ACCELERATING TAXONOMIC PROCESS WITH IT SUPPORT
-- e-Science Application of Joint Research in Qinghai Lake National Nature Reserve

LI Jian; ZHU ChaoDong; CHEN Can; CAO WenBin; LVO Ze; DING Liang; John LA SALLE; YAN BaoPing

Computer Network Information Center, CAS
lijian@cnic.cn
29 June 2011
• After more than two centuries of taxonomic endeavour, taxonomists have recognized only about 20% of the species on the earth.

• Despite this, there is not much difference between previous and current approaches for data collection and sorting.
Overview

• Introduction to Joint Research in Qinghai Lake National Nature Reserve

• Joint research in Qinghai Lake
  – networked video monitoring system
  – Delta species identification && Field Data Collection System based on PDA
  – Species identification based on DNA Barcoding
  – Image Process for species identification
Qinghai Lake

- In Qinghai-Tibet plateau
- the largest inland saline lake in China
- wetland of International Importance
- rich in plants and aquatic biological resources
- a paradise for birds living and breeding

Qinghai Lake National Natural Reserve

- One of the eight major national reserves for wild birds in China
- Conservation of Migratory Birds and wetlands
- Protection of nature resources and ecological environment
- Protection of Biodiversity
Przewalski's Gazelle

Endangered Species, just live in China, total number less than 500 in the world
e-Science Application in Qinghai Lake Region

Avian influenza virus broke out in 2005.

the first e-Science application for supporting ecological protection and research in plateau region, as well as the first application to national nature reserve in China

Joint Research Center of Chinese Academy of Sciences and Qinghai Lake National Nature Reserve
Institute of Zoology (IOZ), CAS

Wuhan Institute of Virology (WHIOV), CAS

Institute of Microbiology (IM), CAS

Institute of Remote Sensing Application (IRSA), CAS

Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), CAS

Institute of Hydrobiology (IOH), CAS
Overview

• Introduction to Joint Research in Qinghai Lake National Nature Reserve
• Joint research in Qinghai Lake
  – networked video monitoring system
  – Delta species identification && Field Data Collection System based on PDA
  – Species identification based on DNA Barcoding
  – Image Process for species identification
蛋岛、鸬鹚岛、布哈河三角洲、三块石、海心山五大核心区域

19个探头
- 海心山全向天线1个,微波天线1个,无线球机3个,太阳能4套
- 三块石全向天线1个,微波天线1个,无线球机4个,太阳能5套
- 布哈河三角洲无线球机3个,太阳能3套

布哈河三角洲的3个探头、蛋岛的2个探头通过无线网桥和蛋岛的全向天线连接。

鸬鹚岛2个探头经汇聚点通过微波和蛋岛的全向天线连接。

三块石4个探头、海心山的3个探头经各自的汇聚点通过微波和蛋岛的微波进行一对一连接。

蛋岛5个探头通过有线连接。
Devices deployed on SanKuaiShi Island
Networked Cameras deployed on Haixin Island
The use of these data

• Species identification
• Analyze the motion patterns of birds

Networked video monitoring system provides scientists a method to conduct behavioral observation remotely, and many non-observed behavior patterns were observed from the video data. For example, scientists got new discoveries in research on territorial behavior of male bar-headed goose in early breeding season, and on behavior pattern of female bar-headed goose before and after egg-laying in early breeding season.
Overview

• Introduction to Joint Research in Qinghai Lake National Nature Reserve

• Joint research in Qinghai Lake
  – networked video monitoring system
  – Delta species identification & Field Data Collection System based on PDA
  – Species identification based on DNA Barcoding
  – Image Process for species identification
structure of the identification system for major wild bird species around Qinghai Lake

- **WEB Portal**
- **Data management and Analysis Platform**
  - Data input and export
  - Data quality evaluation and control
  - Data organization
  - Data query
  - Data analysis
- **Species Identification Platform**
  - Identification engine
    - DELTA
  - Bird image retrieval
  - DNA Barcoding
    - BLAST algorithm
- **Integrated part with external System**
  - Support functions and data of this system to external systems based on Web Service
  - Integrated with internationally known biological barcode database
- **Database System** such as MySql or PostgreSQL
  - DELTA morphological description
  - DNA Barcodes
  - Image of bird
  - Data for bird resources investigation
Delta (Morphological identification)
System based on website
Field Data Collection System based on PDA
The survey route, data and information about the sample, pictures and videos can be visualized and displayed based on GIS.
中国科学院青海湖国家自然保护区联合科研基地的基础数据平台针对联合研究基地、保护区调查等产生的科学数据，结合重大科研方向和保护区工作重点，将重点建设包括鸟类资源调查数据库、候鸟监测视频数据库、环湖植被样地数据库、保护区生物多样性数据库。

鸟类繁殖地定点调查表
样线调查表
土壤调查表
植被样地调查表
鸟类环湖调查表
普氏原羚调查表

数据采集 拼 系统
Overview

• Introduction to Joint Research in Qinghai Lake National Nature Reserve

• Joint research in Qinghai Lake
  – networked video monitoring system
  – Delta species identification && Field Data Collection System based on PDA
  – Species identification based on DNA Barcoding
  – Image Process for species identification
Species identification based on DNA Barcoding

**Step 1:** Collect Sample data from museum, outdoors and so on.

**Step 2:** get the DNA barcodes and related information such as sample data/species data

**Step 3:** Data analysis

**Step 4:** Database construction

**Step 5:** taxonomist
Species identification; supply and modify morphological information, biological information

**Step 3:** Data analysis
Data mining
The database of DNA Barcodes
Comparation (BLAST algorithm)
DNA barcodes

evolutionary tree
Overview

• Introduction

• Update on joint research in Qinghai Lake
  – networked video monitoring system
  – Field Data Collection System based on PDA
  – Species identification based on DNA Barcoding
  – Image Process for species identification
Architecture of Image Retrieval System Based on Color Histogram
Thank you!
Welcome to CNIC!
If you have any question, Please contact me:
lijian@cnic.cn