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Coastal wetland changes and priority areas for waterbird habitat conervation in the Yellow sea Ecoregion in PR China

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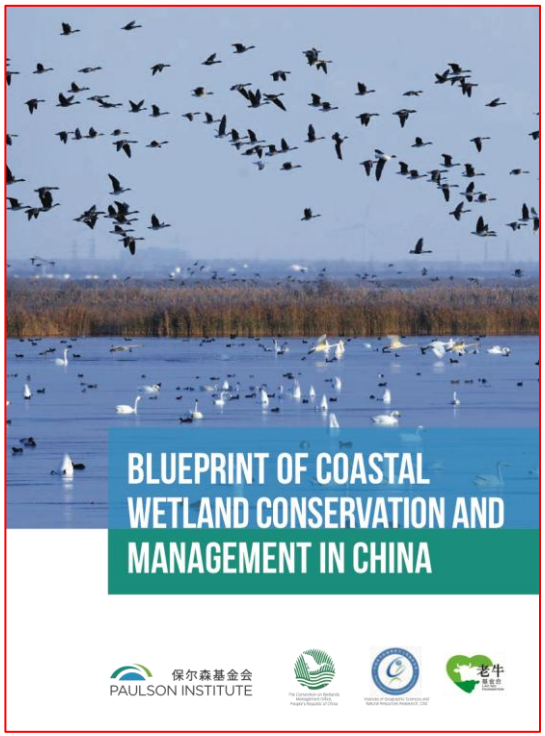


Contents

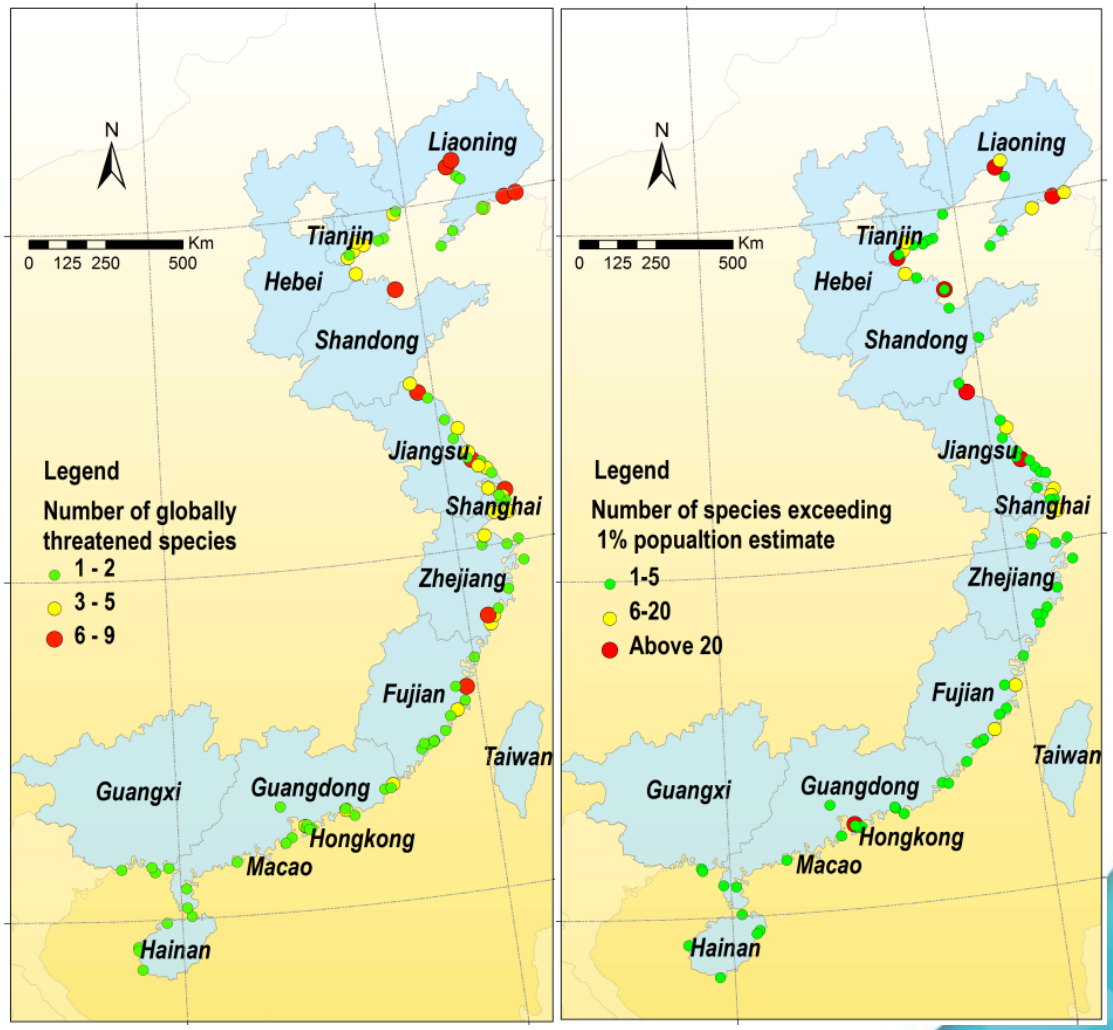
1. Coastal wetland changes

1.1 Yellow sea Ecoregion in PR China

- Yellow sea Ecoregion in PR China covers 11 provinces/regions in China along EAAFP, with a total area of about 5.7959 million hectares (State Forestry Administration in China,2013).
- To date, seven coastal nature reserves have joined EAAFP, i.e., Yalu River Estuary NR, Liaohe River Estuary NR, Nandagang Wetland NR, Yellow River Delta NR, Yancheng NR, and Chongming Dongtan NR.

1.2 Provide important habitat for waterbirds

- 11 threatened species of water birds under IUCN Red List were recorded, which are distributed in 91 sites.
- 57 species of waterbirds were recorded in 83 sites, in which the population of waterbirds exceeds 1% of estimated global or flyway population of the waterbirds

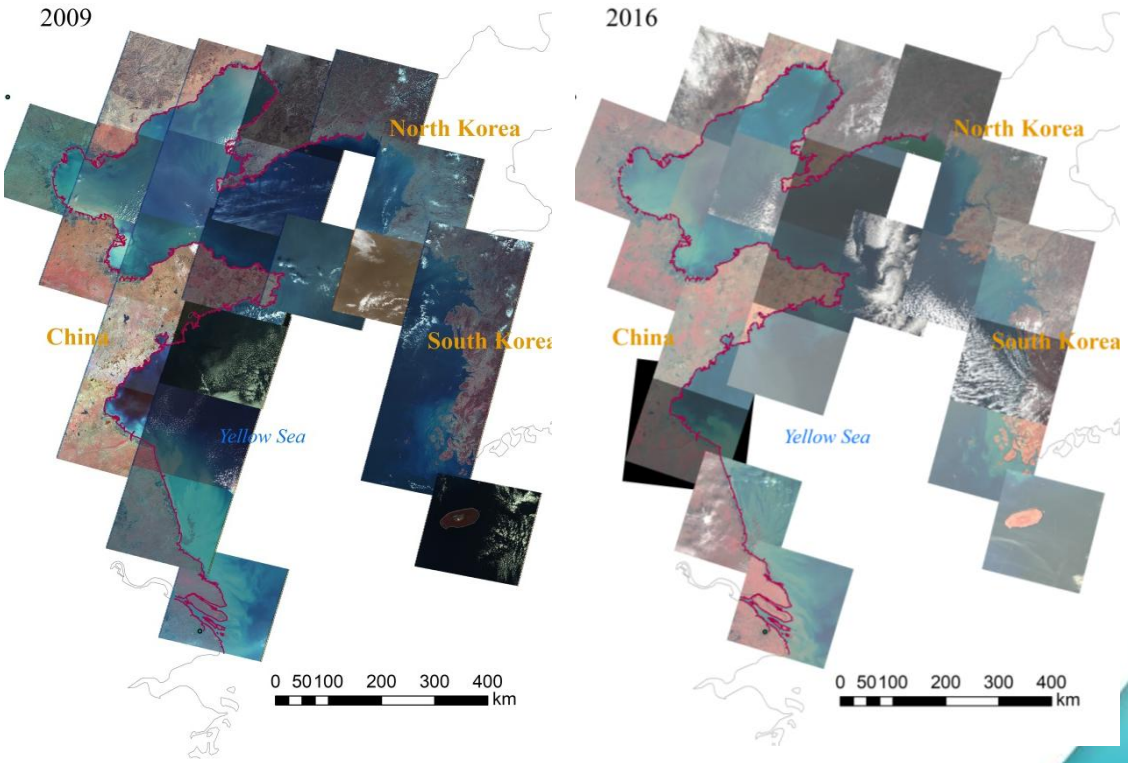


1.3 Wetland changes in Yellow sea Ecoregion-
Coastal line extraction

Method

- Using the satellite imageries of Landsat TM and OLI/TIRS of 2009 and 2016. 25 sciences of imageries were collected for year 2009, and 23 for 2016. All the coastal lines of the Yellow Sea of China are covered, as well as North Korea, South Korea. However, in this report, we focus on the coast of China in the Yellow Sea Region.

Satellite imageries used in coastal lines extraction



1.4 Wetland changes in Yellow sea Ecoregion-
Coastal line extraction

Method

- The coastal lines of the Yellow Sea were extracted and classified followed the categories systems.The imagery resolution is 30 m. Coastal lines of the Yellow Sea are classified into three types: Natural coast line, Reclaimed coastal lines, and coastal lines under reclamation. Each contains several sub-types.

Categories systems

Types	Sub-types	Descriptions
Natural	Rocky	Rocky coastal lines without infrastructures
	Sandy	Sandy coast lines.
	Mud	Mud flat coast lines.
	Vegetated	Coastal lines occupied by mangroves, coral reefs and grass species.
Reclaimed	Spur dike and jetty	Strips built for preventing damages of waves, and extend into sea.
	Port	Coastal lines of ports.
	Fish farming	Coastal lines of fish farming, with levees separate the sea and ponds.
	Salt farm	Coastal lines of salt farms.
	Road	Coastal lines with roads built on.
	Tidal levee	Levees used to separate sea and lands, and functioning in prevent impact of waves
Reclaiming		Coastal lines with constructing infrastructures, building levees extended into sea

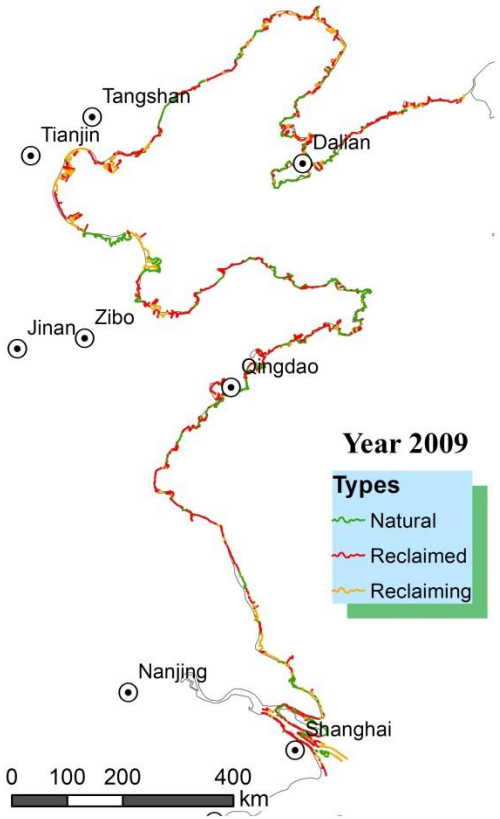
1.5 Wetland changes in Yellow sea Ecoregion- Coastal line change

Outputs

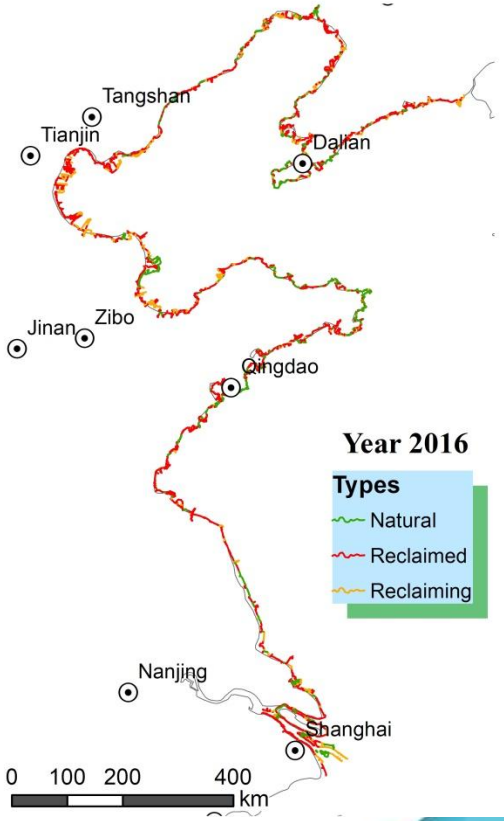
The investigation of Chinese coastal line Yellow Sea based on satellite remote sensing imageries showed that the natural coastal line occupies 29.9% of the total coastal line length in 2009. This ratio declined to 21.7% in 2016.

Status of coastal line in 2009 (Left) and 2016 (right)

Types	Percentage of total length
Natural	29.9%
Reclaimed	50.3%
Reclaiming	19.8%



Types	Percentage of total length
Natural	21.7%
Reclaimed	61.4%
Reclaiming	16.9%



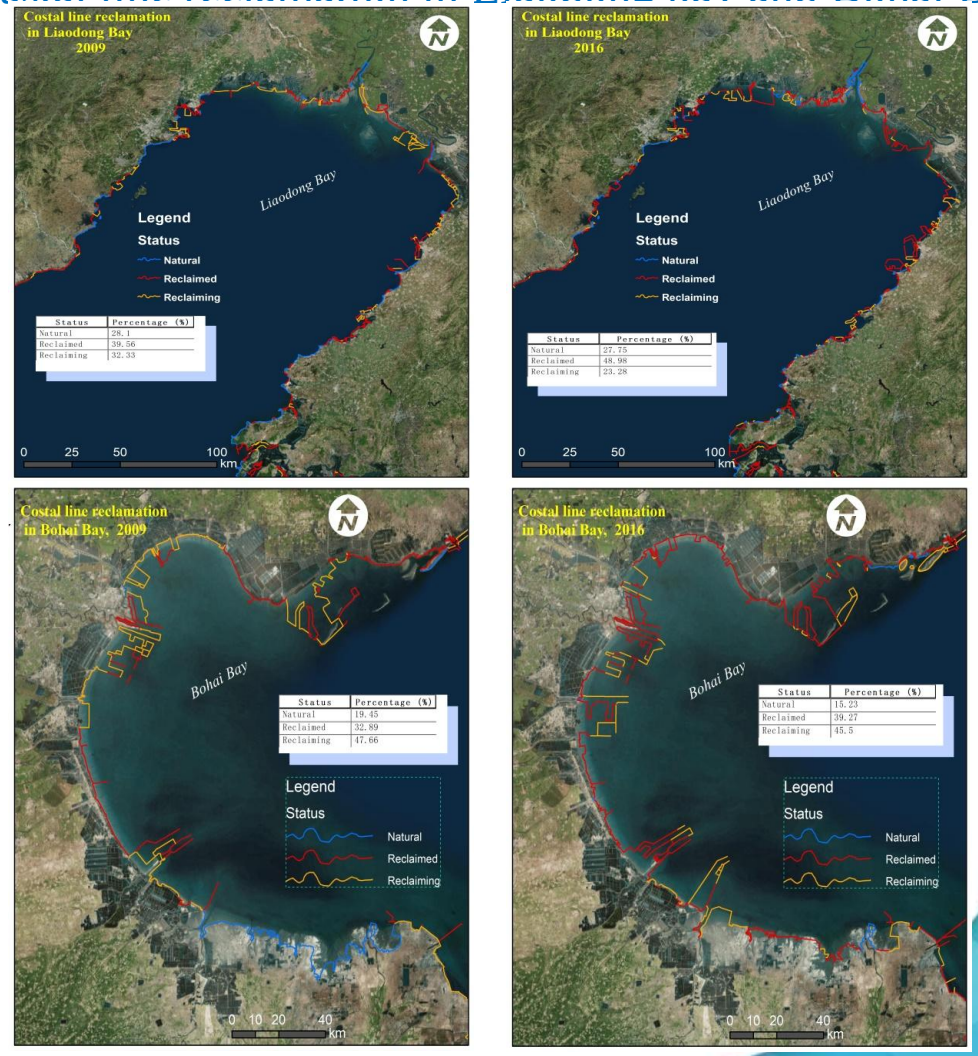
1.6 Wetland changes in Yellow sea Ecoregion-

Coastal line change

Status of coastal line reclamation in Liaodong bay and Bohai Bay

Outputs

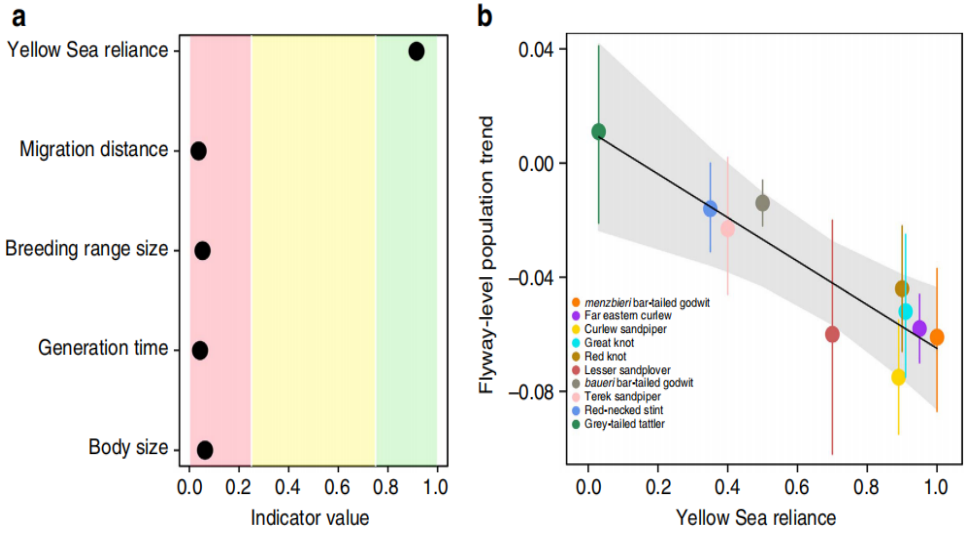
- In Liaodong Bay, the natural coastal occupies 28.1% in 2009, and 27.75% in 2016.
- For Bohai Bay, which covers coastal line of Tianjin and part of Hebei, the ratio of natural coastal lines just occupies 19.45% in 2009, and 15.23% in 2016. Actually, there almost is no natural coastal line left in Tianjin. Ports, roads, residential buildings and fish farming dikes reshaped the coastal lines.

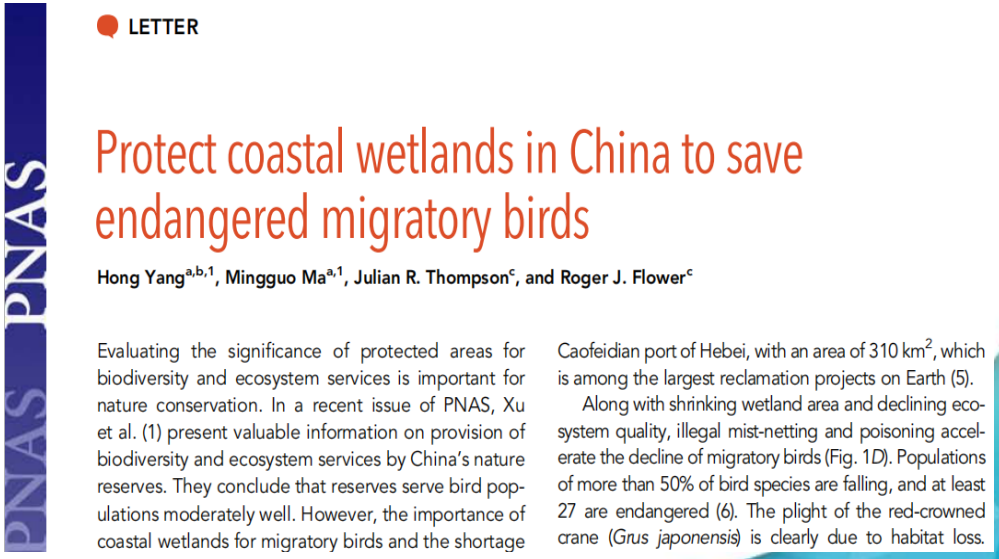


2. Priority areas for waterbird habitat conservation

2.1 Priority area identification

- Using 20 years of continent-wide citizen science data, we assess population trends of ten shorebird taxa that refuel on Yellow Sea tidal mudflats.
- Seven of the taxa declined at rates of up to 8% per year. Taxa with the greatest reliance on the Yellow Sea as a stopover site showed the greatest declines
- Priority area need to be identified as soon as possible so as to save endangered migratory birds





PNAS PNAS

LETTER

Protect coastal wetlands in China to save endangered migratory birds

Hong Yang[a,b,1], Mingguo Ma[a,1], Julian R. Thompson[c], and Roger J. Flower[c]

Evaluating the significance of protected areas for biodiversity and ecosystem services is important for nature conservation. In a recent issue of PNAS, Xu et al. (1) present valuable information on provision of biodiversity and ecosystem services by China's nature reserves. They conclude that reserves serve bird populations moderately well. However, the importance of coastal wetlands for migratory birds and the shortage

Caofeidian port of Hebei, with an area of 310 km^2, which is among the largest reclamation projects on Earth (5).

Along with shrinking wetland area and declining ecosystem quality, illegal mist-netting and poisoning accelerate the decline of migratory birds (Fig. 1*D*). Populations of more than 50% of bird species are falling, and at least 27 are endangered (6). The plight of the red-crowned crane (*Grus japonensis*) is clearly due to habitat loss.

2.2 Priority area identification-Data

Waterbird distribution	Conservation status	Other data
• Bird Watch China • Asian waterbirds survey • China Coastal Waterbirds Census • Literature review	• Wetland NR • Marine NR • Marine special protected area	• Wetland distribution （LULC2010） • World Waterbird Population Estimate Edition 5（WPE5） • IUCN redlist

2.3 Priority area identification-Criteria and thresholds

Criteria	Provisional thresholds for identifying priority sites
Criteria 1 Sites in which a globally threatened species regularly occurs in significant numbers	Presence of a single individuals for Critically Endangered(CR) and Endangered(EN) species; Presence of 30 individuals (or 10 pairs) for Vulnerable species (VU)
Criteria 2 Sites that hold a significant proportion of the flyway population	Species population exceed 1% of global or flyway population (using the maximum value of each waterbird population in the single surveys)
Criteria 3 Sites that support a significant aggregation of individual waterbirds	Supports 5,000 or more waterbirds

2.4 priority area identification-Method

- The irreplaceability index(I) indicates the priority of a site which is expressed as follows:

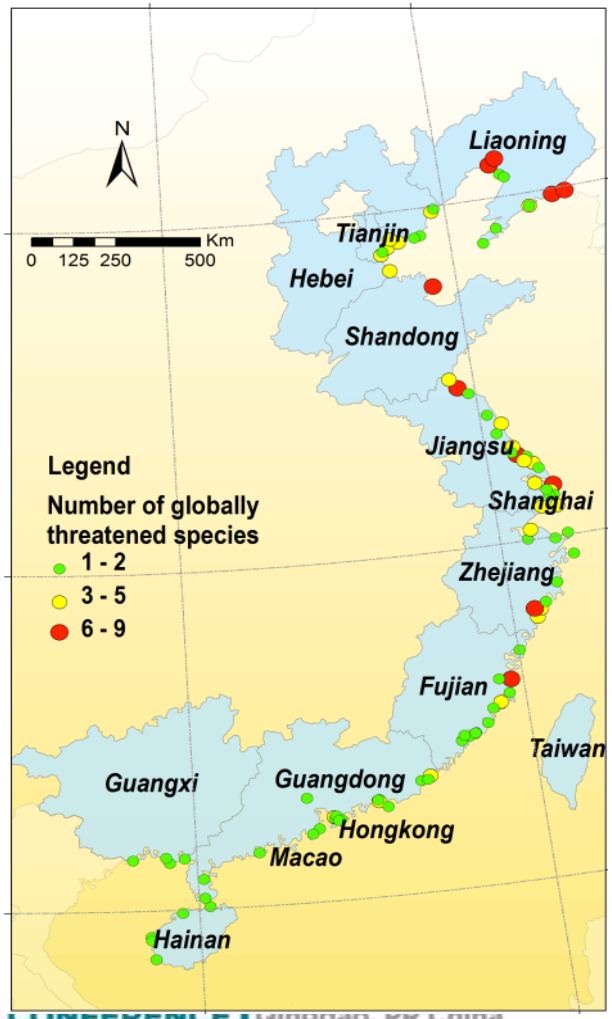
$$I = \sum_{i=1}^{s} {}^{n_i}/_{N} \times 100$$

- Where n_i denotes the population of ***i*** species of waterbirds at the survey point, and ***N*** denotes the population of ***i*** species on global or flyway according to WPE5 and ***s*** denotes the number of species at the survey points. A high value of ***I*** represents a high priority.

Xia Shaoxia, Yu Xiubo, Spike Millington *et al*. 2016. Identifying priority sites and gaps for the conservation of migratory waterbirds in China‘s coastal wetlands. *Biological Conservation*. 210, 72-82

2.5 Priority area identification-Outputs

Threatened waterbirds under IUCN Redlist



Sites where many threatened waterbirds occur:

Liaoning:
Yalu River Estuary NR
Dandong Port coast
Liaohe River Estuary NR

Shandong:
Yellow River Delta

Tianjin: Beidagang wetland

Hebei: Beidaihe

Jiangsu:
Rudong mudflat (Xiaoyangkou)
Lianyungang wetland
Yancheng NR

Shanghai:
Chongming Dongtan, Hengsha Dongtan

Zhejiang: Yongqiang coast

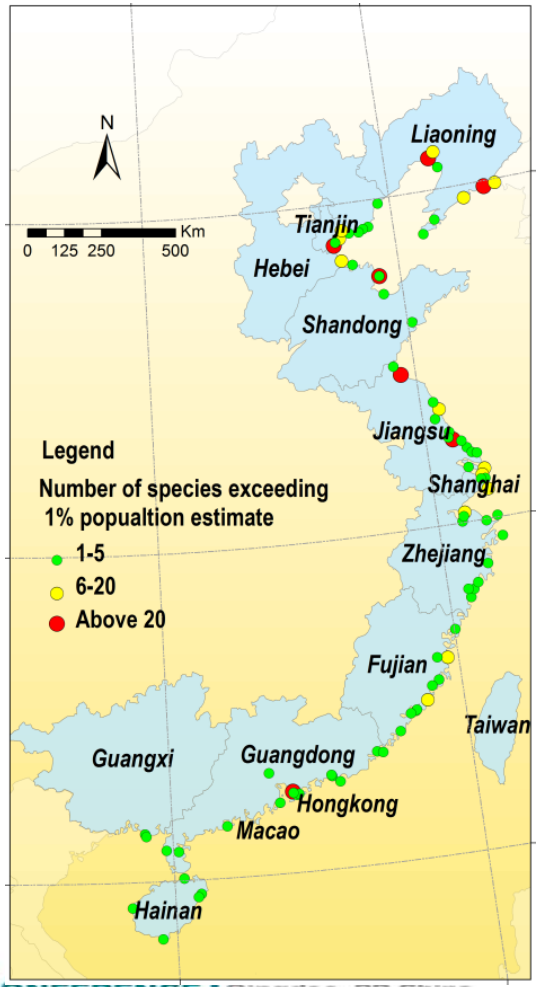
Fujian: Minjiang River estuary NR

11 threatened species of water birds under IUCN Red List were recorded, which are distributed in 91 sites

Threatened waterbirds under IUCN Redlist	22 (species)
CR	2
EN	3
VU	6

2.5 Priority area identification-Outputs

Sites met Ramsar 1% criteria



more than 10 species which meet Ramsar 1% criterion：

Liaoning： Liaohe River Estuary NR, Yalu River Estuary NR, Dandong Port coast, Zhuanghe coast

Shandong： Yellow River Delta

Tianjin： Beidagang, Hangu coast

Hebei： Haixing wetland&Huanghua Port

Jiangsu： Yancheng NR, Rudong Lianyungang wetland

Shanghai： Chongming Dongtan Hengsha Dongtan, Nanhui Dongtan

Zhejiang： Hangzhou Bay

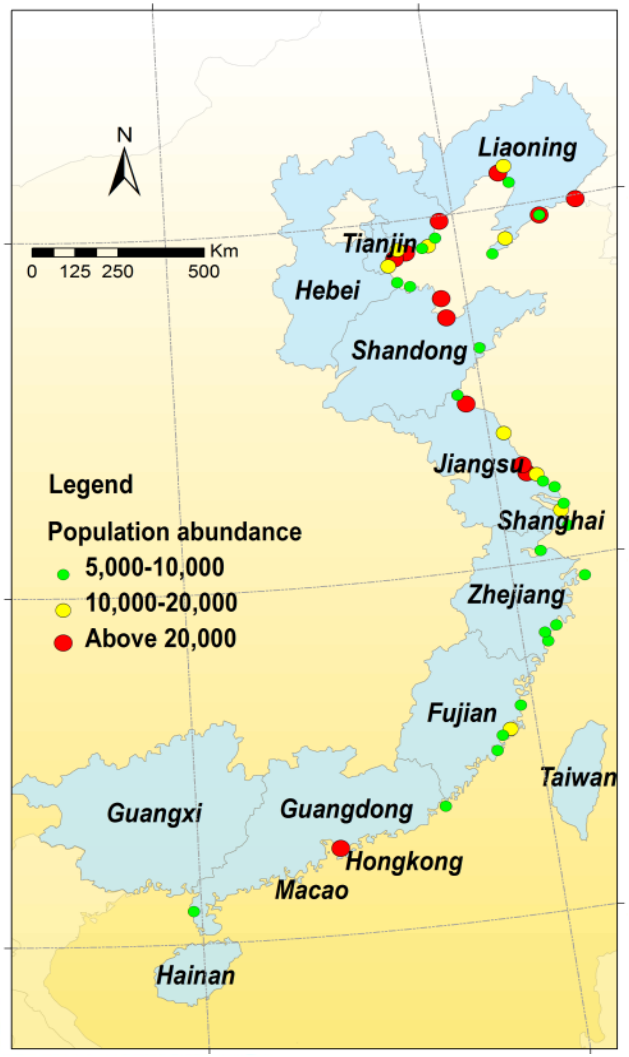
Guangdong： Deep Bay（including Mai Po and Futian, Gongping Dahu NR

Fujian： Minjiang River Estuary wetland, Quanzhou Bay

57 species of waterbirds were recorded in 83 sites, in which the population of waterbirds exceeds 1% of estimated global or flyway population of the waterbirds

2.5 Priority area identification-Outputs

Population abundance of waterbirds



sites in which the population of water birds exceeds 20,000：

Liaoning：

Dandong Port coast, Liaohe River Estuary NR, Yalu River Estuary NR, Zhuanghe coast

Hebei：

Luannan wetland, Cangzhou Haixin wetland, Huanghua Port, Beidaihe

Jiangsu：

Nantong Rudong mudflat, Yancheng Dongtai coast

Lianyungang wetland

Shanghai： Chongming Dongtan

Shandong：

Yellow River Delta, Laizhou Bay

Tianjin：

Binhai New Area mudflat, Beidagang and surrounding mudflats

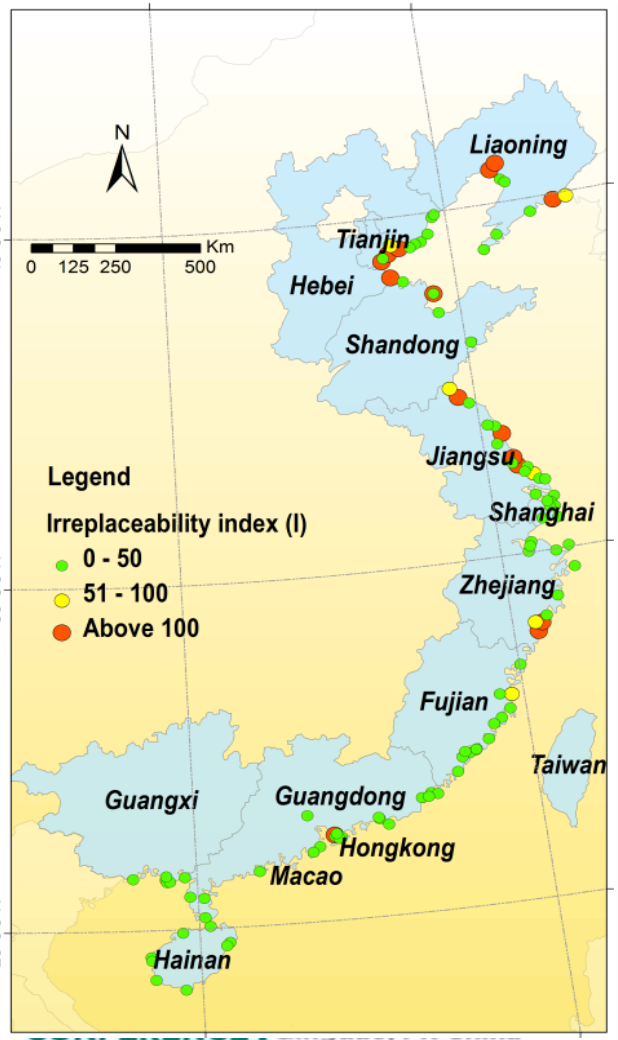
Guangdong：

Shenzh Bay（including Mai Po and Futian）

The maximum population of water birds in single surveys which exceeds 5,000 were recorded in 44 sites. Among 16 sites, the maximum population of water birds in single surveys which exceeds 20,000 were recorded.

2.5 Priority area identification-Outputs

Priority ranking-Irreplaceability Index



Top 20 priority sites:

Liaoning（4）:
Dandong Port, Yalu River Estuary NR, Liaohe River Estuary NR, Nanxiaohe wetland

Shandong （1）:
Yellow River Delta

Tianjin（1）: Beidagang

Hebei（2）: Luannan wetland, Haixing-Huanghua Port

Jiangsu（5）:
Rudong (including Xiaoyangkou), Dongtai coast, Yancheng NR, Lianyungang wetland, Jianggang

Shanghai（1）: Chongming Dongtan

Zhejiang（4）: Hangzhou Bay, Lingkun Island, Wenzhou Bay, Yongqiang coast

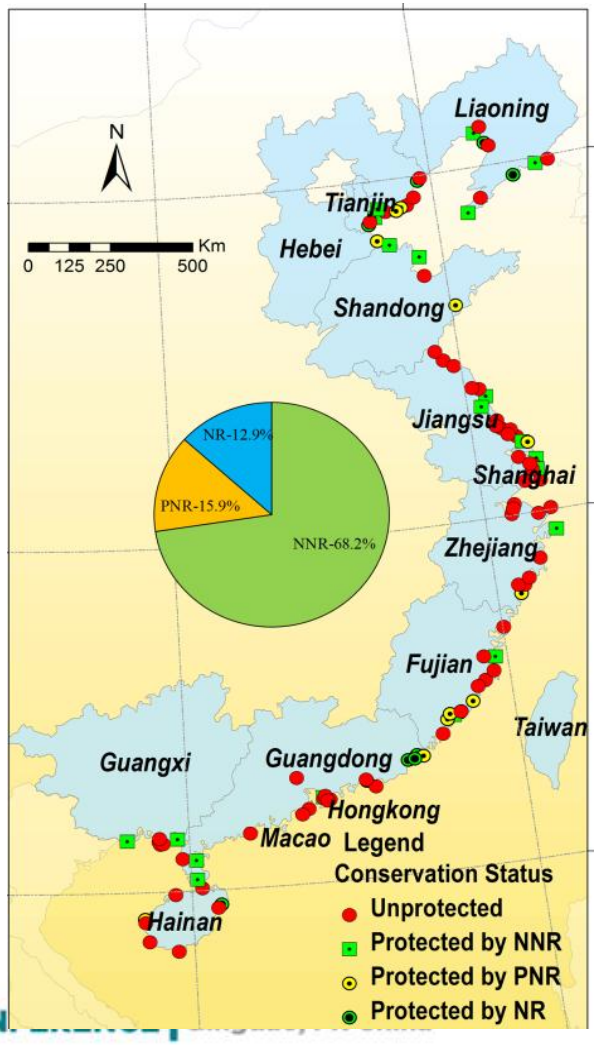
Guangdong（1）:
Deep Bay(Futian and Mai Po)

Fujian（1）: Minjiang River Estuary NR

110 Priority sites	
Sites with globally threatened species	91 sites
Sites with species population exceed 1% or above	83 sites
Sites that supports 5,000 or more waterbirds	44 sites

2.5 Priority area identification-Outputs

Conservation status and gap analysis



Generally poor conservation status of coastal wetlands in China：

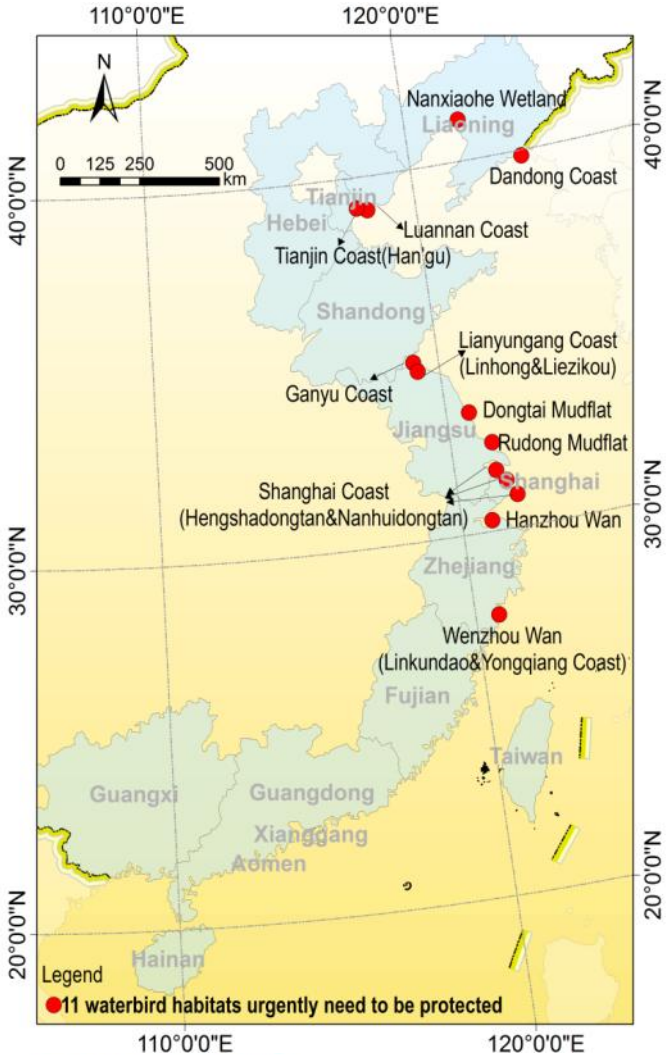
Only 20.4% of coastal wetlands in China have been legally designated as protected areas, much lower than the mean wetland protection rate across China (43%).

A significant gap in coastal wetland conservation:

Our study indicated that: 67 (60.9%) of 110 survey sites that have reached the criteria of Ramsar sites or the protected areas along EAAFP have not yet been designated as protected areas.

2.5 Priority area identification-Outputs

11 coastal waterbird habitats that are urgently needed to be protected in China



We suggested building 8 new nature reserves:

①Luannan Coastal Wetland

②Tinajin Coastal Wetland(Hangu)

③Lianyungang Coastal Mudflat (incl. Linhongkou and Liezikou)

④ Jiangsu Ganyu Mudflat Wetland

⑤ Rudong Mudflat (Xiaoyangkou)

⑥ Shanghai Coastal Wetland (incl. Hengsha&Nanhui Dongtan)

⑦ Hangzhou Bay Wetland

⑧ Wenzhou Bay Wetland

We suggested expanding the scopes of three existing NRs:

① Include Panjin Nanxiaohe Wetland into Liaohe River Estuary NNR

② Include Dandong Coast and Neighboring Areas into Liaoning Yalu River Estuary National Nature Reserve

③ Include Dongtai Mudflat (Qionggang and Taizini) into Jiangsu Yancheng National Nature Reserve

3.Impacts and Follow-up Actions

Release of the findings and recommendations

Release of research findings for the Blueprint Project on 19 October 2015

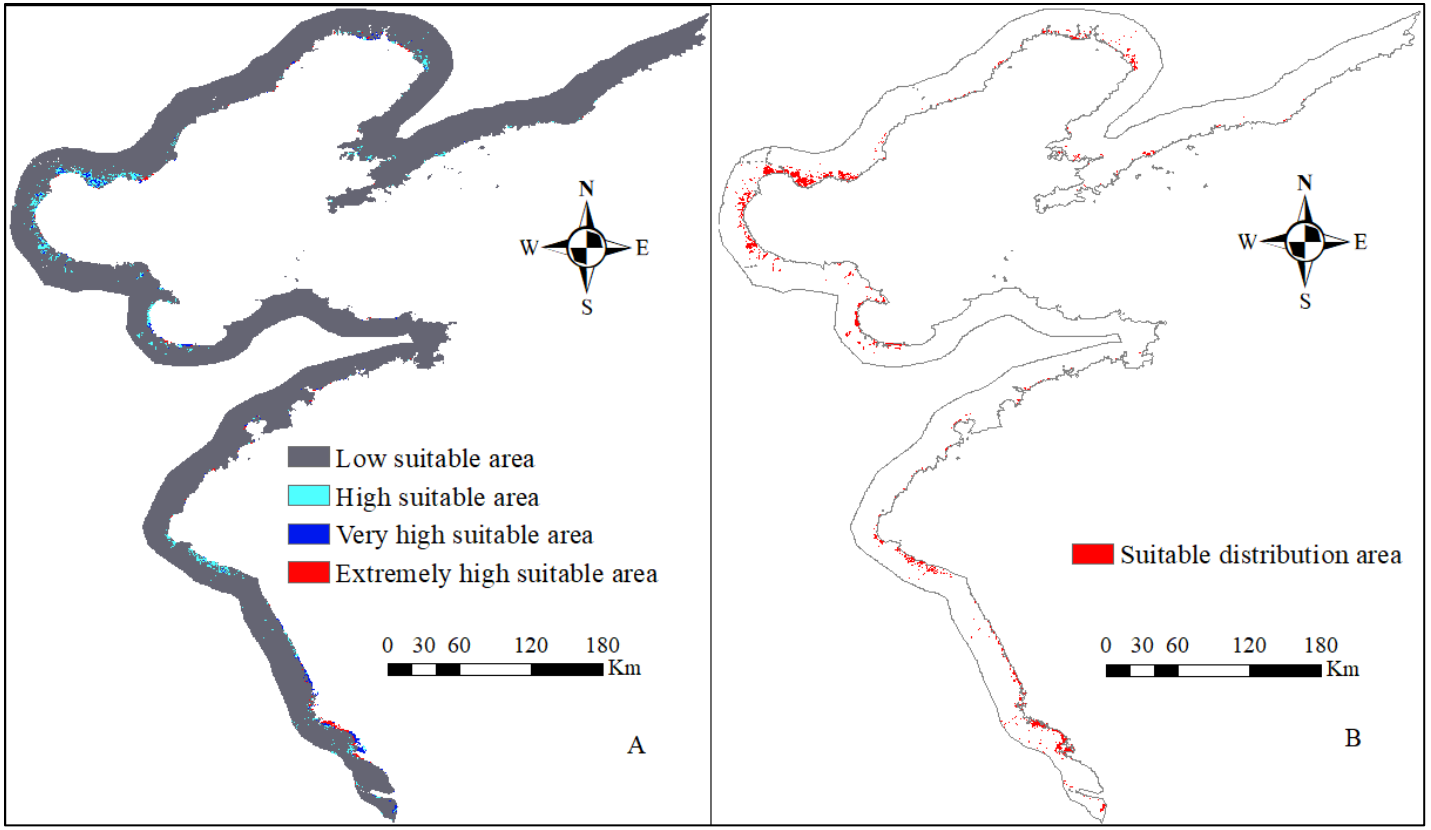
3.1 Impacts of the studies

In July 2018, the Central Government *released Guiding Opinions of the State Oceanic Administration on Strengthening the Management and Protection of Coastal Wetlands*

- To set the protection targets for effective protection of typical representative coastal wetland ecosystem (not further reclamation nor filling-up) by 2020,
- To establish a number of new marine nature reserves and special marine reserves of coastal wetland at the national and provincial levels
- To restore damaged coastal wetlands.

The Guiding Opinions was the turning point for the policy changes from "utilization" to "protection" of coastal wetlands.

3.2 Effect of land reclamation on waterbird habitats

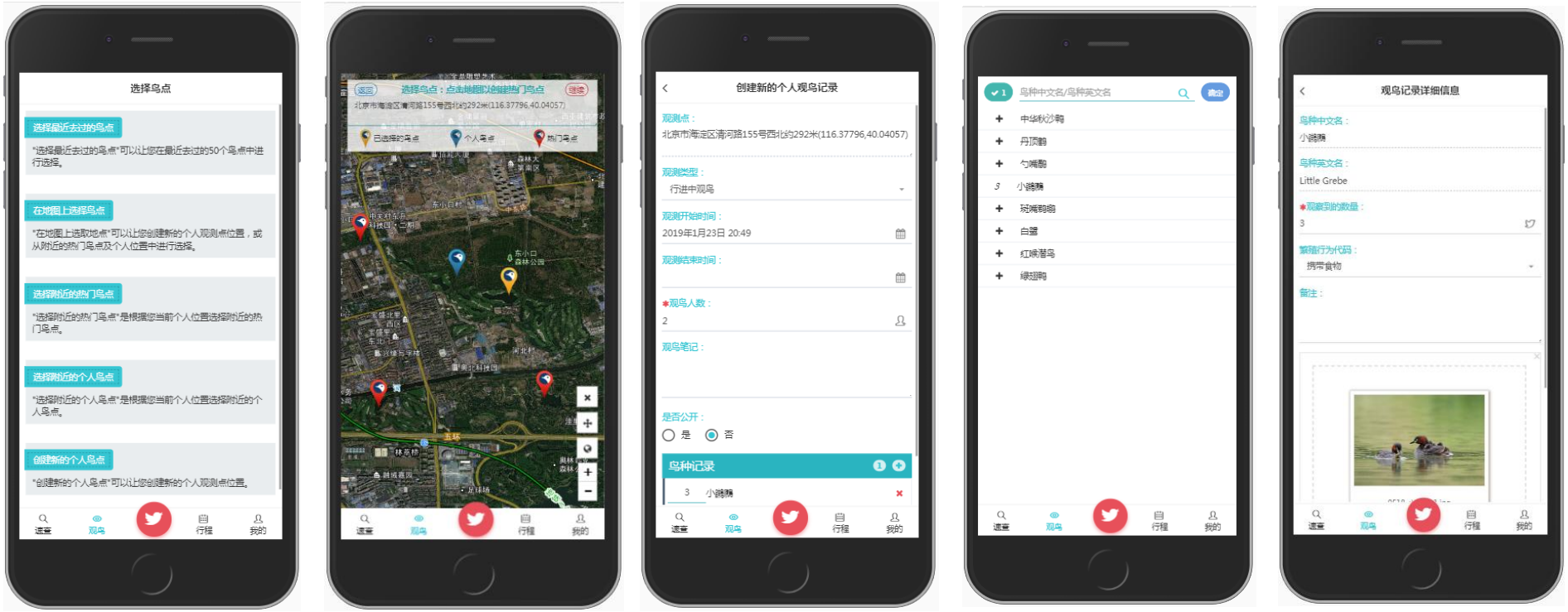


The output of Zonation was divided into four grade: low suitable are, high suitable area, very high suitable area and extremely high suitable area. We retained last three grade as suitable distribution area for 46 shorebirds species. Total area was 4523 km²

3.3 Coastal Waterbirds and Habitats Database

The function included bird recording, album browsing, resource comparison and user communication, and these had been completed

3.3 Coastal Waterbirds and Habitats Mobile APP



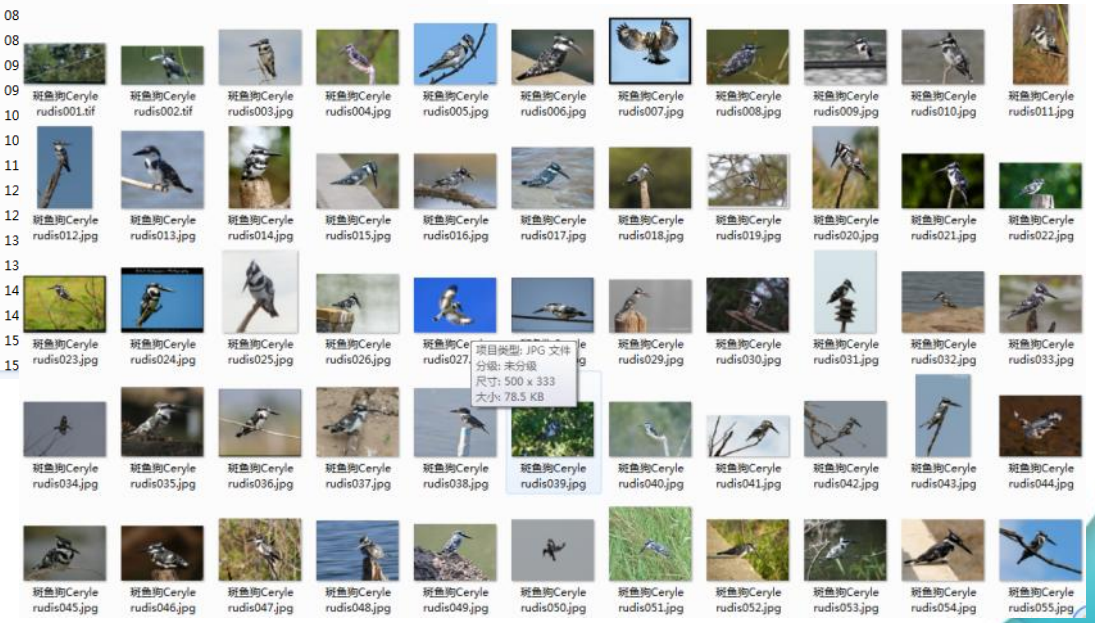
The feature includes species records, important birdwatching area selection and last visited birdwatching area selection

3.3 Coastal Waterbirds and Habitats – Bird Idification

002白头硬尾鸭Oxyura leucocephala
003疣鼻天鹅Cygnus olor
004大天鹅Cygnus cygnus
005小天鹅Cygnus columbianus
006鸿雁Anser cygnoides
007豆雁Anser fabalis
008白额雁Anser fabalis
009小白额雁Anser erythropus
010灰雁Anser anser
011斑头雁Anser indicus
012雪雁Anser indicus
013加拿大雁Branta hutchinsii
014黑雁Branta bernicla
016赤麻鸭Tadorna ferruginea
018翘鼻麻鸭Tadorna tadorna
019瘤鸭Sarkidiornis melanotos
020鸳鸯Aix galericulata
021赤膀鸭Anas strepera
022罗纹鸭Anas falcata
023赤颈鸭Anas penelope
024绿头鸭Anas platyrhynchos
025斑嘴鸭Anas poecilorhyncha
026棕颈鸭Anas luzonica
027琵嘴鸭Anas clypeata
028针尾鸭Anas acuta
029白眉鸭Anas querquedula
030花脸鸭Anas formosa
031绿翅鸭Anas crecca
032美洲绿翅鸭Anas carolinensis
033云石斑鸭Marmaronetta angus...
034赤嘴潜鸭Netta rufina
035红头潜鸭Aythya ferina
036帆背潜鸭Aythya valisineria
037白眼潜鸭Aythya nyroca
038青头潜鸭Aythya baeri
039凤头潜鸭Aythya fuligula
040斑背潜鸭Aythya marila
041小绒鸭Polysticta stelleri
042丑鸭Histrionicus histrionicus
043长尾鸭Clangula hyemalis
044黑海番鸭Melanitta nigra
045斑脸海番鸭Melanitta fusca
046鹊鸭Bucephala clangula
048红胸秋沙鸭Mergus serrator
049中华秋沙鸭Mergus squamatus
050普通秋沙鸭Mergus merganser
051小鸨Tetrax tetrax
052大鸨Otis tarda
053波斑鸨Chlamydotis macqueenii
054白鹤Grus leucogeranus
055赤颈鹤Grus antigone
056白枕鹤Grus vipio
057沙丘鹤Grus canadensis
058蓑羽鹤Grus virgo
059灰鹤Grus grus
060白头鹤Grus monacha
061黑颈鹤Grus nigricollis
062丹顶鹤Grus japonensis
063花田鸡Coturnicops exquisitus
065白喉斑秧鸡Rallina eurizonoides
066普通秧鸡Rallus aquaticus
067长腿秧鸡Crex crex
068红脚苦恶鸟Amaurornis akool
069白胸苦恶鸟Amaurornis phoeni...
070棕背田鸡Porzana bicolor
071姬田鸡Porzana parva
072小田鸡Porzana pusilla
073斑胸田鸡Porzana porzana
074红胸田鸡Porzana fusca
075斑胁田鸡Porzana paykullii
076董鸡Gallicrex cinerea
077紫水鸡Porphyrio porphyrio
078黑水鸡Gallinula chloropus
079骨顶鸡Fulica atra
080丘鹬Scolopax rusticola
081孤沙锥Gallinago solitaria
082林沙锥Gallinago nemoricola
083针尾沙锥Gallinago stenura
086姬鹬Lymnocryptes minimus
087黑尾塍鹬Limosa limosa
088斑尾塍鹬Limosa lapponica
091白腰杓鹬Numenius arquata
092大杓鹬Numenius madagascar...
093鹤鹬Tringa erythropus
096青脚鹬Tringa nebularia
097小青脚鹬Tringa guttifer
098小黄脚鹬Tringa flavipes
101翘嘴鹬Xenus cinereus
102矶鹬Actitis hypoleucos
103灰尾漂鹬Heteroscelus brevipes
106棉凫
107长嘴鹬Limnodromus scolopac...
108半蹼鹬Limnodromus semipal...
111三趾滨鹬Calidris alba
112勺嘴鹬Eurynorhynchus pygme...
113小滨鹬Calidris minuta
116长趾滨鹬Calidris subminuta
118斑胸滨鹬Calidris melanotos
119尖尾滨鹬Calidris acuminata
122阔嘴鹬Limicola falcinellus
123流苏鹬Philomachus pugnax
124红颈瓣蹼鹬Phalaropus lobatus
127铜翅水雉Metopidius indicus
128蛎鹬Haematopus ostralegus
129黑嘴鹮Ibidorhyncha struthersii
132剑鸻Charadrius hiaticula
133长嘴剑鸻Charadrius placidus
134金眶鸻Charadrius dubius
137铁嘴沙鸻Charadrius leschenau...
138红胸鸻Charadrius asiaticus
139东方鸻Charadrius veredus
142距翅麦鸡Vanellus duvaucelii
143灰头麦鸡Vanellus cinereus
144肉垂麦鸡Vanellus indicus
147灰燕鸻Glareola lactea
148短尾贼鸥Stercorarius parasitic...
149长尾贼鸥Stercorarius longicau...
152海鸥Larus canus
153灰翅鸥Larus glaucescens
154北极鸥Larus hyperboreus

Collecting and cleaning waterbirds pictures

Pictures storage is 5.6GB, 31369 photos

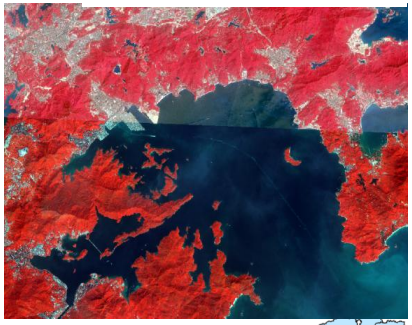


3.3 Coastal Waterbirds and Habitats Satellite Image Processing

Tianjin Port

Yancheng NNR

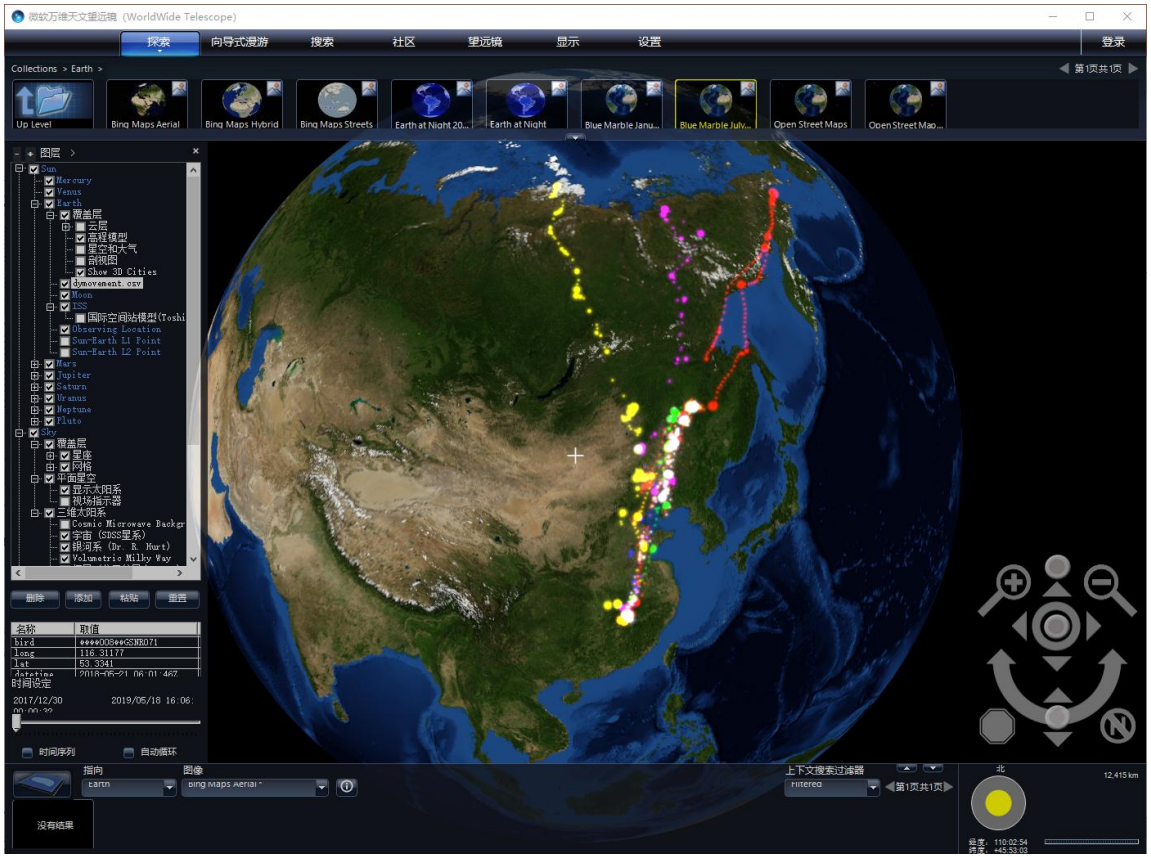
Liaohe Estuary



Shenzhen Bay

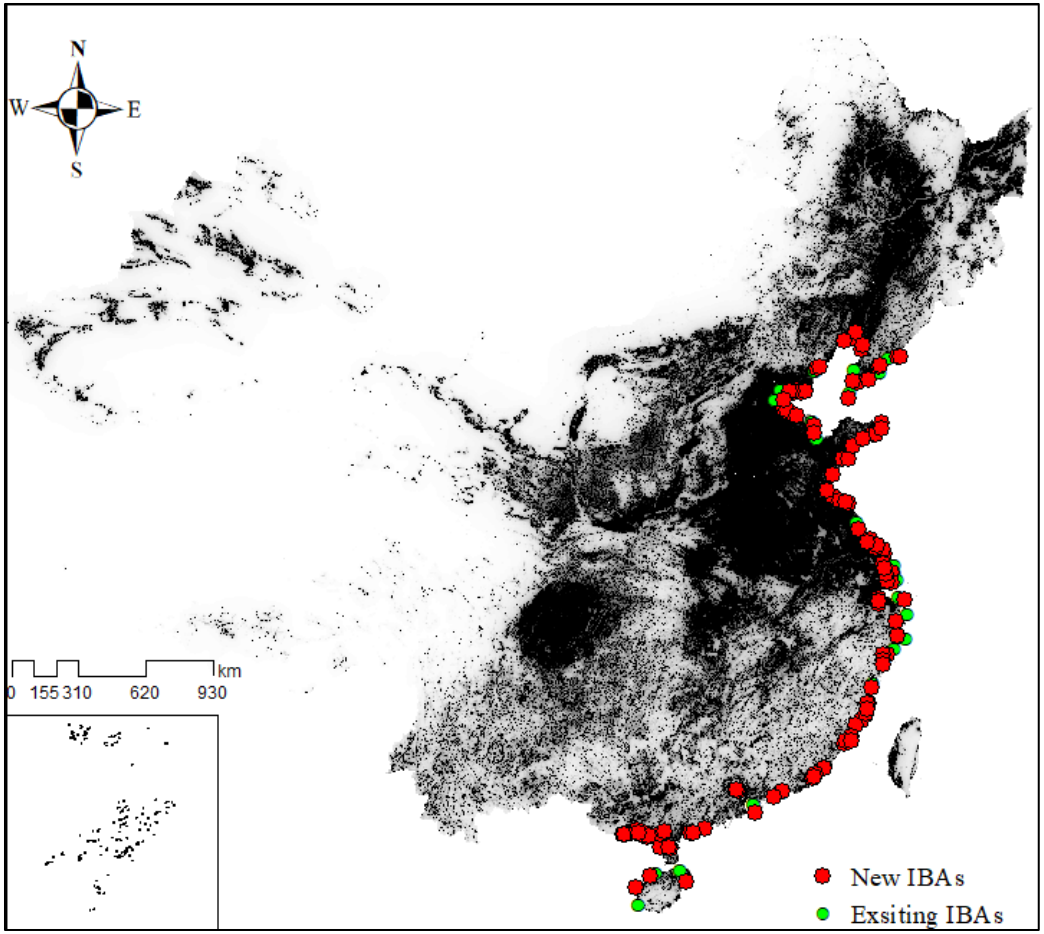
Yellow River Delta

3.3 Coastal Waterbirds and Habitats GPS tracker



Clean, analyze and visualize the data collected by the GPS tracking device on the waterbirds. (example: bean goose)

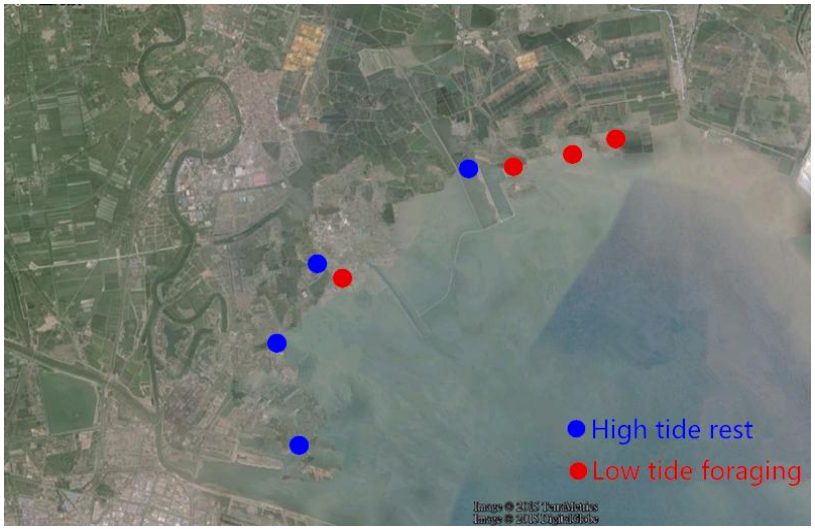
3.3 Coastal Waterbirds and Habitats Application (example)



151 IBAs was identified, including 33 existing IBAs

3.4 Conservation actions of endangered waterbirds and their habitats in the Yellow Sea ecosystem

Funded by UNDP-GEF Yellow Sea Large Marine Ecosystem (YSLME) –Phase II



Pilot area 1. Hangu Coastal Wetlands, Binhai New Area, Tianjin

Pilot area 2. Qinghe River Estuary Wetland, Lianyungang

4. Summary

- Yellow Sea Large Marine Ecosystem is a typical macrosystem, and understanding of macrosystem needs a holistic approaches by integrating of ecosystem monitoring, bird and fishery survey, big data and deep learning, as well as biodiversity assessment and conservation mapping.
- Better understanding of the coastal wetland issues and informing the decision-makers and public are affective approaches to achieve the conservation targets.
- Citizen scientists could contribute more to bird and habitat conservation with applicable database and mobile APP.

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Thank you for your attention