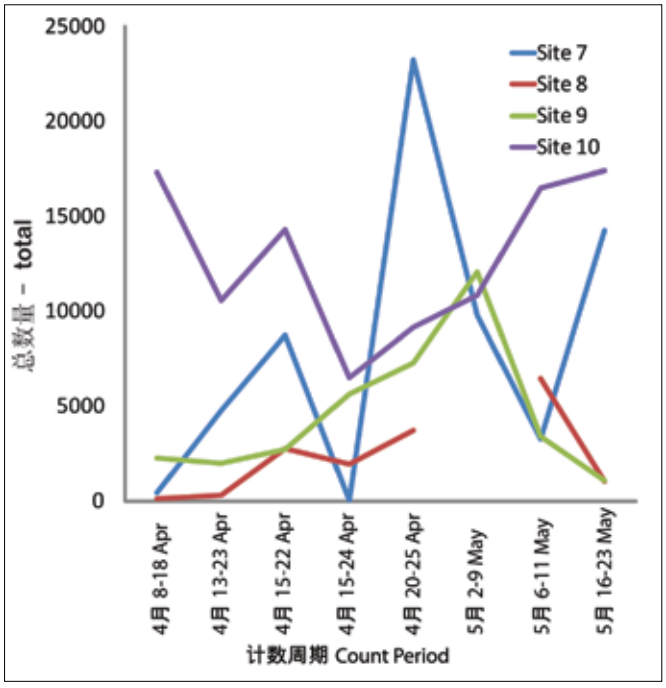


图3. 27 迁徙期7至10号点内鸟类数量的变化。
Fig. 3.27 Numbers of birds using Sites 7 to 10.

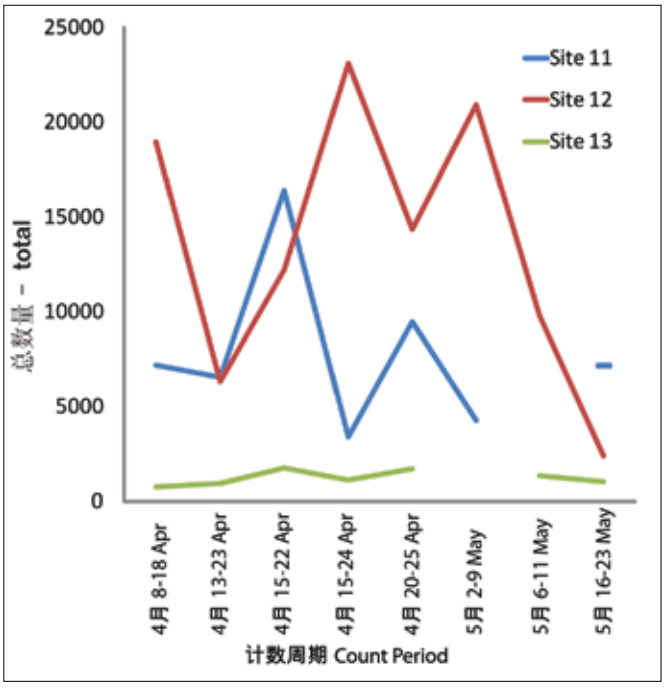


图3. 28 迁徙期11至13号点内鸟类数量的变化。
Fig. 3.28 Number of birds using Sites 11 to 13.

10和11号点

10和11号点的常见种为黑腹滨鹬。10号点内白腰杓鹬和红腰杓鹬的数量很多，其中红腰杓鹬的数量是保护区内所有调查点中最高的。这两个调查点内环颈鸻的数量也不少。如图3.27和3.28所示，10和11号点(趋势不十分明显)的鸟类数量在5月间一直较高，所以这两个位点在整个迁徙期都很重要。

12号点

12号点内鸟类的数量变化较大(图3.28)，因为这个点的调查受潮汐高度影响很大。尽管这个调查点内的最常见物种是斑尾塍鹬、大滨鹬和黑腹滨鹬，但是与10号点一样，这里还是杓鹬的重要休息场所，白腰杓鹬和红腰杓鹬的数量都很多。另外，12号点还是环颈鸻的主要休息场所。

13号点

涨潮时，13号点也会很快被潮水淹没，所以这里的鸟类数量是全保护区内最低的，但是在调查时经常会看到在12号点栖息的涉禽飞入13号点后方的人工养殖塘内，因此，13号点的重要性在于它是12号点鸟类的备用休息场所。尽管13号点内记录到的涉禽物种数很低只有19种，但是值得一提的是，这个调查点内的两种杓鹬的数量虽然不多，但一直都排在杓鹬记录数量最高的地点的前三名。最常见的物种为黑腹滨鹬。

14和15号点

14号点内的鸟类种类和数量都非常低，这主要是因为14号点的潮间带为礁石海岸，不适宜涉禽栖息。在14号点的最大计数是在2005年5月进行的调查(图3.29)，那时15号点还未被划分出去，而记录到的涉禽都栖息于现在15号点所在的区域。自15号点被划分出去后，在14号点记录到的鸟类数量非常少，只有在一些人工养殖塘内的记录。14号点内的最常见种为红嘴鸥*(Chroicocephalus ridibundus)*。

自前往15号点的交通较为便利且其被单独列为一个调查点后，在该点调查到的鸟类有增加趋势。这个调查点的优势种一直以来都是黑腹滨鹬(占全部涉禽总数量的74%－93%)，所以也可以算作在保护区内黑腹滨鹬最重要的休息场所。而其他的物种都不太常见。

芦苇地

在芦苇地内调查到的涉禽数量较低且不稳定。这是由于每年芦苇地内灌水的时间都不一样，我们每次调查时的情况也不一致。在芦苇地里较为常见的物种只有林鹬。2004年，在刚灌水的芦苇内地记录到了1169只小杓鹬，但这也只是一次偶然事件。

Keith Woodley

rocky and generally unsuitable for shorebirds. The unusually high count for May 2005 (Fig. 3.29) was made before Site 15 had been split off and counted separately and these birds are thought to have been using the area that is now Site 15. Since Site 15 has been counted separately the numbers at 14 have been very low, with birds counted in ponds only. The most common species present at Site 14 is Black-headed Gull *(Chroicocephalus ridibundus).*

Since better access allowed Site 15 to be counted separately more birds have been found there. This site is consistently and strongly dominated by Dunlin (between 74% and 93% of all the birds counted) and it is marginally the most important site for them in the reserve. Other species are not common here.

Reedbeds

The numbers of shorebirds using the reedbeds are low and variable. This is because the counts may or may not coincide with the times the reedbeds are flooded, which varies from year to year. The only species to be regularly recorded in high numbers is Wood Sandpiper. In 2004, 1,169 Little Curlew were seen in the newly flooded reedbeds but this may have been an opportunistic event.

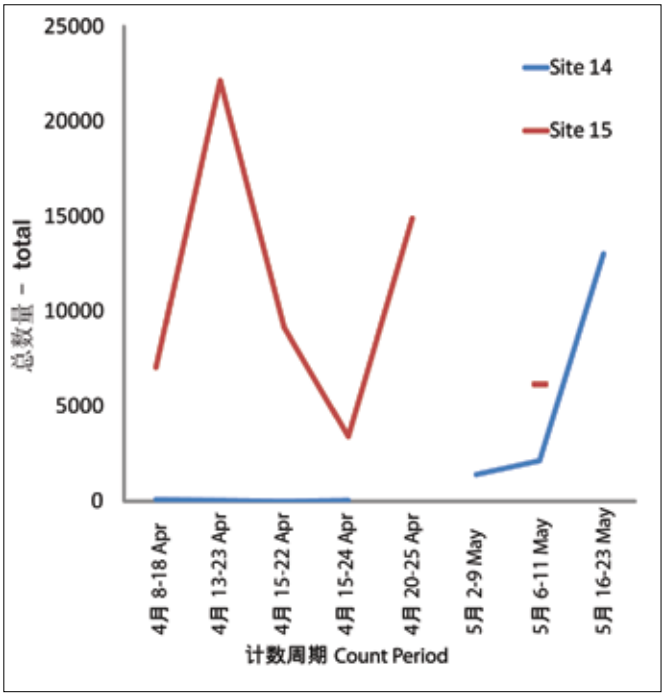


图3. 29 迁徙期14和15号点内鸟类数量的变化。14号点内鸟类数量较高的几次调查都是在15号点被划分出来之前进行的。

Fig. 3.29 Counts at Sites 14 and 15. High counts of birds at Site 14 only occurred before Site 15 was counted separately.

佩戴四种颜色旗标的鸟 *Four colour-flagged birds in New Zealand - Brian Chudleigh*

黑腹滨鹬，大滨鹬 *Dunlin & Great Knot - Jan van der Kam*

4. 讨论

我们的调查数据反映了鸭绿江口涉禽的分布格局及每个调查点的栖息地利用情况，但这仅仅是个初步研究。未来还需要更多的研究工作来了解这里的栖息地及涉禽对它的利用情况，同时还要加强在5月份的调查。由于在南迁时期从未在鸭绿江口做过全面的鸟类调查，所以这个区域作为南迁鸟类迁徙补给地的功能还不是很清楚，但是卫星跟踪的数据显示，一些斑尾塍鹬 *menzbieri* 亚种的个体会在南迁时在鸭绿江口停歇。通常，鸟类的休息场所都是靠近它们的觅食地(Rogers *et al.* 2006a, 2006b)，所以我们也希望现有的数据也可以反映鸟类觅食地的分布情况，然而由于鸟类会在调查点间移动，因此还需要进行涉禽的摄食生态学的研究以及全面的底栖动物调查。

通过以上的调查结果，我们对鸭绿江口保护区和周边地区对鸟类的重要性，以及在这里栖息的鸟类所面临的威胁已略知一二。

4.1 鸭绿江口对于涉禽的特殊意义

对于一些长距离迁徙的涉禽来说，黄海地区的战略意义远不仅仅只是处于东亚——澳大利西亚迁徙路线上的中间位置。位于黄海北端的鸭绿江口保护区是很多涉禽在到达北边繁殖地前可以补给能量的最后一站。较之繁殖地和越冬地之间的10,000公里距离，对于不同的物种及种群，鸭绿江口保护区到它们繁殖地的距离范围为2000公里至7000公里，这也就意味着，这些鸟可以在抵达繁殖地后，体内仍还储备着一定的能量为开始繁殖做更好的准备。同时，鸭绿江口保护区内的鸟类密度远高于黄海地区的其他地点也表明，鸭绿江口的重要性不仅仅只在于其地理位置，该区域还为鸟类提供了必需的食物及高潮时的休息场所。

From Mark Barter's PowerPoint - Photographers unknown

图4.1　每种涉禽都有各自的觅食方式。
Fig. 4.1 Different shorebirds feed in different ways.

红腰杓鹬 *Eastern Curlew - Bai Qingquan* 白清泉

4. Discussion

The data provided show interesting patterns in both species and site use, but they are just a beginning. To fully understand this area and the shorebirds that use it a lot of work remains to be done. Much of May has yet to be surveyed. There is little information on the value of the reserve as a staging site during southward migration as no full surveys have been undertaken, but satellite tracking data show it is a stopover site for some *menzbieri* Bar-tailed Godwits. Generally waders roost close to their feeding grounds (Rogers *et al*. 2006a, 2006b) and so it is to be expected that the relative numbers recorded by the counts reflect the distribution of feeding birds, however there is movement between the sites so work on the feeding ecology of the shorebirds is required and a comprehensive benthic survey is essential.

With this caveat there is now much that can be said about the Yalu Jiang Estuary Wetland National Nature Reserve and the adjacent areas, why it is important, and what threats are facing the shorebirds that use the region.

4.1 What makes Yalu Jiang Estuary so special for shorebirds?

The Yellow Sea is strategically sited more than halfway along the EAAF flyway for the longest travellers, and the YJNNR, located at the northern end of the Yellow Sea, is the last opportunity for many birds to feed before heading for their northern breeding grounds. Compared with flights of up to 10,000 km from non-breeding grounds, the distance from the YJNNR to most breeding areas ranges from 2,000 to 7,000 km, depending on the species and population, meaning birds can arrive at their destination with reserves of fuel. This in turn, means they are better prepared for the start of the breeding season. But it is the concentration of birds in the YJNNR compared to other locations in the Yellow Sea that indicates it is more than just its geographical location that underlies the reserve's importance. Waders need food and high tide roost sites, both of which have been found here.

4.1.1 Mudflats

Most of the shorebirds using the YJNNR feed on the tidal mudflats. These have been formed by sediment and nutrients washed down major rivers particularly the Yalu River (Yuan *et al.* 2001). The sediment falls out according to the local hydrology, creating various types of mudflats that each contains different quantities and types of food. Sediment loads have been halved since dams were built along the Yalu River. The productivity of the YJNNR mudflats is easily seen not only in the vast quantities of birds that they can support but the large numbers of people they feed, evidenced by the hundreds of people picking shellfish off the mudflats and hundreds of small inshore fishing boats that work along the coast.

Each species of shorebird uses the food resource in a slightly different way. The most common species in the reserve, Bar-tailed Godwit, feeds largely on worms, while Great Knots feed on bivalve molluscs, which they swallow whole. The shorter bills and smaller size of Dunlins mean that they specialise on smaller worms and crustaceans close to the surface and the long curved bills of curlews allow them to feed on worms and crabs deep in their burrows. Grey Plover have large eyes and watch for movement. Oystercatchers break open large shellfish to gain access to the flesh inside. (Fig. 4.1).

4.1.1 潮间带滩涂

在鸭绿江口保护区内，大多数涉禽都是在潮间带滩涂上觅食的，这些滩涂是由河口上游的河流，特别是鸭绿江所携带的沉积物及营养物质堆积而成(Yuan *et al.* 2001)。在每个地点不同的水文特征影响下，不同的沉积层形成了多样化的滩涂，每种滩涂所提供的食物的类型和数量都不相同。但是沿鸭绿江修建的一些大坝使得输入鸭绿江口的沉积物减少了一半。鸭绿江口保护区的滩涂湿地不仅仅为鸟类提供了丰富的食物，同时也抚育了当地的人民，在滩涂上有几百位渔民捡拾贝类，沿着海岸线还有上百只小渔船在浅海作业。

每种涉禽对食物资源的利用方式都有些许差别。鸭绿江口保护区内最常见的物种斑尾塍鹬主要取食沙蚕，而大滨鹬主要取食双壳类软体动物，并且可以整个吞下。黑腹滨鹬的体型较小且喙较短，它们只取食接近地表的小沙蚕和甲壳类动物，而喙较长的杓鹬则可以取食藏匿于洞穴深处的沙蚕和甲壳类动物。灰斑鸻的眼睛较大，它们会追逐在地表行动的底栖动物。砺鹬则可以弄碎并打开双壳类的壳，直接取食壳内的肉(图4.1)。

在不同的调查点内涉禽的种类和数量都不相同，这或许可以反映这些休息场所及作为替补的休息场所的质量，以及周边滩涂底栖动物的种类及产量。在鸭绿江口，不同的物种对不同的区域都表现出明显的偏好，大部分的斑尾塍鹬和大滨鹬都是在保护区东部被记录到的。黑腹滨鹬在保护区内的分布较为均匀，但是，在没有其他的物种经常出现的15号点，黑腹滨鹬却是那的优势物种。灰斑鸻在12号点以东区域的分布也较为平均。大部分的杓鹬和环颈鸻是在10号点和12号点间记录到的。之前的调查发现砺鹬的分布主要集中在7号点，不过最近在6号到10号点间都有少量的砺鹬记录。小青脚鹬的记录几乎都出现在2号点和3号点，可能是和它们偏好的觅食地有关。未来涉禽摄食生态学的研究和底栖动物的进一步调查可以帮我们了解这些鸟类为何会如此利用鸭绿江口潮间带湿地。

4.1.2 休息场所

当潮水将滩涂淹没后，涉禽便无法在那里觅食，这时它们需要寻找被捕食概率最低且干扰很少的地方休息。它们会在高潮期整理羽毛、睡觉和消化食物。这样它们才可以充分利用低潮期的时间，不分昼夜的在滩涂上觅食。

涉禽偏好开阔、视野良好，最好可以避风的休息场所(Rogers *et al.* 2006; Rosa *et al.* 2006; Peters & Otis 2007)。一个高质量的休息场所可以让鸟尽量减少能量消耗，因为躲避捕食者、在寒风中保持体温，或者受干扰时的飞行都会消耗能量，而这些能量的功能本是用以消化食物、生长新羽毛或是通过增加体重为下一段的迁徙飞行储存的能量。例如，Rogers *et al.*(2006b)在澳大利亚西北部的研究发现若大滨鹬在每个高潮期都多花30分钟进行“警戒飞行”，它们的能量消耗值将上升13.3%。对于那些想尽快增加体重并早日飞往繁殖地的鸟类而言，这种能量消耗是必须要避免的。

在鸭绿江口保护区内，涉禽首先选择的休息场所通常是滩涂上地势较高且尽量接近水线的土丘。滩涂上的休息场所通常都符合前面所列的高质量休息场所的标准：最小的人为干扰，没有捕食者的藏匿处及海防大堤提供的一小部分

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The different numbers and variety of birds found at the different count sites probably reflect the quality of each as a roost or sub-roost and the nature of the nearby mud, the kinds of animals that live in it and its productivity. The different shorebird species show clear preferences for different parts of the reserve, the majority of the Bar-tailed Godwit and Great Knot counted are found at the eastern end of the reserve. Dunlin are more evenly spread throughout the reserve, however, no other species spreads regularly into Site 15, thus accounting for the dominance of Dunlin at that site. Grey Plover are also evenly spread but only as far as Site 12. The majority of curlews and Kentish Plover can be found between Sites 10 and 12. Oystercatchers were once very concentrated at Site 7, and are now recorded at lower numbers between Sites 6 and 10. While Spotted Greenshanks are present only in low numbers sightings are almost all from Sites 2 and 3. It seems likely that this is related to the preferred feeding areas of the species. Studies of feeding ecology and benthic fauna in the tidal flats would enable a much better understanding of why the shorebirds use the reserve as they do.

4.1.2 Roosts

When the tide covers the mudflats birds are no longer able to feed. At this time they need to find a place with a minimum amount of predation and disturbance to roost. They spend the high tide period preening, sleeping and digesting their food. This allows them to feed throughout the low tide period whether it occurs by day or night.

For roosting, shorebirds prefer clear open spaces with good visibility, possibly with some protection from prevailing winds (Rogers *et al.* 2006; Rosa *et al.* 2006; Peters & Otis 2007). A good roost site will require that the birds spend a minimum of energy while they are there, as avoiding predation, maintaining body temperatures in cold winds, or flying in response to disturbance all incur energy costs, diverting energy from functions such as digesting food, growing new feathers, or gaining weight for their next migration flight. One example of this comes from Northwest Australia where Rogers *et al.* (2006b) found that Great Knots that spent an extra 30 minutes per tidal cycle in "alarm flights" increased their energy usage over that period by 13.3%. For birds that are attempting to quickly put on weight for their journey to the breeding grounds these sort of energy costs must be minimised.

At the YJNNR the first choice shorebird roost sites are usually raised mud banks on the tidal flats, as close to the water as possible. These mudflat roost sites usually fit the criteria outlined above well, with a minimum of human disturbance, no place for predators to hide, and often a small amount of protection from the elements due to the seawall. On smaller high tides this is possible but as tides increase in height the birds are pushed closer to the seawall, where disturbance and predation risks are higher. If the tide rises high enough it will cover the mudflats entirely, forcing the shorebirds to leave the mudflats and find inland locations to settle.

Once they are forced off the mudflats most shorebirds at the YJNNR prefer to roost on islands of mud remaining in partially filled aquaculture ponds. As ephemeral sites, these are not areas where ground-predator numbers can build up and as they are islands direct human disturbance is still low, although shorebirds will often respond in alarm to people walking along the edge of the ponds. If no islands are available shorebirds will often roost on the sides of the ponds provided they are clear of vegetation. Curlews, which are more wary birds, will often be on the tops of these banks, while species such as Great Knot or Grey Plover are often seen on the sides, possibly sheltering from the wind as found by Rosa *et al.* (2006) at sites in the USA.

No natural roost areas in saltmarsh, shellbanks or sandbanks now occur at YJNNR as very little of the natural coastline remains, and that which does is largely the rocky coastal area, unsuitable as a roost site. The aquaculture ponds have therefore become a critical resource for migrating shorebirds.

Rogers *et al.* (2006) showed that in Northwest Australia if shorebirds are forced to "commute" to a suitable roost site the mudflats are less likely to be used for feeding. This is related to energy use: the further birds must travel to a roost the more energy they must expend, and at some point the food available does not cover the energy costs of that flight on top of the other energy needs of the birds.

The reason that shorebirds come to the Yalu Jiang Estuary is to increase their energy reserves as fast as possible, allowing them to reach their breeding sites at the best time to nest and raise their young. The lack of safe roosting sites forces them to waste energy avoiding disturbance or travelling to more distant roost sites. Birds that are unable to reach their breeding ground in good condition are less likely to raise chicks, and may incur increased mortality (Burton *et al.* 2006).

4.2 YJNNR - a staging site in context

Around the world there are a number of 'mega sites' that are used by shorebirds as refuelling sites on their migrations. It is only when comparing the Yalu Jiang Estuary to these well known, important sites that the true importance of this site can be seen. While not as large as some of the largest staging sites the estimated 250,000 birds using the reserve make it one of the top shorebird staging sites in the world.

More importantly YJNNR can be compared to other sites within its own context, the EAAF. Most of the large staging sites in this flyway are based around the shores of the Yellow Sea, but there are also some further north, around the shores of the Sea of Okhotsk.

避风处。在小潮的高潮期，这种理想的状况是可能实现的，但是随着潮汐高度的增加，涉禽被潮水赶到海堤边，人为干扰和被捕食的风险就非常大了。如果潮水非常高以至于淹没了所有的滩涂，涉禽就要离开潮间带并在内陆寻找落脚的地方。

在鸭绿江口，当涉禽被迫离开滩涂后，它们喜欢在灌了一部分水的人工养殖塘中的“小岛”休息。作为一块短暂存在的裸地，这些小岛中地面捕食者数量较少，尽管涉禽也会常常被养殖塘边经过的人惊飞，但总体来讲，人为干扰还是算较低的。如果连这样的岛都找不到，涉禽会在没有植被覆盖的养殖塘边休息。性情机警的杓鹬会常常站在塘边的土埂上，而大滨鹬或是灰斑鸻则会在塘边。根据Rosa *et al.*（2006）在美国的研究结果，推测它们可能是为了避风。

而在盐沼、贝壳埂或沙丘中也未发现涉禽的自然休息场所。所以对迁徙涉禽而言，人工养殖塘的作用也非常关键。

Rogers *et al.*（2006）在澳大利亚西北部的研究指出，如果涉禽的觅食地和休息场所的距离相隔较远，它们可能不会在这一处觅食的觅食。因为这和能量的消耗有关，休息地和觅食地离得越远，鸟类来回飞行要消耗的能量就越多，到了一定的程度，鸟类从食物中获取的能量已经无法支持来回飞行所需的能量，就更无法满足其他方面的能量需求了。

涉禽飞到鸭绿江口的目的是为了尽快补充和储备能量，这样它们才可以在最佳时间达到繁殖地筑巢及哺育后代。若中途补给地上缺少安全的休息场所，会使它们浪费更多的能量去躲避干扰或是飞往距离更远的休息场所。如果涉禽在达到繁殖地的时候身体状况不好，它们将无法成功繁殖，并导致死亡率上升(Burton *et al.* 2006)。

4.2 鸭绿江口保护区—承上启下的迁徙补给地

全球范围内有很多个支持涉禽在迁徙途中补给能量的“大型驿站”。当与一些著名的迁徙补给地比较之后，鸭绿江口的重要性更为凸显。尽管鸭绿江的面积没有最大的迁徙补给地大，但是每年估计有250,000只涉禽停歇的记录已经让鸭绿江口成为世界上最重要的迁徙补给地之一。

鸭绿江口保护区比其他迁徙补给地更为重要的另外一个原因是鸭绿江口在东亚-澳大利西亚迁徙路线上还起到了承上启下的作用。迁徙路线上，大多数大型的迁徙补给地都在环黄海地区，但是还有一些在更北方的鄂霍次克海(Sea of Okhotsk)的海岸边。

黄海地区对于在西伯利亚和阿拉斯加繁殖，且在新西兰、澳大利亚和东南亚越冬的涉禽来说是至关重要的栖息地。这里有超过20,000平方公里的滩涂，是世界上滩涂面积最大的地区。2002年研究者曾估计，每年北迁时期利用黄海地区的滩涂的涉禽超过2百万只(Barter 2002)。但是很多种类的涉禽种群数量都在下降，且不同地点的研究结果都表明迁徙期经过黄海地区的涉禽数量在降低逗号可以删除，“如”该放到括号内，(Moores *et al.* 2008)。

自从韩国的新万锦围垦工程导致该地区的河口滩涂被破坏后，鸭绿江口保护区成为了黄海地区记录到涉禽数量数量最高的区域，迁徙路上约12.5%的涉禽在利用保护区内的栖息地。表4.1列出了东亚-澳大利西亚迁徙路线上鸟类数量较多的迁徙补给地，而这些地区也都已受到了经济发展的威胁。有至少250,000只涉禽迁徙经过的鸭绿江口保护区显然是保证这条迁徙路线成功运转的必要组成部分。

4.3 国际重要意义

中国是《关于特别是作为水禽栖息地的国际重要湿地公约》简称《拉姆萨尔湿地公约》)的缔约国。公约制定了评断国际重要湿地的9条标准，而鸭绿江口保护区符合其中4条标准，它们是：

标准2：
如果一块湿地支持着易危、濒危、极危物种或者受威胁的生态群落，就应被认为具有国际重要意义。

作为小青脚鹬的迁徙补给地，鸭绿江保护区内经常可以记录到这种濒危物种 (BirdLife International 2008)。小青脚鹬全球总种群数量少于1000 只，而在鸭绿江口就曾有高达24只的记录，足可见鸭绿江口的重要性。另外，每年鸭绿江口的易危物种大滨鹬和红腰杓鹬的数量也都超过了国际重要意义标准。因为新万锦河口的栖息地被破坏，大滨鹬和红腰杓鹬的种群数量正在下降，所以最近国际自然保护联盟将这两个物种的受胁等级提升

The Yellow Sea is a critically important area for birds that breed in Siberia and Alaska, and spend their non-breeding period in New Zealand, Australia and Southeast Asia. With more than 20,000sq km, it is the largest region of mudflats in the world. It was estimated in 2002 that, during the northern migration, the mudflats of the Yellow Sea supported more than two million shorebirds (Barter 2002). Many shorebirds are declining and based on individual site studies it now seems likely that this number is lower (eg. Moores *et al.* 2008).

Since the destruction of the estuaries associated with Saemangeum, South Korea, the YJNNR is now the site with the highest recorded numbers of shorebirds in the Yellow Sea, with an estimated 12.5% of the shorebirds on the flyway using the area. Table 4.1 shows the locations of staging areas that hold large numbers of shorebirds on the EAAF; each of these sites is threatened by development. With at least 250,000 shorebirds passing through the YJNNR it is obviously an essential part of the successful functioning of the flyway.

4.3 International Significance

China is a Contracting Party to the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention). The Convention recognises nine criteria that identify a wetland as being of

表4. 1 涉禽在东亚–澳大利西亚迁徙路上的大型迁徙补给地。(数据来源Barter 2002, 凡注明除外：**Carey *et al.* 1998: +Butler *et al.* 2001: ++Ma *et al.* 2002: ^Yi 2004).

Table 4.1 Largest EAAF staging sites for shorebirds (Information from Barter 2002 except where marked: **Carey *et al.* 1998: +Butler *et al.* 2001: ++Ma *et al.* 2002: ^Yi 2004).

地点 Sites	最大计数 Highest Count	估计值 Estimate
美国阿拉斯加育空–柯斯科克溫三角洲 Yukon-Kuskokwim Delta, Alaska, USA		1,000,000 - 2,000,000
俄罗斯莫罗舍奇纳亚河口 Moroshechnaya Estuary, Russia		400,000+
中国丹东鸭绿江口湿地国家级自然保护区鸭绿江西水道 Yalu Jiang Estuary Wetland NNR & River, Liaoning, China	176,535*	250,000*
俄罗斯尚塔尔群岛 Shantar Islands, eastern Russia		200,000
中国山东省黄河三角洲国家级自然保护区 Huang He NNR, Shandong, China	130,122	>200,000
中国江苏省盐城国家级珍禽自然保护区 Yancheng NNR, Jiangsu, China	111,285	-
中国天津沿海地区 Tianjin Municipality, Hebei, China	73,553	>100,000
中国辽宁凌河口 Linghekou, Liaoning, China	34,445	>50,000
中国辽宁凌河口 Chongming Dao, Shanghai, China	24,770++	-
中国香港米埔 Mai Po, Hong Kong SAR, China		68,000**
辽宁双台河口国家级自然保护区 Shuangtai Estuarine Wetland NNR, Liaoning, China	63,641	>100,000
中国江苏省东沙 Dong Sha, China	72,584	>100,000
韩国牙山湾 Asan Man, South Korea		74,000^
韩国南阳湾 Namyang Man, South Korea		45,000^

为“易危”(IUCN 2010a, 2010b)。

标准4：
如果一块湿地支持着动植物物种生活史中的一个关键阶段，或者在恶劣生存条件下为它们提供庇护场所，就应被认为具有国际重要意义。

鸭绿江口保护区是涉禽重要的迁徙补给地。

标准5：
如果一块湿地定期栖息着2万只或更多的水禽，就应被认为具有国际重要意义。

在鸭绿江口，鸟类调查的最大计数是176,535只，同时估计在每年4-5月有近250,000只涉禽迁徙途经这里。

标准6：
如果一块湿地定期栖息着一个水禽物种或亚种某一种群1%的个体，就应被认为具有国际重要意义。

在鸭绿江口，有14种涉禽的数量超过了东亚-澳大利西亚迁徙路线上种群总数的1%。特别是斑尾塍鹬有38次的记录超过1%标准，白腰杓鹬有13次，红腰杓鹬18次，大滨鹬有19次。

另外，在鸭绿江口有些物种并不是常见种，这里只是它们紧急条件下的迁徙停歇地。强风或恶劣的天气常常会导致候鸟无法继续沿迁徙路线飞行，这时它们可能会临时降落在紧急停歇地。鸟类会寻找距离最近适合的栖息地临时停歇，或是干脆返回之前经过的一个迁徙补给地(Gill unpubl. data)。对在西非毛里塔尼亚越冬并飞往德国瓦登海的红腹滨鹬的研究结果也证实了这一点(Shamoun-Baranes *et al.* 2010)。所以，对于如红腹滨鹬和翻石鹬这样在鸭绿江口只有一次计数超过国际重要意义标准的物种而言，鸭绿江口可能是它们的紧急条件下的迁徙停歇地。

显然，对于那些每年都会来到鸭绿江口保护区的物种而言，这里是他们赖以生存的栖息地；但对于几年才会出现在保护区内一次的物种来说，尽管它们没有表现出对鸭绿江口的明显依赖性，但是这里的栖息地对它们仍然十分重要。在5月鸭绿江口作为紧急条件下迁徙停歇地的概率要大于4月份，因为这时很多鸟都已经在其他迁徙补给地储备好能量且在前往繁殖地途中飞过鸭绿江口。未来需要在5月份进行有针对性的调查以确认有多少鸟类将鸭绿江口做为紧急条件下的迁徙停歇地，但是这可能需要长时间的调查来实现。

4.4 鸭绿江口面临的威胁

很明显，对于那些从澳大利西亚、东南亚及东亚迁徙到中国、蒙古、俄罗斯和阿拉斯加的繁殖地的涉禽而言，鸭绿江口保护区及其邻近的鸭绿江西水道是极其重要的。如果没有这个能量补给站，许多涉禽都无法成功完成它们的旅程。

为了在每次迁徙开始前用最短时间补充好能量，几千年来涉禽不断调整它们的迁徙时间，以便更好地利用特定的停歇地内丰富的食物资源。能量补给地就像是一条长链条上的每一个环，环环相扣完整无缺才能保证链条发挥功能。在迁徙路线上，破坏任何一个重要的能量补给地都会导致候鸟的生活史周期被打乱，这种影响甚至是致命的。在一个国家内，这些不利的变化产生的全部影响可能不会马上显现，可能只有当鸟类到达繁殖地或是越冬地才能被发觉。

在北迁时期，涉禽可能只在迁徙补给地停留4至6周，但是以下两个近期的研究都充分表明迁徙补给地对涉禽至关重要，遗憾的是，这两个研究地点都因人类活动影响而已不适宜鸟类的栖息。

美国特拉华州海湾是美洲涉禽重要的迁徙补给地，当地的鸟类迁徙期也是大量美洲鲎上岸产卵的季节，而在此时停歇的涉禽都以美洲鲎的卵为食物。但是由于人类过度捕捞美洲鲎，该物种数量迅速下降，同时也减少了鸟类的食物资源。对红腹滨鹬产生的最直接影响是因鸟类身体状况变差而导致的死亡率急速增加，在北极的繁殖率降低，种群内幼鸟的补充率较差。在南美越冬地的调查显示，红腹滨鹬的种群数量从100,000 - 150,000只下降到只有18,000 - 33,000只—损失了近80% (Niles *et al.* 2010)。

韩国围垦导致大面积的滩涂湿地丧失，也使得在此补给能量的大滨鹬数量下降，其全球种群总数量下降了近25% (Moores *et al.* 2008)。

要衡量这些大尺度的栖息地变化产生的巨大影响还是较为容易的，而很多小一些的变化累积起来可能会有同样巨大的影响。Goss-Custard *et al.*(1995)的研究表明，越冬地内不断积累的栖息地变化最终会导致砺鹬的数量下降。Burton *et al.*(2006)也指出，当红脚鹬被迫离开最适越冬地而转移到临近的栖息地后，随后几年它们的

international importance. These include:

Criterion 2
A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 4
A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Criterion 5
A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6
A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Yalu Jiang Estuary Wetland National Nature Reserve meets all four criteria for recognition as a Wetland of International Importance.

Criterion 2
The reserve is a regular staging site for the 'Endangered' Spotted Greenshank (BirdLife International 2008). With a world population of less than 1,000 individuals the counts of up to 24 individuals at the Yalu Jiang Estuary highlight the importance of this site. In addition Great Knot and Eastern Culew both use the reserve in internationally important numbers each year. The IUCN recently upgraded the threat status of these two species to 'Vulnerable' due to rapid population declines caused by the habitat destruction that occurred at the Saemangeum estuaries (IUCN 2010a, 2010b).

Criterion 4
YJNNR is used by shorebirds as a critical staging area on migration.

Criterion 5
This criterion is easily met with a high count of 176,535 birds, and an estimated 250,000 individuals passing through the reserve in April and May.

Criterion 6
14 species of shorebird have been recorded in numbers that exceed the 1% threshold for a site to be considered important for that species. In particular, counts of up to 38 times the 1% criterion for Bar-tailed Godwits have been recorded, 13 times the value for Eurasian Curlews, 18 times the value for Eastern Curlews and 19 times the value for Great Knots.

In some cases it seems likely that the counts of a species at the Yalu Jiang Estuary are not regular and that the migrating groups may be using the area as an emergency stopover site. Emergency stopovers occur when the migrating birds are unable to continue along their path, often due to high winds or bad weather. The birds will then stop at the nearest available site, or indeed return to a previous site (Gill unpubl. data). This is a strategy recognised in Red Knots as they move from their wintering grounds of Mauritania, West Africa to the Wadden Sea in Germany (Shamoun-Baranes *et al.* 2010). In YJNNR it appears likely that some of the one-off counts of international significance, such as the Red Knot or Ruddy Turnstone could be records of a flock using the area as an emergency stopover site.

While it is clear that species using the reserve every year rely on the area, it is less obvious, but no less true, that other species use the reserve only every few years. Emergency stopovers would be better detected in May than April, as this is when birds would have finished refuelling elsewhere and be moving through. Further surveys in May, determining how many birds use the reserve in this way, would be a specific study which by its nature would take some time.

4.4 Threats at Yalu Jiang Estuary

It is clear that YJNNR and the Yalu River West are incredibly important to shorebirds migrating from Australasia, Southeast Asia and East Asia to their breeding grounds in China, Mongolia, Russia and Alaska. Without this refuelling site many of these birds may fail to complete their journey.

Shorebirds have fine-tuned their long migrations over many millennia to take advantage of very specific sites that provide the ideal types of food in sufficient quantity to enable them to refuel in a short time before continuing their migration. Refuelling sites are like links in a chain with each link needing to be intact for the chain to work. Destroy a key shorebird refuelling site and their annual cycle is disrupted, possibly fatally. The full impact of detrimental changes in one country may not be immediately obvious and may only be seen once birds arrive in the breeding or non-breeding grounds.

Staging sites may be used for only about 4 to 6 weeks on the northward migration, however their vital importance to shorebirds has become clear in two recent cases where human activities have made habitats unsuitable for them.

At Delaware Bay, USA, staging shorebirds congregated in large numbers to feed on the eggs of Horseshoe Crabs that came ashore in vast numbers to spawn just when the migrating birds passed. Human overharvesting of the crabs caused their numbers to decline quickly to low levels, thus reducing the food available to the birds. The immediate impact of this on Red Knots was a loss of body condition followed by dramatically reduced adult survival, lack of productivity on

死亡率一直在增加。
在鸭绿江口栖息的涉禽也面临着若干迫切的和潜在的威胁。

4.4.1 围垦

由于韩国新万锦湿地的围垦行为，其作为亚洲地区支撑东亚–澳大利西亚迁徙路线上涉禽数量最多的停歇地的功能已经丧失，中国丹东鸭绿江口湿地成为东亚–澳大利西亚涉禽北迁途中，亚洲地区支撑涉禽停歇数量最多的停歇地也是最为重要的停歇地。

保护区沿海的滩涂是迁徙涉禽在保护区觅食的场所，沿海防护大堤以北的虾塘及水田是迁徙涉禽在高潮时的停歇场所。保护区的沿海防护大堤修建于上个世纪八十年代左右，其功能是保护大堤内的虾塘和水田以及沿海乡镇部分村庄住宅的安全。保护区内的虾池大部分修建于三、四十年前，由于没有迁徙涉禽的考察数据对比，无法说明虾池的围垦对迁徙涉禽的影响。但需要明晰的是大规模的滩涂围垦行为势必会对保护区内的涉禽产生影响，因此应该慎重开展对滩涂的围垦行为。

4.4.2 人为干扰

人为干扰是影响鸟类利用迁徙补给地的一个有长期影响的限制因子。Pfister *et al.* (1992)认为，在美国普利茅斯海滩(Plymouth Beach)，人为干扰是导致涉禽数量长期下降的一个潜在原因。Burger 等 (2004)在美国特拉华州的研究也明确指出，人为干扰减少了鸟类觅食的时间，而在迁徙补给地觅食时间的减少会导致涉禽无法为继续迁徙储备足够的能量。另外一些模型研究结果还表明，强度较小但发生较频繁的干扰累积产生的负面影响要比次数较少的大规模干扰严重得多(West *et al.* 2002; Stillman *et al.* 2007)。

在鸭绿江口，不论涉禽是在觅食地还是在休息场所，它们都会受到人为干扰。随着当地人口数量增长所带来的压力，人为干扰的程度也在逐渐增加。人为干扰将影响到保护区未来能否支持现有的涉禽数量，这需要进一步的研究。

人鸟共同利用滩涂

在鸭绿江口，渔民经常在滩涂上捕捞贝类、虾及其他无脊椎动物。这类滩涂作业是当地居民主要的生产生活方式，已经持续了很长一段时间，但是还未进行过详细的研究来分析滩涂作业对本地海洋生物的影响。尽管涉禽看起来还能应对这种“互不来往”的干扰，但是在一些贝类养殖的区域，渔民偶尔会多种方式惊吓鸟类以防止它们取食贝类。不过这种行为是有地域性的，只在小范围地区发生。人类和鸟类之间是否存在强烈的食物竞争还需要进一步的研究来证实。

Adrian Riegen

their Arctic breeding grounds and poor recruitment of young birds into the population. Counts in the non-breeding sites in South America showed that the population has dropped from between 100,000 and 150,000 to between 18,000 and 33,000 – a loss of some 80% (Niles *et al.* 2010).

The loss through reclamation of a large area of tidal flat in South Korea used for feeding by staging Great Knot resulted in the loss of about a quarter of the world population of that species (Moores *et al.* 2008).

While these large-scale changes have big impacts that can easily be measured, many smaller changes may add up to a similar scale of effect. Goss-Custard *et al.* (1995), showed how incremental change in the non-breeding areas of oystercatchers would lead to a decline in numbers, while Burton *et al.* (2006), showed that forcing Common Redshanks from their preferred non-breeding grounds into adjacent areas led to increased mortality of those individuals over the following years.

There are a number of actual and potential threats facing shorebirds at Yalu Jiang Estuary.

4.4.1 Reclamation

As a result of the reclamation of South Korea's Saemangeum wetlands, which used to support the largest number of shorebirds along the Asian coast of the East Asian - Australasian Flyway the Yalu Jiang Estuary Wetland has now become the most important site on the Asian coast. The mudflats in the reserve are the feeding habitat for the migratory shorebirds, and the shrimp ponds and rice paddies to the north side of the seawall are roosting habitat for the migratory shorebirds during high tides. The seawall in the reserve was built around the 1980s, its function to protect the shrimp ponds, rice paddies, and villages near the coast. Most shrimp ponds in the reserve were built in the 1950s and 1960s. As we do not have any data from that period, it is hard to assess the impacts on shorebirds of the reclamation for shrimp ponds. However, it is clear that the large-scale reclamation must have affected the shorebirds in the reserve.

4.4.2 Human Disturbance

Disturbance has been considered as a long term limiting factor on the use of staging sites. Pfister *et al.* (1992) suggested that disturbance was a potential factor in long term declines of shorebirds using Plymouth Beach, USA. Burger *et al.* (2004) showed clearly that human disturbance limited foraging time available at Delaware Bay, USA and suggested that the limited time frame available for shorebirds at staging sites could mean these disruptions limit the birds' ability to put on the weight needed for migration. Modelling studies suggest that numerous small disturbances may be more damaging than fewer, larger disturbances (West *et al.* 2002, Stillman *et al.* 2007). Shorebirds at the Yalu Jiang Estuary are disturbed both on roost sites and while foraging. Disturbance levels are increasing as the human population pressures in the area increase. The effect of this on the reserve's ability to support the number of shorebirds that currently use the area should be investigated.

Shared Use

Human harvesting of shellfish, shrimps and other invertebrates is common on the mudflats in the Yalu Jiang Estuary. Whilst these activities are the main livelihoods of local people and have been for a long time the impact on marine life has not been studied in any detail. Shorebirds do appear to cope with this level of disturbance but in some areas of shellfish production, bird-scaring techniques are used occasionally to prevent shorebirds from feeding. This activity appears to be quite localised and on a small scale. Whether there is much competition for food between people and shorebirds has not been studied.

Birdwatchers

A large number of birdwatchers come to the Yalu River Estuary Wetlands every year. Although most people adhere to good birding behaviour, there are still some birdwatchers who startle birds and cause some disturbance. Their behaviour near the shorebirds can often leave the birds unsettled over the high tide period. Bird photography is now popular and photographers have been observed using firecrackers to make the birds fly in order to get better pictures. On a smaller scale photographers seeking to get better pictures have been seen approaching roosting shorebirds without taking due care. Unless this is done carefully it can alarm the birds, causing them to fly away. A programme of education is needed to advise people on the best way to behave around the birds whilst still being able to observe them.

Adrian Riegen

观鸟者

每年有大量的观鸟者到鸭绿江口保护区观鸟，尽管大部分人可以恪守良好的观鸟行为，但是仍有部分的观鸟者利用驱赶鸟类的方式观鸟，严重影响了鸟类的栖息。在高潮期，人们有机会近距离观察涉禽的时候，他们的行为却让常常扰乱鸟类的栖息。鸟类摄影现在也很流行，一些摄影者为了拍到满意的照片用爆竹惊吓鸟群让鸟起飞。另外还有一些行为较为收敛的摄影者也会毫不注意的径直接近鸟类的休息场所。如果在接近鸟群的时候不够小心翼翼，鸟群是很容易受到惊吓并飞走的。所以应适当开展环境教育项目以告知民众在观鸟时有哪些可以做和需要避免的行为。希望能在鸭绿江口推广一个环境教育方案以推广无干扰的观鸟活动。

4.4.3 小结

滩涂开发是一个不可逆转的过程，是黄海地区和渤海湾涉禽面临的最大威胁，也是鸭绿江口涉禽面临的一个潜在威胁。由于丹东、东港及周边城镇的人口数量越来越多，滩涂开发的压力也随之增加，这将会导致渔业和滩涂采集作业捕捞量的增加，使人类更直接地与涉禽竞争食物。

一直以来，涉禽研究都表明，尽管黄海地区有大面积的滩涂，但并不是每一块滩涂都适合于涉禽的栖息，因此保护它们现有的主要栖息地对于鸟类生命的延续至关重要。无可置疑，鸭绿江口至少是6种涉禽的北迁路线中最重要的一环，对这个如此关键区域的破坏，即使只是部分破坏，都会对涉禽造成极为不利的影响。

Keith Woodley

Xiao-Yang Liu 刘晓阳

Development of the mudflats is not reversible and is the greatest threat to the shorebirds in the Yellow Sea, the Bohai and potentially at the Yalu Jiang Estuary and the River. Human pressure will also increase as more people move to Dandong, Donggang and surrounding towns. This in turn may lead to increased harvesting of food from the sea and mudflats, putting people in more direct competition with shorebirds for food.

Studies of shorebirds continue to show that although the Yellow Sea contains large areas of mudflats, they are not all equally suitable for all shorebird species, therefore protecting known major sites of a species is vital to the long term survival of that species. The Yalu Jiang Estuary is without doubt the most important link in the chain for at least six species of shorebirds during northward migration and destroying or even partially destroying this incredible place would have a major detrimental impact on these shorebirds.

Keith Woodley

Janie Vaughan

5 建议

政府层面

1. 希望辽宁省和丹东市政府大力支持有关滩涂可持续利用的科学研究以及相关活动。
2. 希望在规划港口发展蓝图时要最大化地利用目前的港口空间，不要盲目破坏滩涂湿地。
3. 开发一个观鸟旅游产业，可以根据不同季节不同迁徙鸟类的过境高峰期，在每年的不同时期组织相关的旅游活动。
4. 新西兰和中国可以利用候鸟作为纽带来促进两国的联系。
   4a. 鼓励双边合资企业资助保护区的涉禽教育和研究工作。
   4b. 与“东亚-澳大利西亚迁徙路线伙伴”开展合作。
   4c. 鼓励丹东地区的学校与新西兰的学校合作，建立基于候鸟迁徙的互动和联系。目前在韩国与新西兰间的一些学校已经开展了类似联谊活动。
5. 增加对鸭绿江口保护区的资金支持，特别是保育宣传和教育工作的资金支持。

地方层面

6. 考虑目前存在问题的一些工程解决方案。例如：
   - 为靠近公路的鸟类休息场所(例如10号点的休息场所)建造隔离屏障，借由些屏障来降低交通对鸟的干扰。
   - 沿保护区为鸟类修造人工休息场所。只需临海每隔4公里简单修建一个大型人工养殖塘，并在周边修建隔离屏障以消除人为干扰。
7. 人工修建多个无人为干扰的鸟类休息场所，当中至少有一个可以以吸引游客为目的来经营管理。
8. 雇用专职人员在保护区滩边管理观鸟人的行为并进行宣传教育。

科学研究

9. 为了监测涉禽的种群动态并进一步了解5月份和南迁时鸭绿江口保护区内涉禽的种类和数量，仍需要继续定期进行涉禽调查。
10. 底栖动物调查结合涉禽觅食行为的研究将有助于了解涉禽对栖息地利用的机制和模式。
11. 有些涉禽物种，尤其是黑腹滨鹬还需要辨认到亚种的程度。

人类只要真心愿意与涉禽分享我们共同生活的环境，那么上述的所有事情都有可能实现。

备注

1、本报告所涉及的保护区基础情况为2010年以前数据。

Keith Woodley

5. Recommendations

Governmental Level

1. Liaoning Province and Dandong City governments could support research and activities of sustainable use of mudflats.
2. Port developments should be planned to maximise use of existing space rather than blindly destroying wetlands.
3. Develop a tourism industry based around migratory birds over different seasons – shorebirds and waterfowl are all present in large numbers at different times of the year.
4. New Zealand and China should use the link provided by the migratory species to encourage links between the nations.
    - 4a. Joint Venture industries should be encouraged to sponsor the shorebird education and research work done by the reserve.
    - 4b. Work with the East Asian-Australasian Flyway Partnership.
    - 4c. Encourage integration between schools in New Zealand and the Dandong region based on shorebird migration as has begun between schools in South Korea and New Zealand.
5. Increase funding to YJNNR in particular for advocacy and educational work.

Local Level

6. Consider engineered solutions to some problems. For example:
    - Screen roosts close to roads, such as the Site 10 roost site, with barriers to reduce the disturbance associated with vehicle traffic.
    - Create artificial roost sites along the reserve. These could be as simple as a single large aquaculture pond, about one per 4km, adjacent to the sea with screening to stop human disturbance.
7. Develop artificial roost sites free from human disturbance. At least one could be managed as a tourist attraction.
8. Hire an education officer dedicated to people control and education along the reserve foreshore.

Research

9. Regular surveys of the shorebirds still need to be carried out to monitor populations, to determine what species use the reserve in May and to look at southward migration.
10. Benthic surveys combined with studies of feeding behaviour would provide information about why shorebirds use the area the way they do.
11. Some species, particularly Dunlin, still needs to be identified to subspecies level.

All these things are possible if there is a willingness to allow shorebirds to share the environment with the human population.

Note

1. This report is based on data and conditions before 2010.

Keith Woodley

2004

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8 附录 Appendicies

附录1：涉禽的英文名、中文名及学名
Appendix 1. Chinese, English & Scientific Shorebird Names

涉禽	Chinese Pinyin	Common Name	Scientific name
扇尾沙锥	Shan Wei Sha Zhui	Fantail Snipe	*Gallinago gallinago*
黑尾塍鹬	Hei Wei Cheng Yu	Black-tailed Godwit	*Limosa limosa*
斑尾塍鹬	Ban Wei Cheng Yu	Bar-tailed Godwit	*Limosa lapponica*
小杓鹬	Xiao Shao Yu	Little Curlew	*Numenius minutus*
中杓鹬	Zhong Shao Yu	Whimbrel	*Numenius phaeopus*
白腰杓鹬	Bai Yao Shao Yu	Eurasian Curlew	*Numenius arquata*
红腰杓鹬	Hong Yao Shao Yu	Eastern Curlew	*Numenius madagascariensis*
鹤鹬	He Yu	Spotted Redshank	*Tringa erythropus*
红脚鹬	Hong Jiao Yu	Common Redshank	*Tringa totanus*
泽鹬	Ze Yu	Marsh Sandpiper	*Tringa stagnatilis*
青脚鹬	Qing Jiao Yu	Common Greenshank	*Tringa nebularia*
小青脚鹬	Xiao Qing Jiao Yu	Spotted Greenshank	*Tringa guttifer*
白腰草鹬	Bai Yao Cao Yu	Green Sandpiper	*Tringa ochropus*
林鹬	Lin Yu	Wood Sandpiper	*Tringa glareola*
翘嘴鹬	Qiao Zui Yu	Terek Sandpiper	*Xenus cinereus*
矶鹬	Ji Yu	Common Sandpiper	*Actitis hypoleucos*
灰尾鹬	Hui Wei Yu	Grey-tailed Tattler	*Tringa brevipes*
翻石鹬	Fan Shi Yu	Ruddy Turnstone	*Arenaria interpres*
大滨鹬	Da Bin Yu	Great Knot	*Calidris tenuirostris*
红腹滨鹬	Hong Fu Bin Yu	Red Knot	*Calidris canutus*
三趾鹬	San Zhi Yu	Sanderling	*Calidris alba*
红胸(颈)滨鹬	Hong Xiong(Jing) Bin Yu	Red-necked Stint	*Calidris ruficollis*
青脚滨鹬	Qing Jiao Bin Yu	Temminck's Stint	*Calidris temminckii*
长趾滨鹬	Chang Zhi Bin Yu	Long-toed Stint	*Calidris subminuta*
尖尾滨鹬	Jian Wei Bin Yu	Sharp-tailed Sandpiper	*Calidris acuminata*
黑腹滨鹬	Hei Fu Bin Yu	Dunlin	*Calidris alpina*
弯嘴滨鹬	Wan Zui Bin Yu	Curlew Sandpiper	*Calidris ferruginea*
勺嘴鹬	Shao Zui Yu	Spoon-billed Sandpiper	*Eurynorhynchus pygmeus*
阔嘴鹬	Kuo Zui Yu	Broad-billed Sandpiper	*Limicola falcinellus*
流苏鹬	Liu Su Yu	Ruff	*Philomachus pugnax*
蛎鹬	Li Yu	Far Eastern Oystercatcher	*Haematopus {ostralegus} osculans*
黑翅长脚鹬	Hei Chi Chang Jiao Yu	Black-winged Stilt	*Himantopus himantopus*
反嘴鹬	Fan Zui Yu	Pied Avocet	*Recurvirostra avosetta*
金斑鸻	Jin Ban Heng	Pacific Golden Plover	*Pluvialis fulva*
剑鸻	Jian Heng	Ringed Plover	*Charadrius hiaticula*
金眶鸻	Jin Kuang Heng	Little Ringed Plover	*Charadrius dubius*
灰斑鸻	Hui Ban Heng	Grey Plover	*Pluvialis squatarola*
环颈鸻	Huan Jing Heng	Kentish Plover	*Charadrius alexandrinus*
蒙古沙鸻	Meng Gu Sha Heng	Lesser Sandplover	*Charadrius mongolus*
铁嘴沙鸻	Tie Zui Sha Heng	Greater Sandplover	*Charadrius leschenaultii*
东方鸻	Dong Fang Heng	Oriental Plover	*Charadrius veredus*
普通燕鸻	Pu Tong Yan Heng	Oriental Pratincole	*Glareola maldivarum*

附录2：东亚澳大利西亚迁徙路线涉禽旗标系放协议

Appendix 2. EAAF Shorebird Flagging Protocol

(As of 25 Aug 2010)

White	White	White	White	White	White	White
no flag	White	Black	Blue	Green	Orange	Yellow
North Island NEW ZEALAND (may be engraved)		Chongming Island (old) CHINA	Taiwan CHINA (may be engraved)	South Island NEW ZEALAND	Eastern Yellow Sea SOUTH KOREA	Hong Kong CHINA (may be engraved)

Black	Black	Black	Black	Black	Black	Black
no flag	White	Black	Blue	Green	Orange	Yellow
Alaska (engraved only) V Australia (engraved only) NZ (engraved only) ost on Satellite tagged godwits	Chongming Island CHINA (may be engraved)	MYANMAR	Philippines PHILIPPINES	*Typical (Right leg):* Gulf of Thailand *Angled (Left leg):* Thailand Peninsular (Ko Libong) THAILAND (may be engraved) (Note angled flags on left legs)	Java & Bali INDONESIA	(proposed) MALAYSIA

Blue	Blue	Blue	Blue	Blue	Blue	Blue
no flag	White	Black	Blue	Green	Orange	Yellow
Shunkunitai, Eastern Hokkaido Northern Japan JAPAN (on left legs)	*Typical:* Obitsu *Angled:* Yatsu Tidal Flats Tokyo Bay JAPAN (on left legs) (may be engraved)	Hainan-Guangxi CHINA	Lake Komuke, Northern Hokkaido Northern Japan JAPAN	MONGOLIA	Kyushu Southern Japan JAPAN (on left legs) (may be engraved)	Tangshan & Cangzhou Bohai Bay CHINA

Green	Green	Green	Green	Green	Green	Green
no flag	White	Black	Blue	Green	Orange	Yellow
Qeensland AUSTRALIA (may be engraved)	Singapore SINGAPORE	CAMBODIA	Jiangsu CHINA		Yalujiang CHINA	Gulf of Carpentaria AUSTRALIA

Orange	Orange	Orange	Orange	Orange	Orange	Orange
no flag	White	Black	Blue	Green	Orange	Yellow
Victoria AUSTRALIA (may be engraved)	Eastern Yellow Sea (old) SOUTH KOREA	Sumatra INDONESIA	Tasmania AUSTRALIA (may be engraved)	New South Wales AUSTRALIA (may be engraved)		South Australia AUSTRALIA (may be engraved)

Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
no flag	White	Black	Blue	Green	Orange	Yellow
N Western Australia AUSTRALIA y be engraved or carrying four other colour bands)	Sakhalin Island RUSSIA (may use angled flags in future)	Kamchatka RUSSIA (may use angled flags in future)	Northern Territory AUSTRALIA	VIETNAM	SW Western Australia AUSTRALIA	

Pale Green	Pale Green	Pale Green	Pale Green	Pale Green	Pale Green	Pale Green
no flag	White	Black	Blue	Green	Orange	Yellow
Southern Chukotka RUSSIA	Southern Chukotka RUSSIA (white may be engraved)					

Pale Blue	Pale Blue	Pale Blue	Pale Blue	Pale Blue	Pale Blue	Pale Blue
no flag	White	Black	Blue	Green	Orange	Yellow
Northern Chukotka RUSSIA	Wrangel Island RUSSIA					

01.12.13	Red	Red	Red	Red	Red	Red
no flag	White	Black	Blue	Green	Orange	Yellow
? NEW ZEALAND y be engraved or carrying four other colour bands)						

附录3：每年调查到的涉禽的种类和数量。**Appendix 3.** Total of survey counts in time of year order.

		4月 April				
		8-18	15 - 22	13 - 23	15-24	20 - 25
物 种	Species	2009	2007	2006	2010	2004
扇尾沙锥	Common Snipe					2
沙 锥 类	Snipe sp.		4			
黑尾塍鹬	Black-tailed Godwit		1	3	2	2
斑尾塍鹬	Bar-tailed Godwit	74,611	38,283	45,691	84,680	66,134
小 杓 鹬	Little Curlew					1,183
中 杓 鹬	Whimbrel	26	50	89	135	414
白腰杓鹬	Eurasian Curlew	8,155	6,243	6,100	3,039	13,136
红腰杓鹬	Eastern Curlew	6,818	4,001	2,126	3,282	3,874
杓 鹬 类	Curlew sp.	4,377	5,930	4,100	1,258	1,407
鹤 鹬	Spotted Redshank	10	210	113	3	171
红 脚 鹬	Common Redshank	8	27	54	17	18
泽 鹬	Marsh Sandpiper		7	2		1
青 脚 鹬	Common Greenshank	19	124	33	50	165
小青脚鹬	Spotted Greenshank	4	23	24	15	
白腰草鹬	Green Sandpiper					5
林 鹬	Wood Sandpiper		102	3		465
翘 嘴 鹬	Terek Sandpiper	12	22	27	18	56
矶 鹬	Common Sandpiper	2	3	6	3	3
灰 尾 鹬	Grey-tailed Tattler					
翻 石 鹬	Ruddy Turnstone		2	4	5	9
大 滨 鹬	Great Knot	20,393	19,917	16,268	53,467	32,880
红腹滨鹬	Red Knot		21	1	5	33
三 趾 鹬	Sanderling	4			2	7
红胸滨鹬	Red-necked Stint		5	62		20
青脚滨鹬	Temminck's Stint					
长趾滨鹬	Long-toed Stint					3
尖尾滨鹬	Sharp-tailed Sandpiper		3			35
黑腹滨鹬	Dunlin	40,861	32,276	43,875	25,301	34,841
弯嘴滨鹬	Curlew Sandpiper			7		1
勺嘴鹬	Spoon-billed Sandpiper					
阔嘴鹬	Broad-billed Sandpiper					12
流 苏 鹬	Ruff	1	2			
蛎 鹬	Far Eastern Oystercatcher	159	190	296	177	224
黑翅长脚鹬	Black-winged Stilt		104	13	4	14
金 斑 鸻	Pacific Golden Plover	4				9
剑鸻	Ringed Plover					
金 眶 鸻	Little Ringed Plover	2				w
灰 斑 鸻	Grey Plover	3,570	4,643	5,573	3,001	4,628
环 颈 鸻	Kentish Plover	1,354	894	1,485	1,251	436
蒙古沙鸻	Lesser Sandplover	2	8	4	1	171
铁嘴沙鸻	Greater Sandplover					
东方鸻	Oriental Plover					
普通燕鸻	Oriental Pratincole					1
未识别涉禽	Unidentified	40	3,200	3,400	819	6,111
合计	TOTALS >	160,432	116,295	129,359	176,535	166,471

		5月 May			
		2 - 9	6 - 11	8 - 12	16 - 23
物 种	Species	1999	2008	2005	2000
扇尾沙锥	Common Snipe				
沙 锥 类	Snipe sp.	5	3		
黑尾塍鹬	Black-tailed Godwit		1		17
斑尾塍鹬	Bar-tailed Godwit	51,918	35,321	49,100	26,169
小 杓 鹬	Little Curlew			20	
中 杓 鹬	Whimbrel	286	240	166	232
白腰杓鹬	Eurasian Curlew	234	3,702	645	563
红腰杓鹬	Eastern Curlew	3,744	1,114	955	731
杓 鹬 类	Curlew sp.	20	2,282		130
鹤 鹬	Spotted Redshank	162	382	31	10
红 脚 鹬	Common Redshank	49	77	35	44
泽 鹬	Marsh Sandpiper			16	
青 脚 鹬	Common Greenshank	351	707	72	258
小青脚鹬	Spotted Greenshank		5	12	3
白腰草鹬	Green Sandpiper				
林 鹬	Wood Sandpiper	490	72	49	123
翘 嘴 鹬	Terek Sandpiper	153	358	99	326
矶 鹬	Common Sandpiper	5	6	3	23
灰 尾 鹬	Grey-tailed Tattler	6	11	2	19
翻 石 鹬	Ruddy Turnstone	44	399	39	194
大 滨 鹬	Great Knot	55,178	26,972	20,270	26,093
红腹滨鹬	Red Knot	1,499	107		61
三 趾 鹬	Sanderling		34		13
红胸滨鹬	Red-necked Stint	299	154	36	541
青脚滨鹬	Temminck's Stint			1	
长趾滨鹬	Long-toed Stint	24		7	
尖尾滨鹬	Sharp-tailed Sandpiper	61	80	47	97
黑腹滨鹬	Dunlin	25,181	31,954	22,913	22,482
弯嘴滨鹬	Curlew Sandpiper		2	6	2
勺嘴鹬	Spoon-billed Sandpiper				1
阔嘴鹬	Broad-billed Sandpiper	729	14	98	723
流 苏 鹬	Ruff				
蛎 鹬	Far Eastern Oystercatcher	70	150	109	189
黑翅长脚鹬	Black-winged Stilt	38	4	15	
金 斑 鸻	Pacific Golden Plover	147		2	
剑鸻	Ringed Plover		2		
金 眶 鸻	Little Ringed Plover		1		
灰 斑 鸻	Grey Plover	4,005	7,113	6,010	7,232
环 颈 鸻	Kentish Plover	12	62	15	17
蒙古沙鸻	Lesser Sandplover	306	540	305	647
铁嘴沙鸻	Greater Sandplover		25		
东方鸻	Oriental Plover		4		
普通燕鸻	Oriental Pratincole				
未识别涉禽	Unidentified	7,702	7,519	17,930	6,050
合计	TOTALS >	152,718	119,417	119,008	92,990

附录4：调查地点的纬度和经度

Appendix 4. Site location Latitude and Longitude

点位 Site	北纬 North	东经 East
1	39° 50.02’	124° 06.86’
2	39° 49.64’	124° 05.19’
3	39° 48.53’	124° 26.20’
4	39° 48.17’	123° 59.23’
5	39° 48.96’	123° 56.90’
6	39° 49.23’	123° 54.26’
7 (老 old)	39° 49.60’	123° 50.97’
7 (新 new)	39° 50.12’	123° 49.34’
8	39° 49.84’	123° 47.97’
9	39° 49.36’	123° 45.69’
10	39° 49.49’	123° 44.00’
11	39°48.81’	123° 41.47’
11a	39° 50.00’	123° 39.82’
12	39°49.87’	123° 38.21’
13	39° 47.95’	123° 37.52’
14	39° 45.53’	123° 32.64’
15	39° 47.29’	123° 31.70’
芦苇地 Reedbeds	39° 52.6’	123° 36.0’
西水道港区 ‘River’	39°51.6’	124° 12.4’
储灰池 Ash storage pools	39° 51.4’	124° 11.4’

Murray Potter

Adrian Riegen