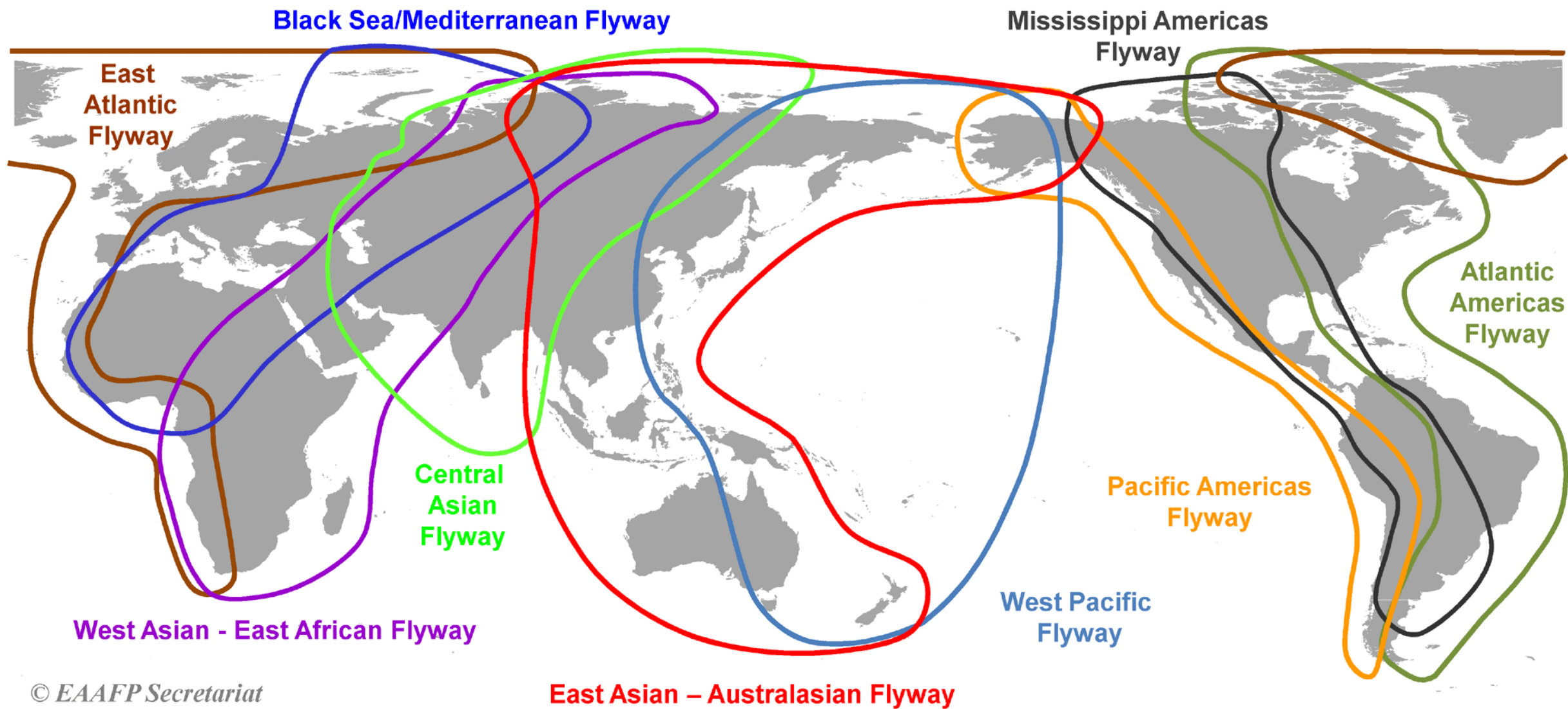


# Using long-term ringing and movement data to monitor and conserve migratory waterbirds in East Asia, with an emphasis on the Black-faced Spoonbill





© EAAFP Secretariat

© The Cornell lab of Ornithology



# The threatened migratory waterbirds along the EAAF



**CR** Siberian Crane

新华网  
WWW.NEWS.CN



**EN** Eastern Curlew

Far Eastern curlew  
大杓鹬, dà sháo yǔ  
*Numenius madagascariensis*



**VU** Black-faced Spoonbill

© Li Dongming



**CR** Spoon-billed Sandpiper

© Alexander Nastachenko

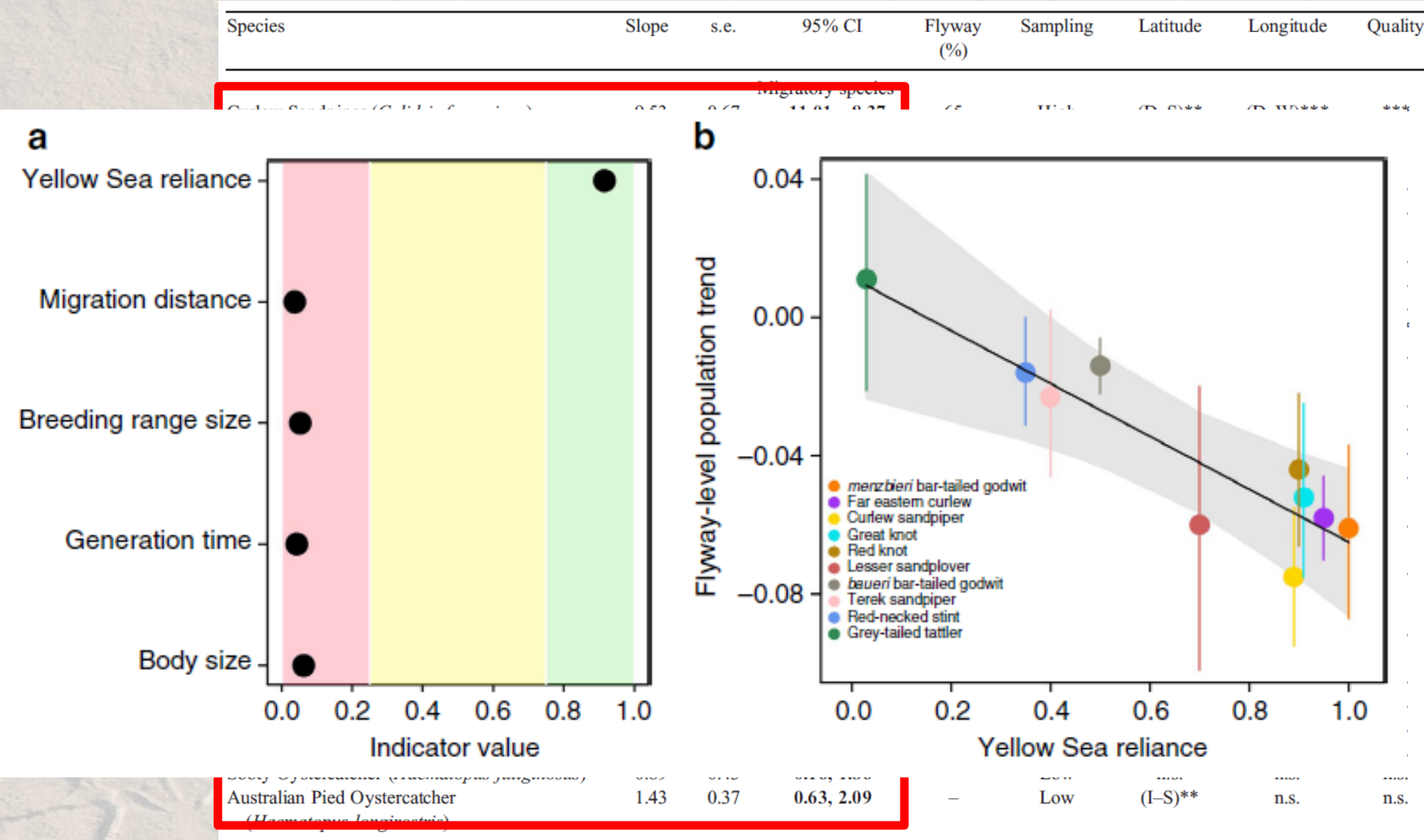
**What's happening?**



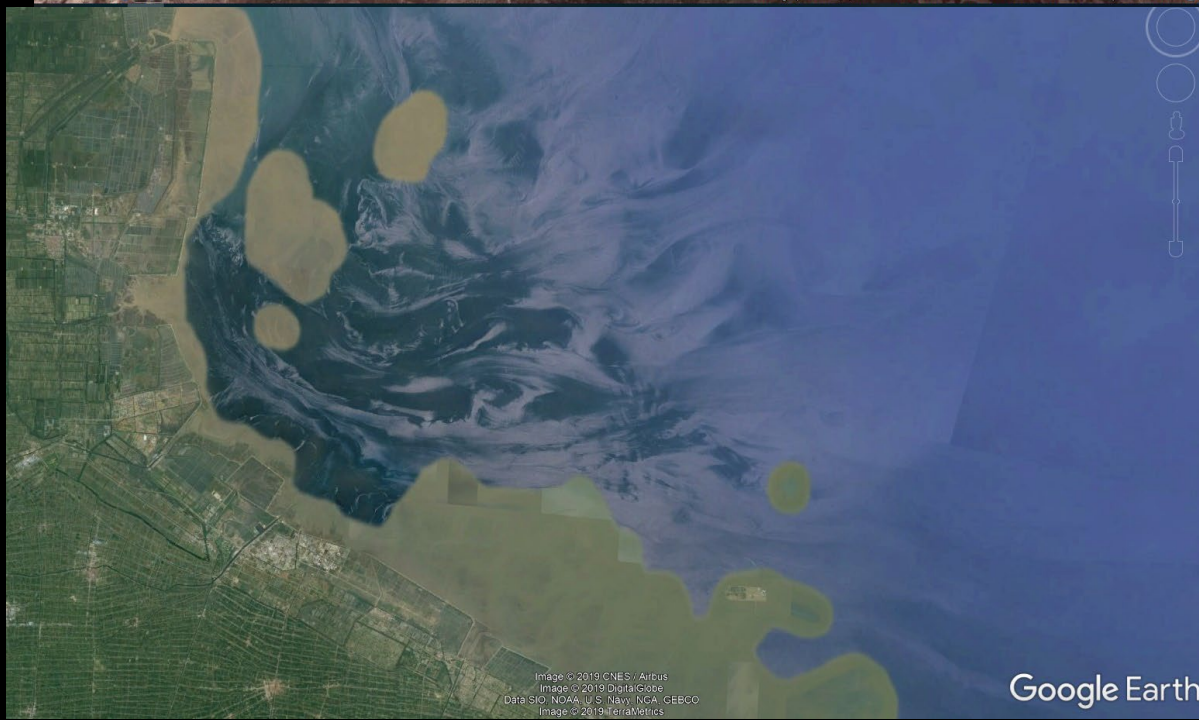
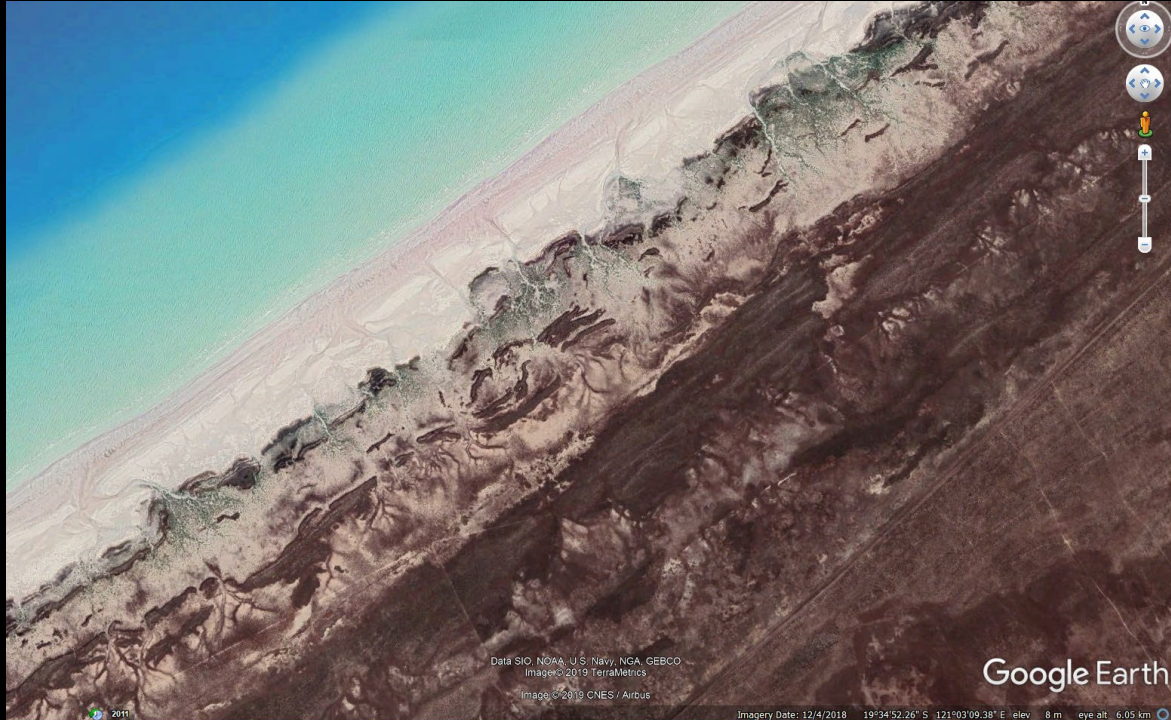
# Drivers for various population trends in migratory shorebirds

Clemens *et al.* 2016 *Emu*

Studds *et al.* 2016  
*Nature Communication*











HANGZHOU BAY WETLAND  
Zhejiang Province



# Coastal wetlands in East Asia



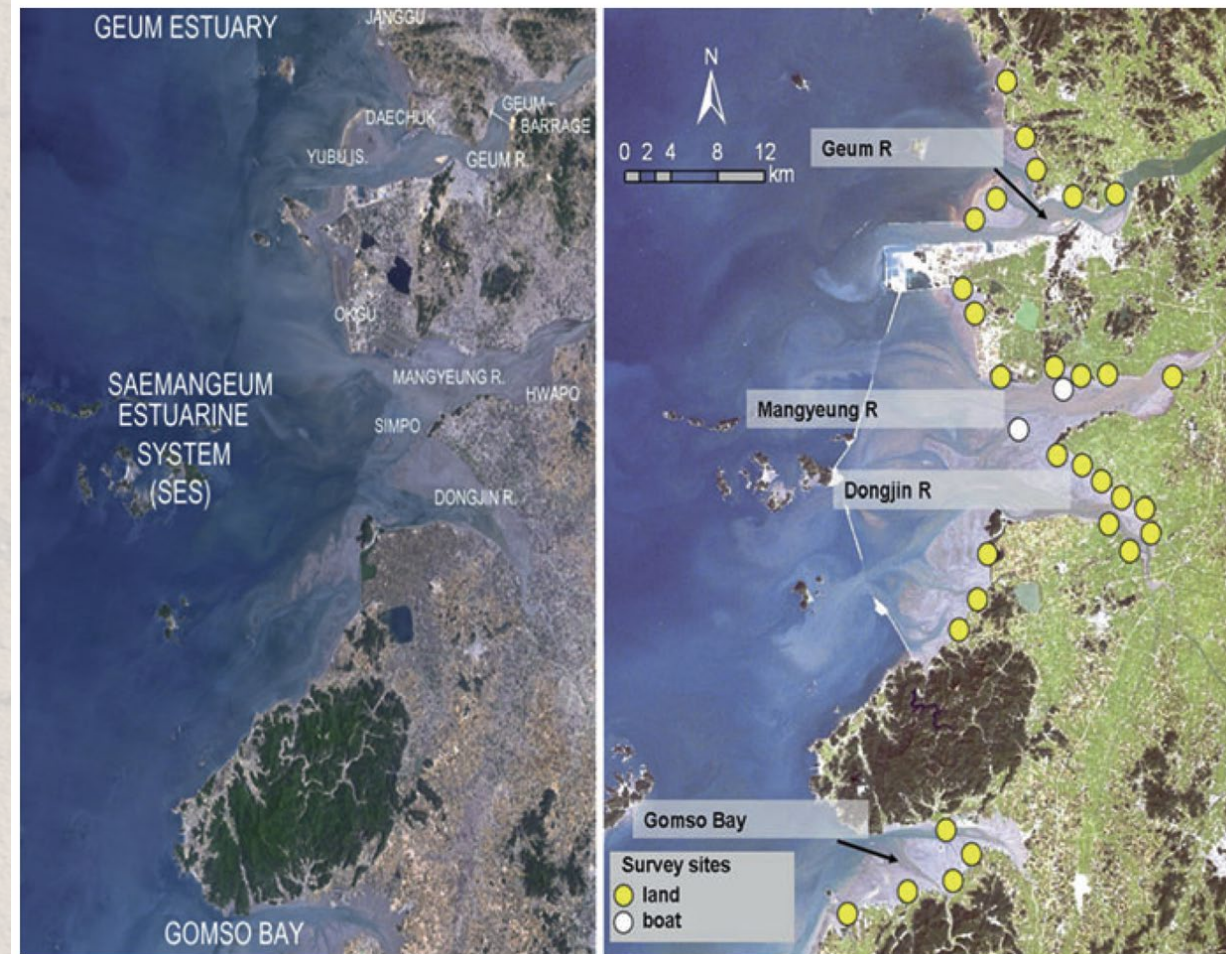
© Xie zongyu



**FIGURE 1** Low-tide satellite image taken on 3 August 2015, showing the rapid advance of the seawall at Chongming Dongtan, Shanghai. This conversion of natural tidal wetlands into aquaculture ponds and arable lands is occurring at an alarming rate in coastal China and South-East Asia (Image courtesy of the U.S. Geological Survey). The inset shows the location of Chongming Dongtan and Jiangsu coast (shaded in cyan) within the Yellow Sea. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



# Habitat loss through reclamation



**Fig. 1** The SSMP Study Region in May 1989 (*Left*) before construction started on the Saemangeum seawall and in late 2005/early 2006 (*Right*), showing SSMP count sites (NASA images, reproduced with permission in Moores [2012](#))



# Habitat loss through cordgrass invasion



Gan *et al.* 2009  
*Est. Coast.  
Shelf. Sci.*

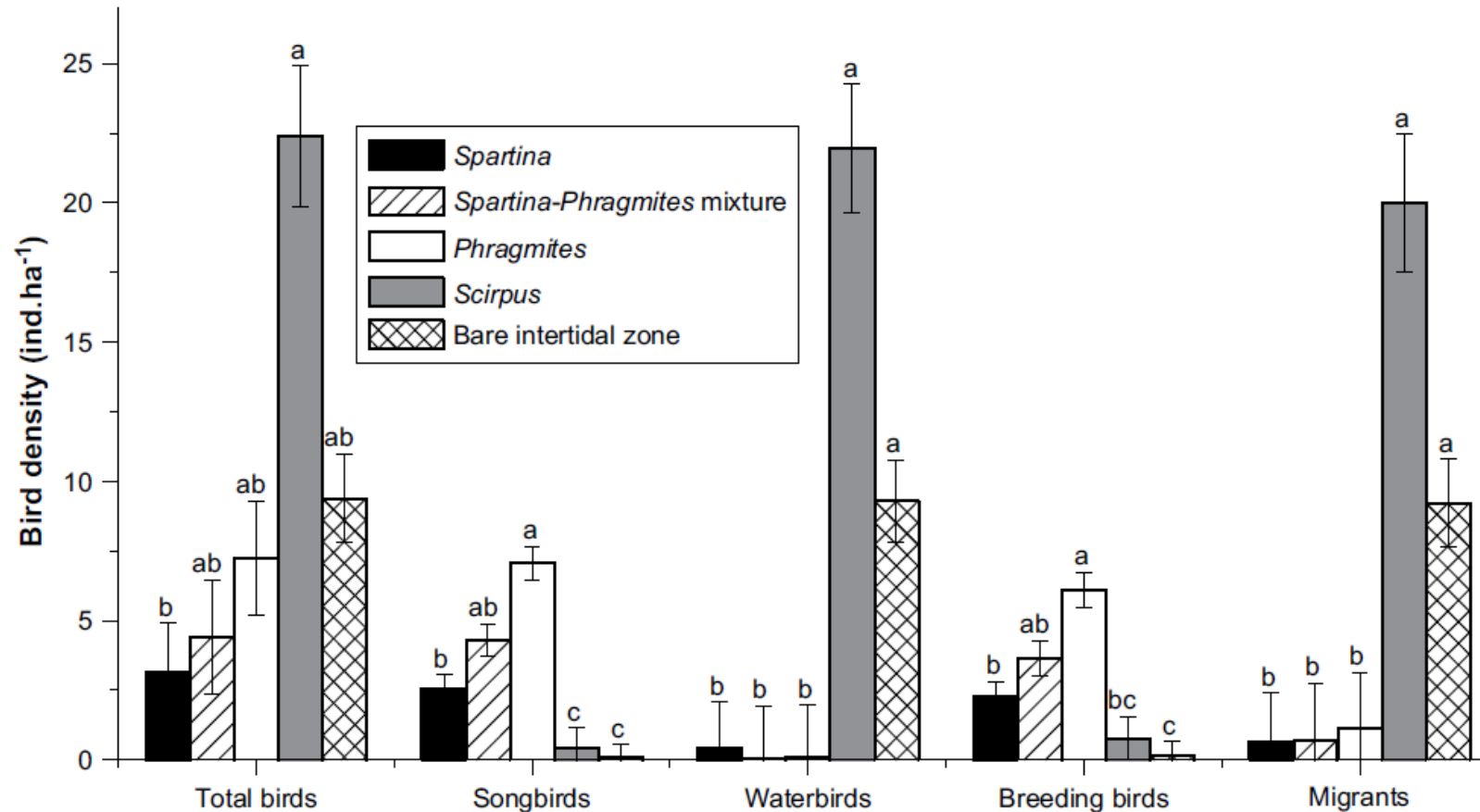


Fig. 3. Mean bird densities ( $\pm$ SE) of various bird groups in the five habitats. For each bird group, bars with the same lowercase letters are not significantly different ( $P > 0.05$ ).





# Habitat loss through cordgrass invasion

Jackson *et al.* 2021  
*J. Env. Manag.*

- ↘ A net loss in tidal flat area in 39 of 53 individual sites (74%)
- ↘ *Spartina alterniflora* occurred at 28 of 53 sites (53%) in 2015, of which 22 sites (79%) also had a net loss in tidal flat area between 2000 and 2015

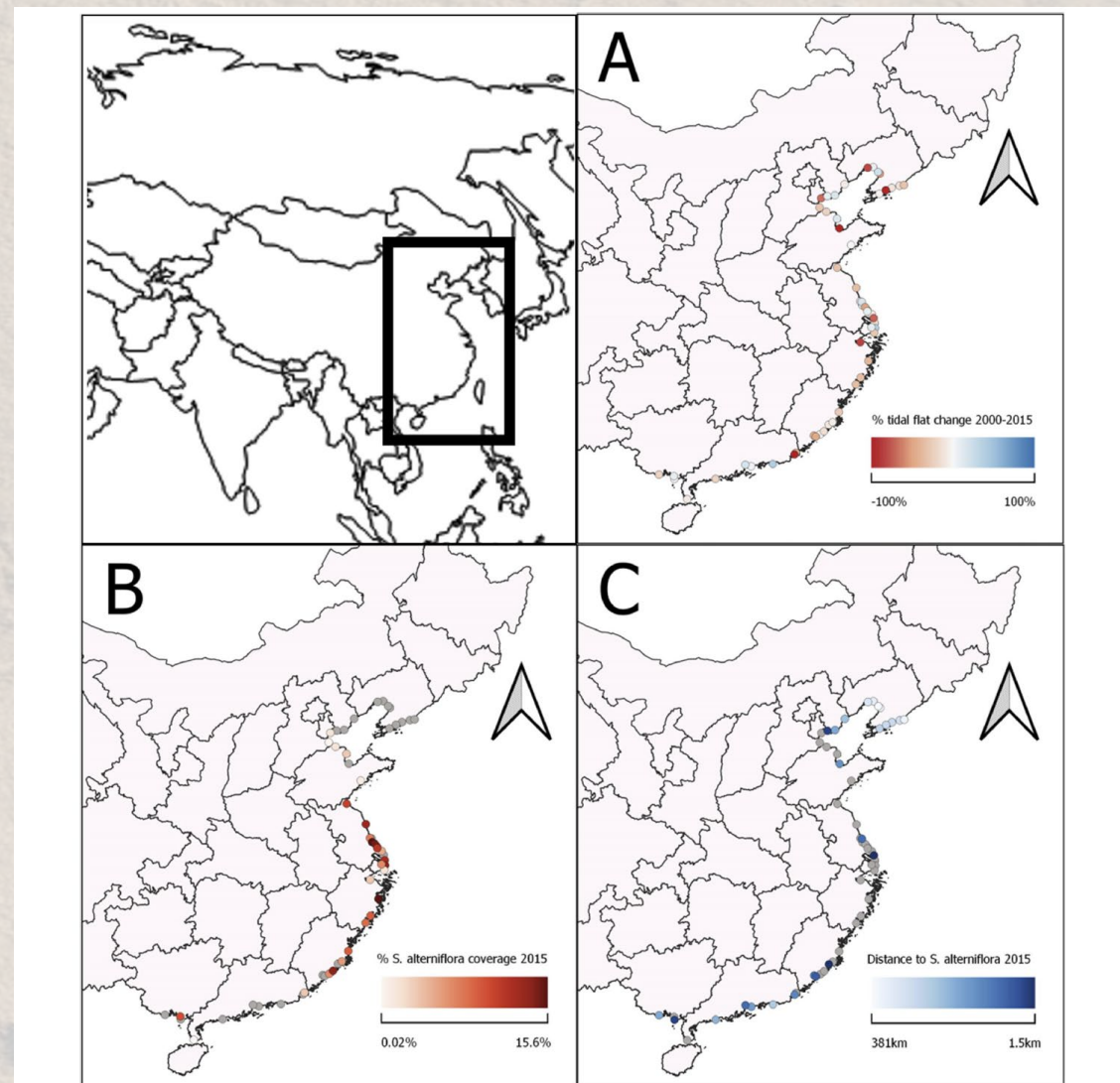


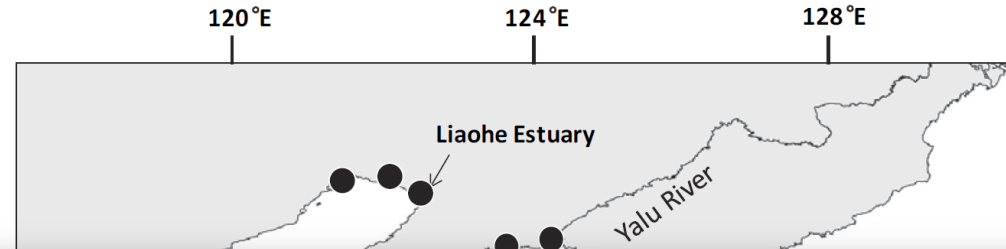
Fig. 1. Regional map showing approximate area of interest with a black rectangle (upper left panel); map of sites in mainland China where internationally important numbers of shorebirds have been recorded, showing (A) change in tidal flat area between 2000 and 2015, (B) extent of *S. alterniflora* coverage of the site in 2015 (sites with no coverage shown in grey) and (C) distance to nearest *S. alterniflora* in cases where *S. alterniflora* did not occur in the site in 2015 (sites with *S. alterniflora* coverage shown in grey).



# Habitat degradation

↓ The rise and fall of the *Potamocorbula laevis*

Choi *et al.* 2014 *Wetlands*; Choi *et al.* 2017 *Auk*



By Phil Battley



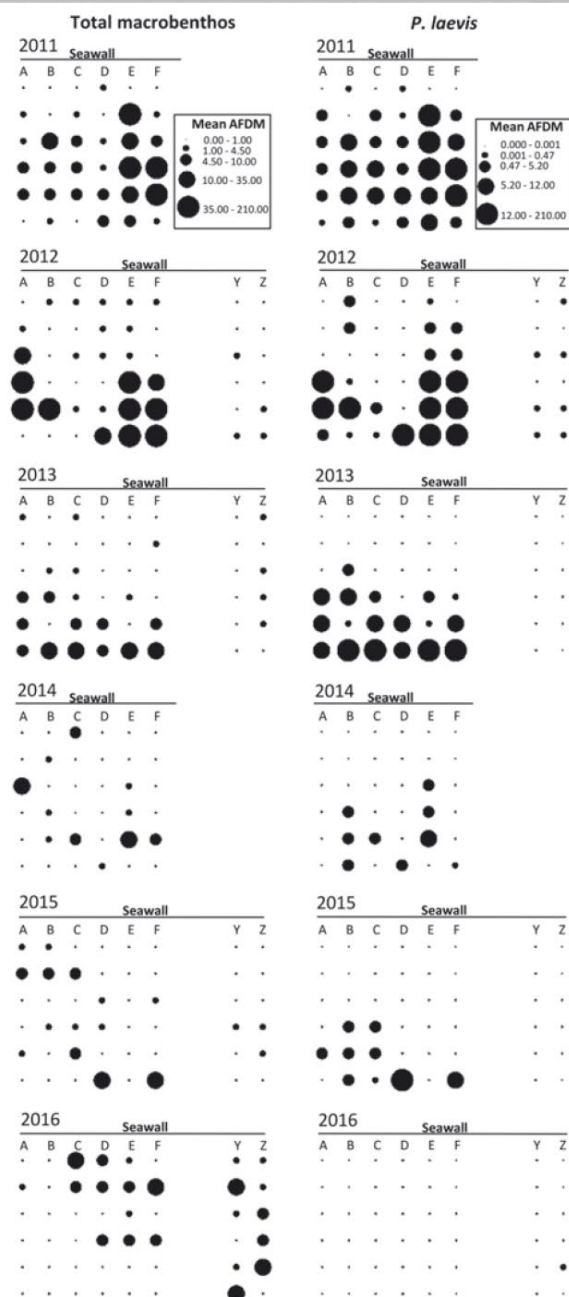
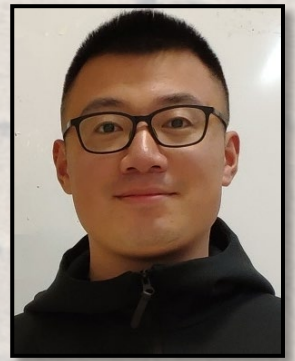


Figure 2. Distribution of benthos biomass across the intertidal flats from 2011–2016. Circles show the mean biomass (g AFDM m<sup>-2</sup>) for the total macrozoobenthos (left-hand plots) and *P. laevis* (right-hand plots). Data represent the benthos contained in the upper 5 cm sampled from 36 sampling stations in 2011 and 2014 and 48 sampling stations in 2012, 2013, 2015, and 2016.

# Habitat degradation



Zhang *et al.* 2018  
*Bird Cons. Int.*

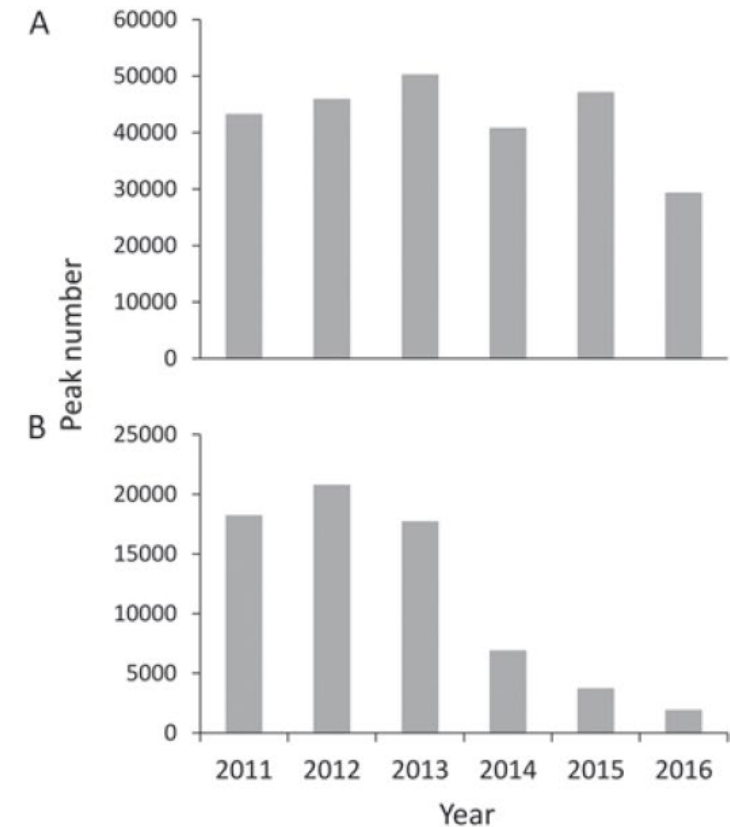


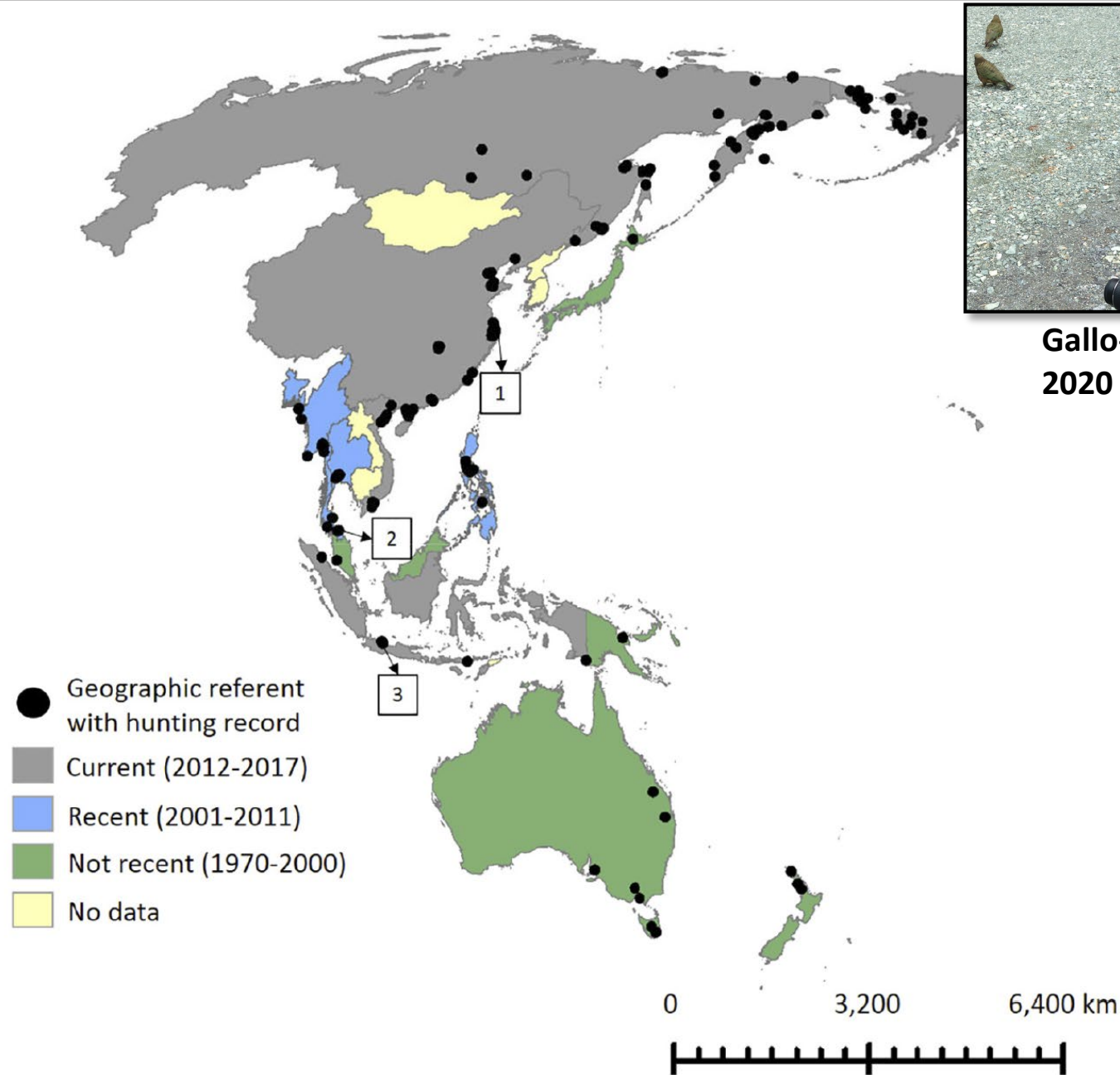
Figure 6. Peak numbers estimated of *L. l. baueri* (A) and *L. l. menzbieri* (B) from 2011–2016.



# Poaching



Peter Crighton



Gallo-Cajiao *et al.*  
2020 *Biol. Cons.*

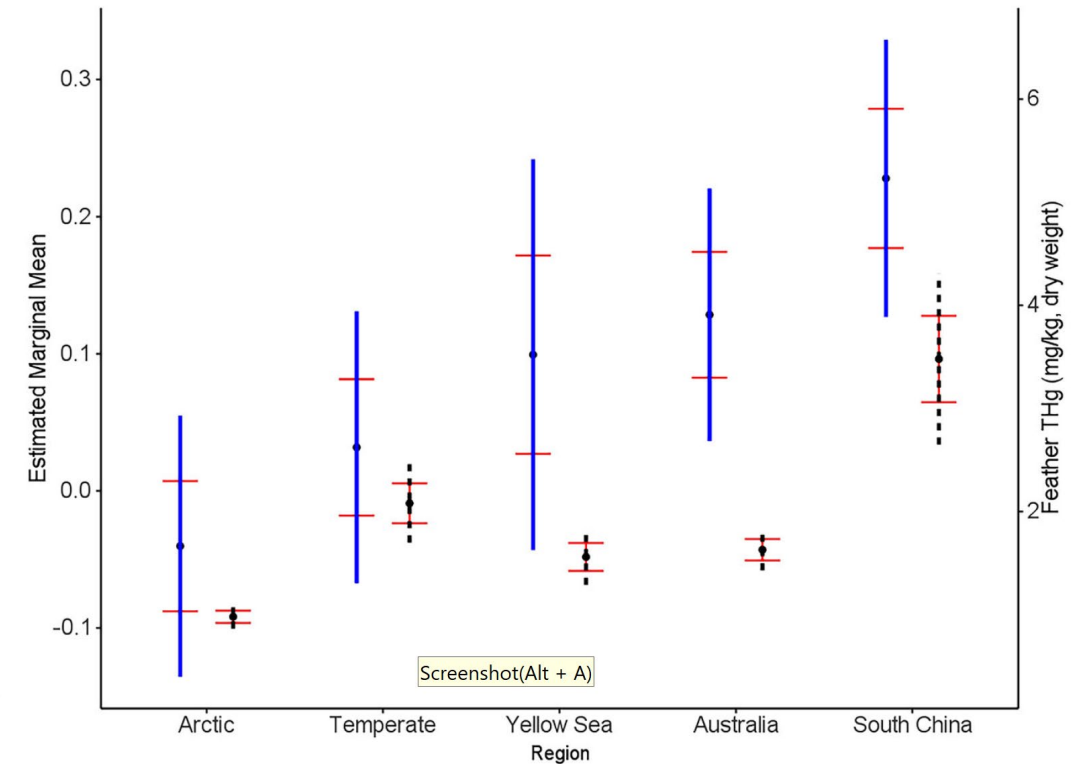
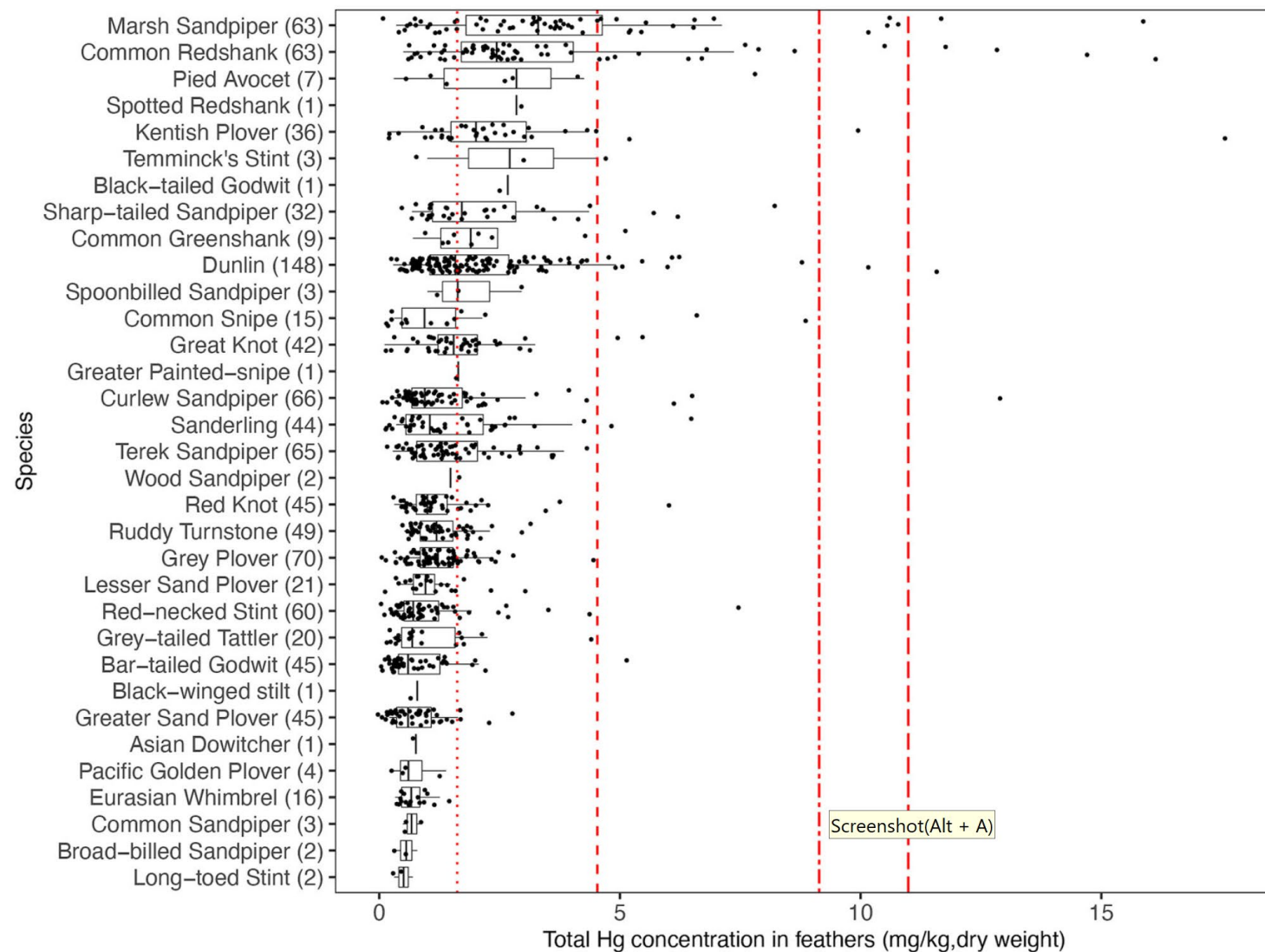
**Fig. 1.** Geographic referents with records of hunting of migratory shorebirds in the East Asian-Australasian Flyway between 1970 and 2017 according to categories per country based on the latest data available [Clusters of geographic referents with robust data: (1) Yangtze River Delta, China (Tang and Wang, 1995); (2) Pattani Bay, Thailand (Ruttanadakul and Ardseungnern, 1989), and; (3) West Java, Indonesia (Milton and Marhadi, 1989)].



# Pollutant contamination - Mercury



Ma et al. 2024  
Comm. Biol.





**Habitat loss, degradation,  
poaching and pollutant  
contamination could be driving  
waterbird population decline**



# So What?

- ↓ A question that your manuscript reviewer, thesis examiner, hiring committee, potential funder may have in their mind
- ↓ What does it mean to other people from different fields?
- ↓ Think about the applied values of your work – solid practical solution





**What can we do?**  
**What have we done?**



# Where to draw the line for Protected Areas?



Choi, Peng *et al.*  
2019 *Biol. Cons.*

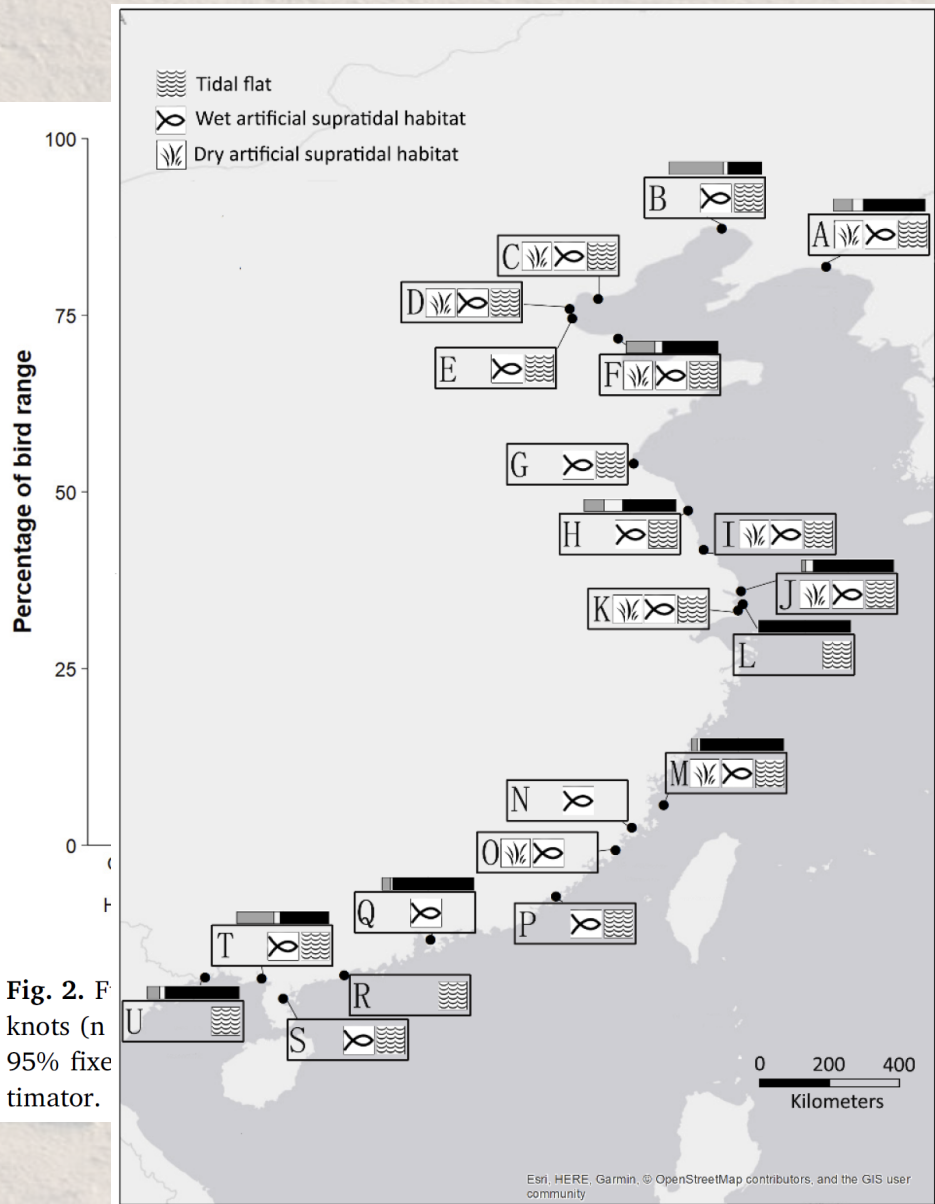


Fig. 2. F  
knots (n  
95% fixe  
timator.

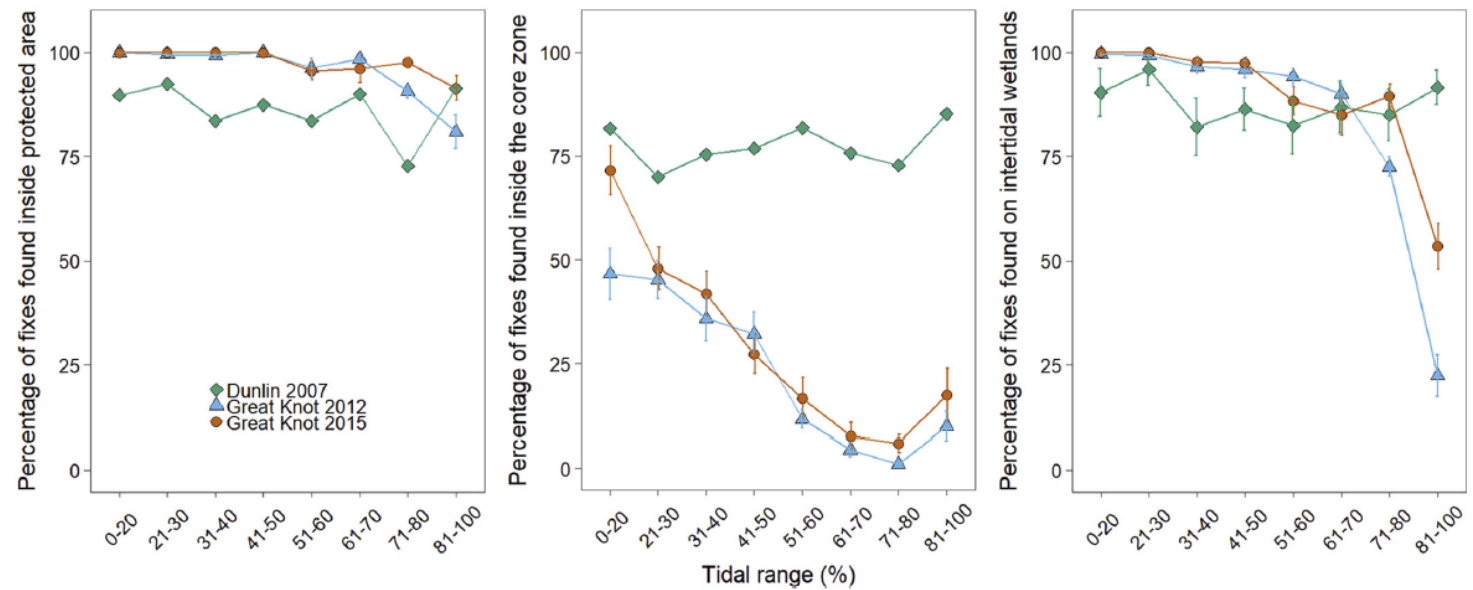
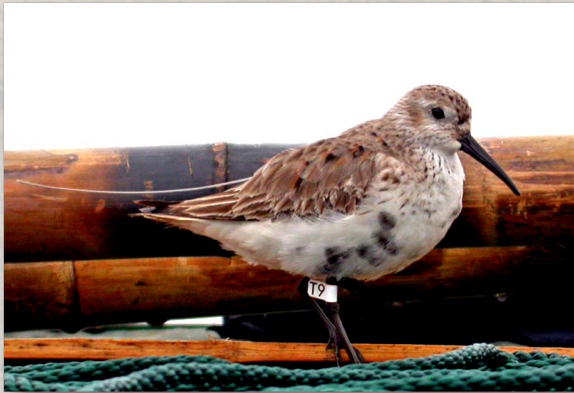


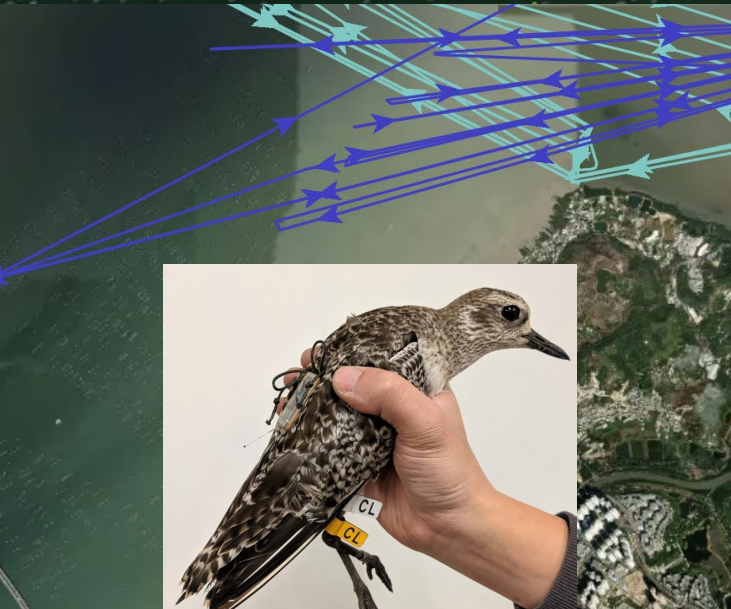
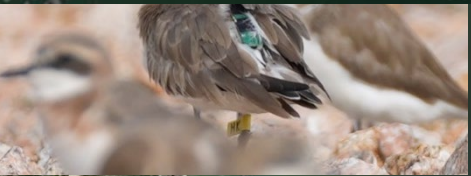
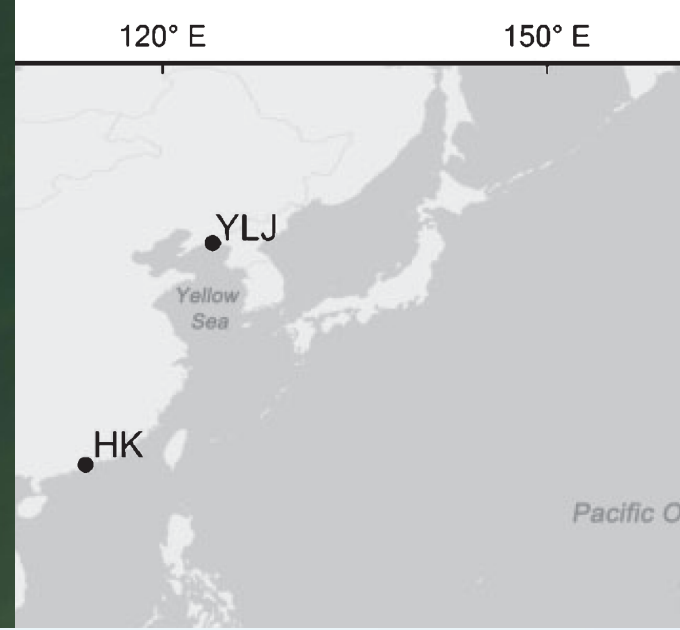
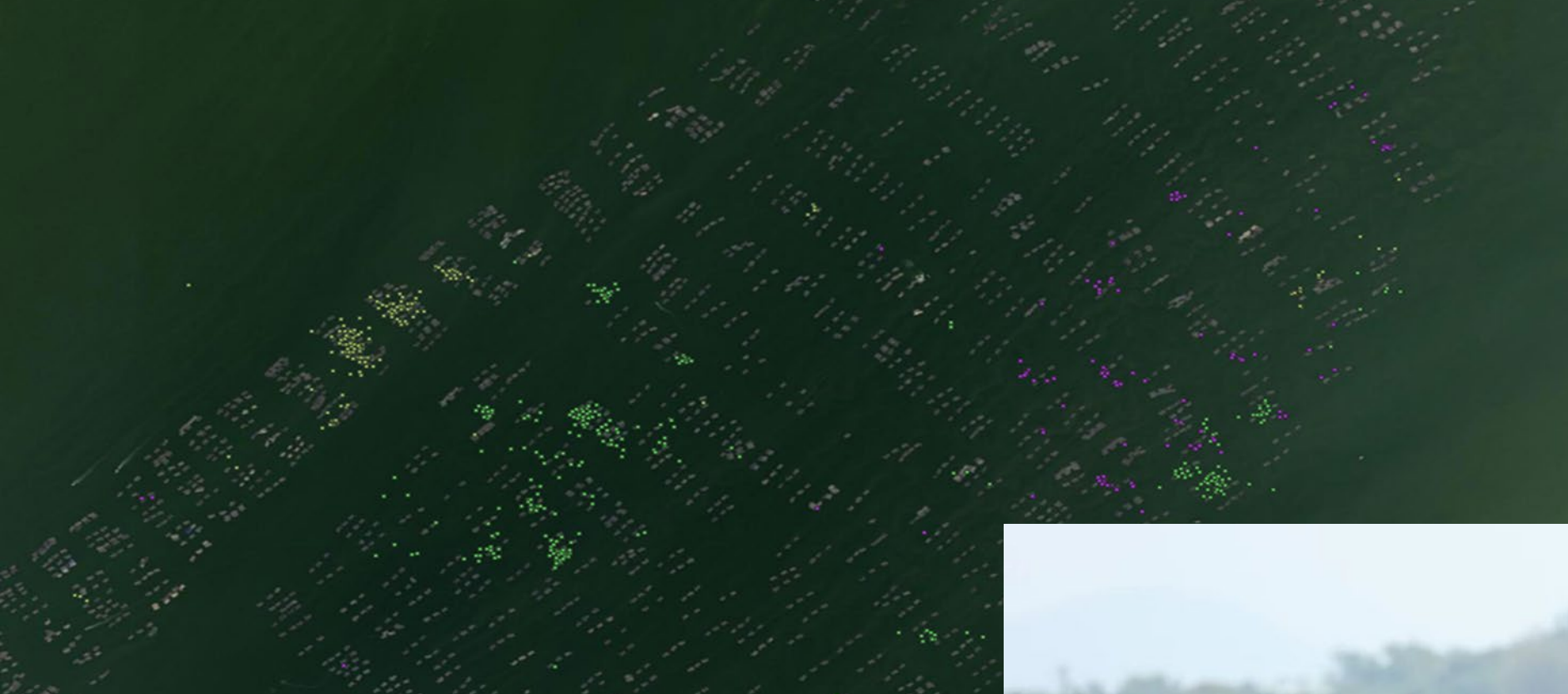
Fig. 4. The change in distribution of location fixes (mean  $\pm$  S.E. of percentage) with tidal ranges (0% as the lowest tide level and 100% as the highest) inside and outside of the reserves (left panel); inside and outside of core zone in a reserve (middle panel); on intertidal wetlands and artificial supratidal habitats (right panel). No standard error was given in dunlins in the first two panels as location fixes from all individual dunlins were pooled due to the small number of location fixes per individual.



# Effort is needed to create and protect high-tide roosting habitats







Henry Lui 摄





Mu-Ming Lin

# Learning From Success

Recovery of the Black-faced Spoonbill,  
an endangered migratory waterbird  
in East Asia





# Why Study Recovering Species?

- Increasing conservation resources lead to more species being rescued from extinction
- Counterbalance to the prevailing pessimism in conservation efforts
- An opportunity to evaluate conservation efforts and apply lessons learned to other species





# Black-faced Spoonbill

*Platalea minor*



(Photo by Dong-Hui Guo; IUCN, 2024)



(Lin et al. 2023)







# International Black-faced Spoonbill Census

## 1989 - 2024

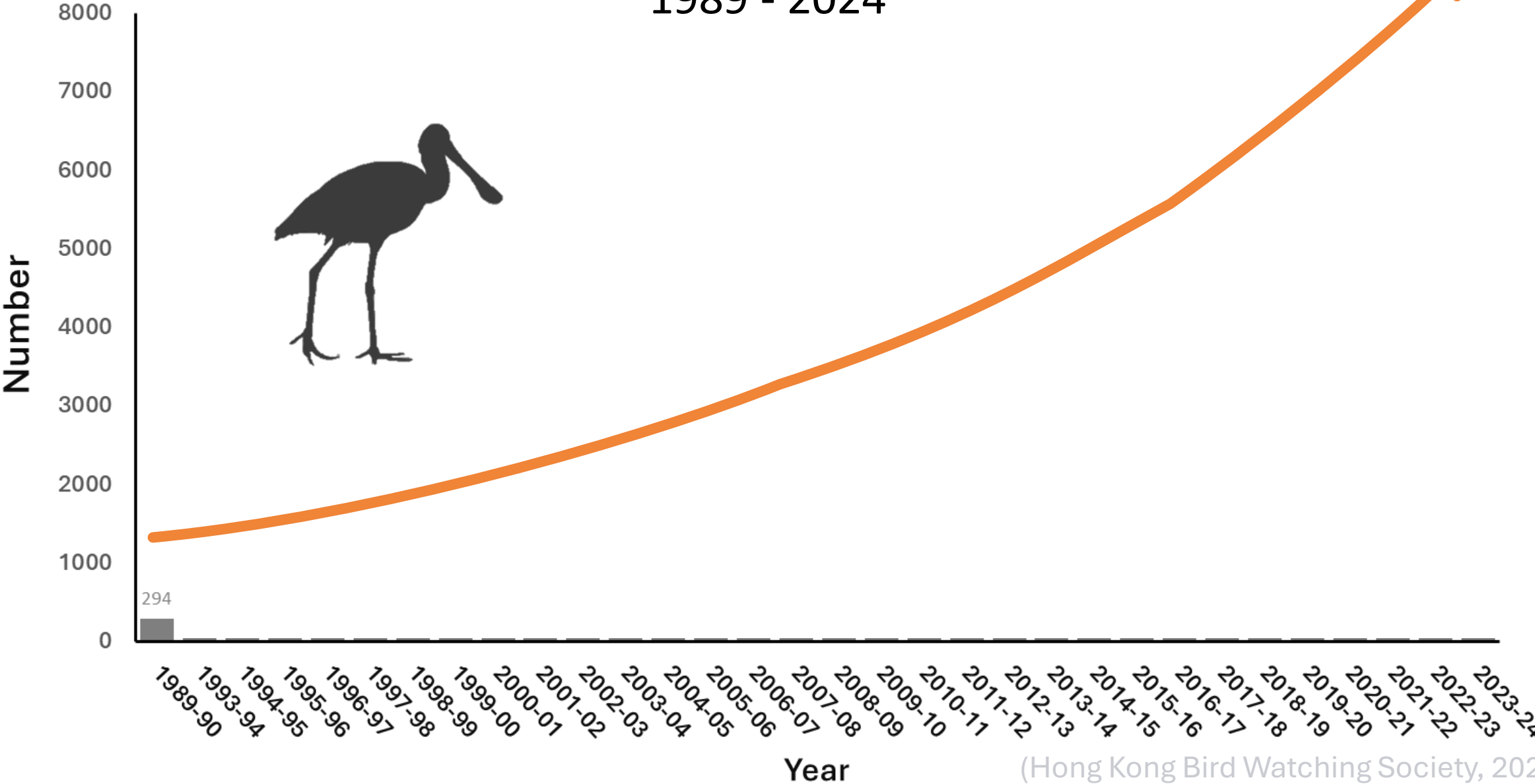


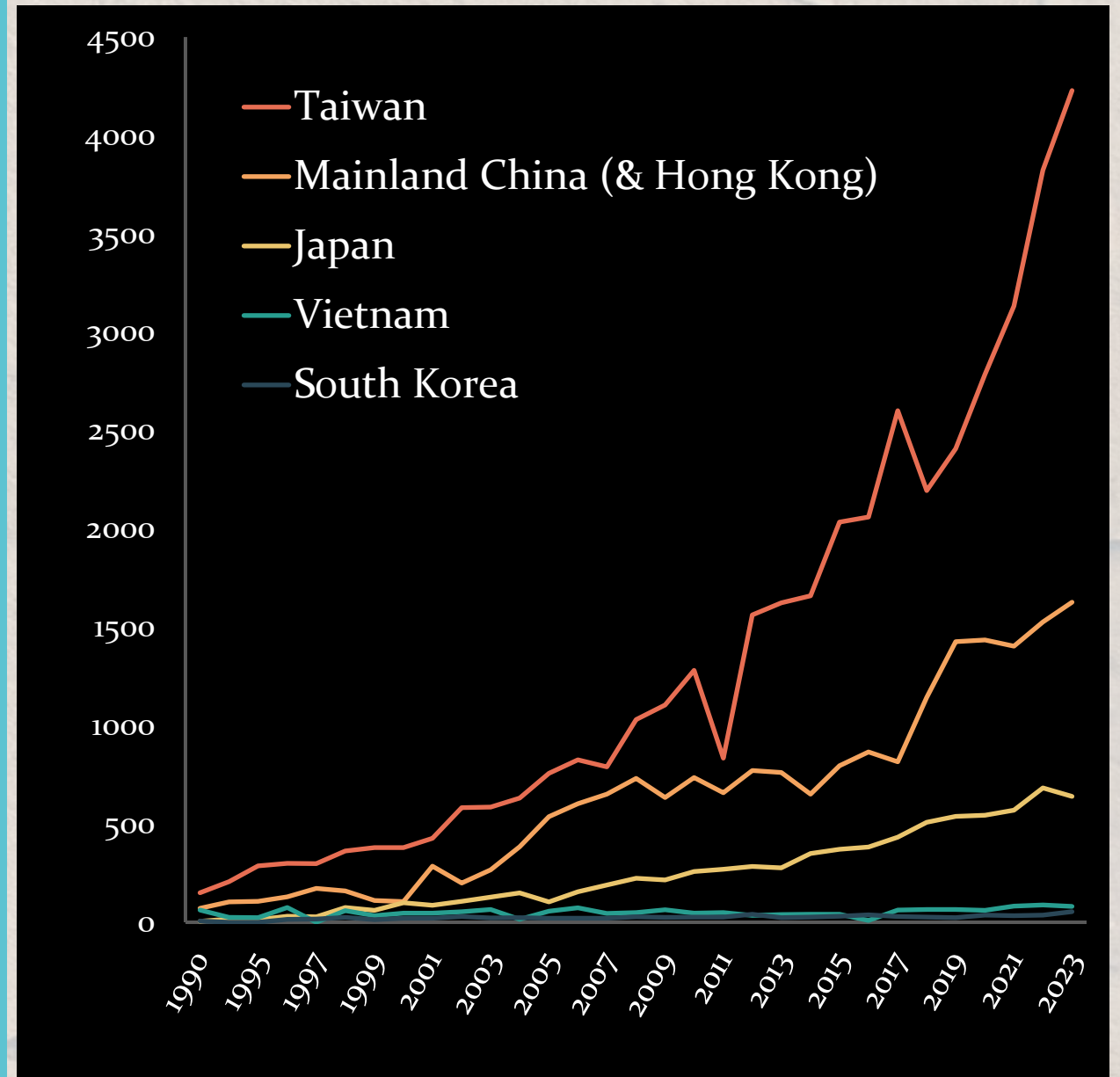




Figure 2.1.1.1. Black-faced Spoonbill distribution and migration routes (areas in orange=breeding grounds, areas in yellow=stopover sites, areas in blue=wintering grounds; solid lines=known flight paths, dashed lines=inferred flight paths).

(Lin et al. 2023)

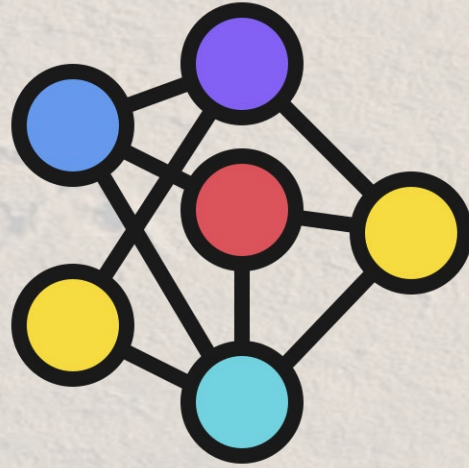
BFS number counted in major wintering regions, 1989–2023 (Yu et al. 2023).



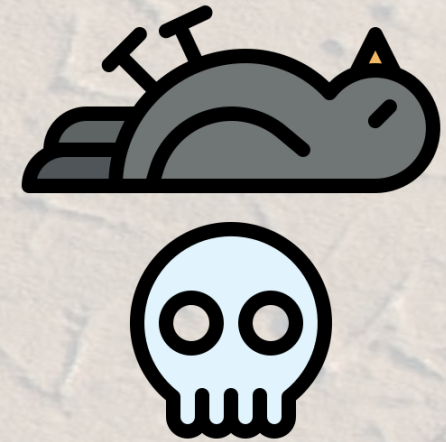


Why do BFS  
wintering  
populations  
show uneven  
recovery?

Spatial Structuring



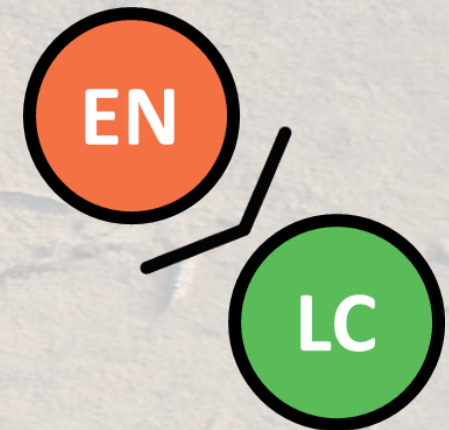
Wintering Survival



Habitat preferences

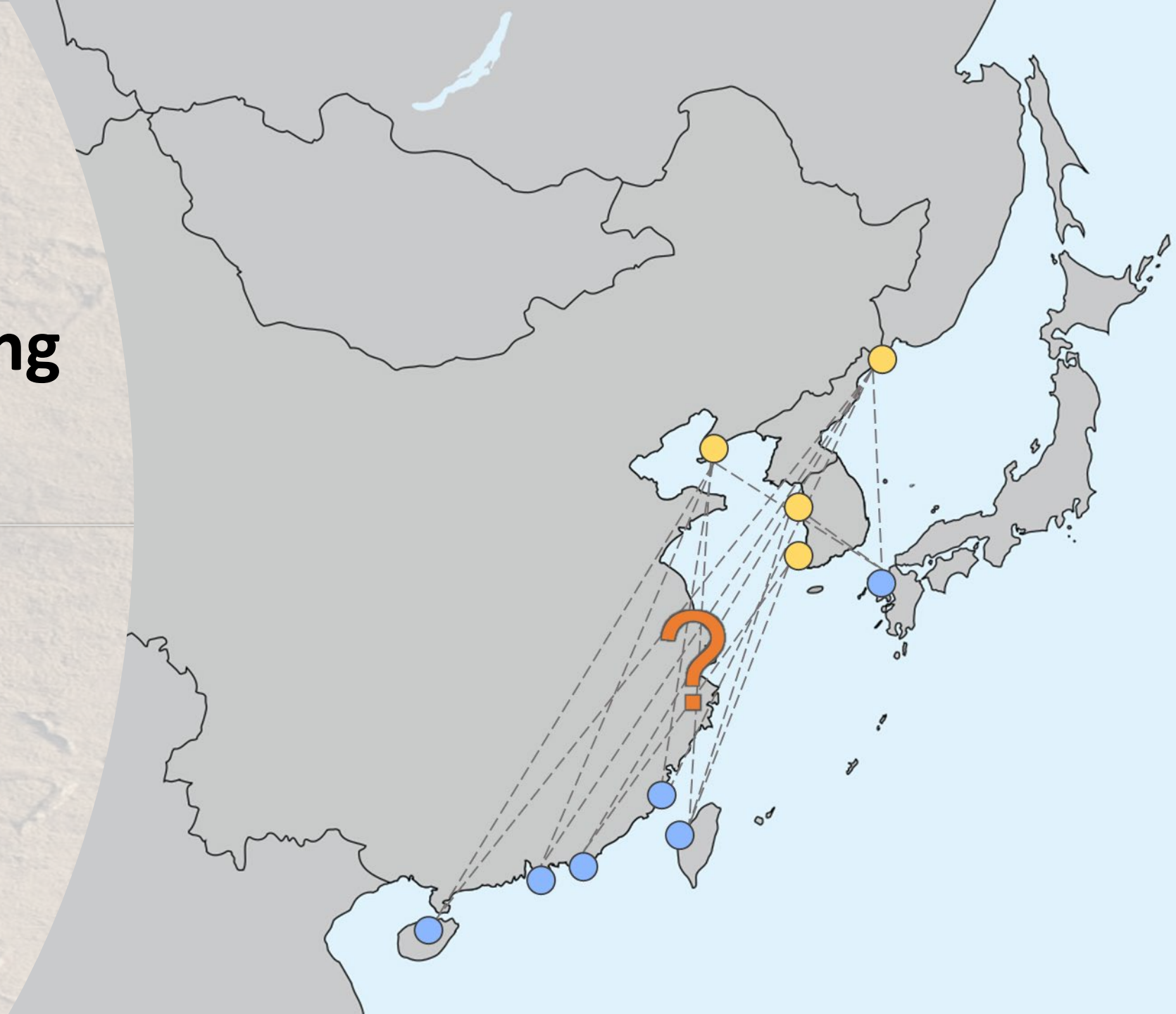


Red List Downlisting

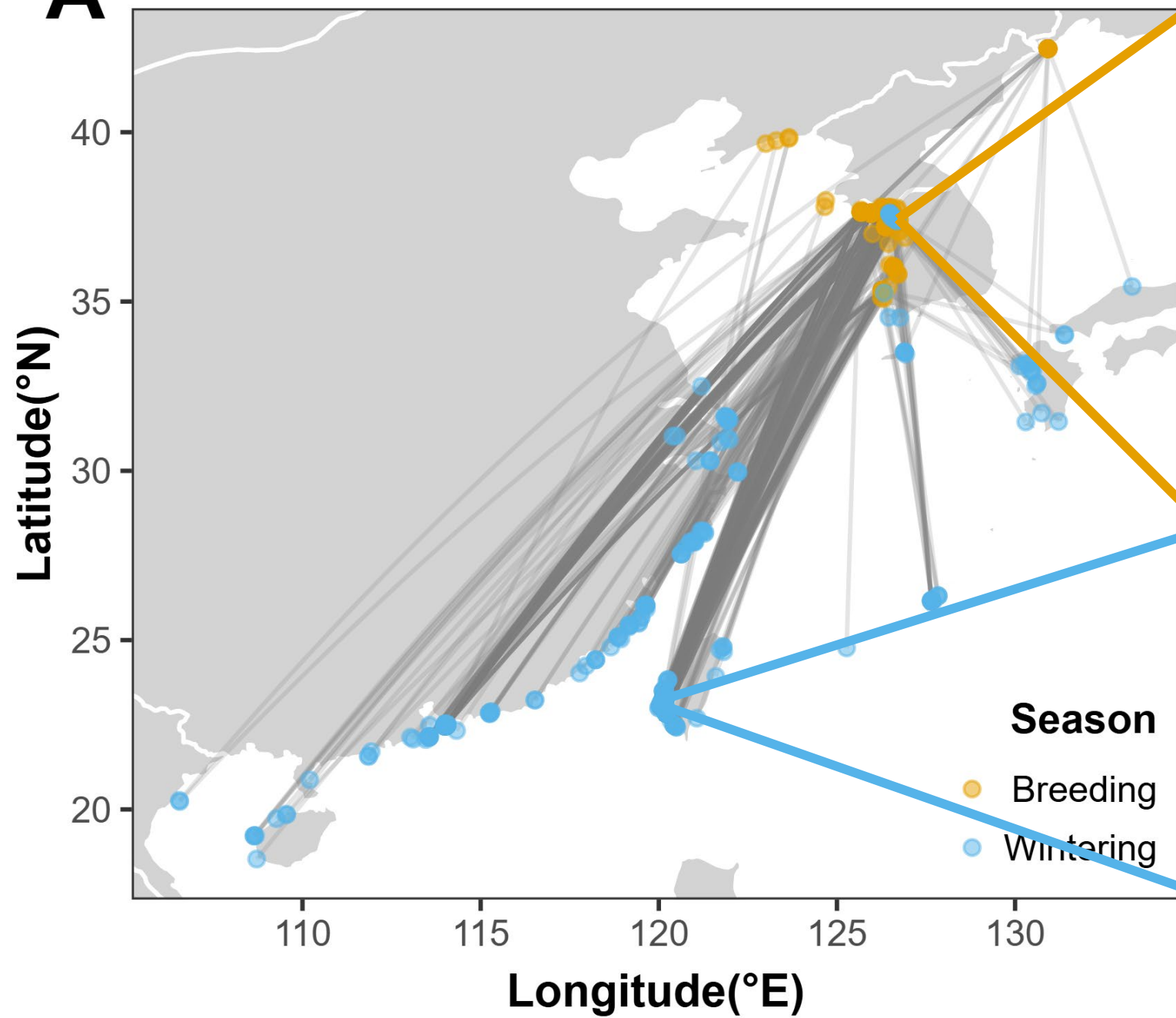




# Spatial Structuring of Black-faced Spoonbill Populations



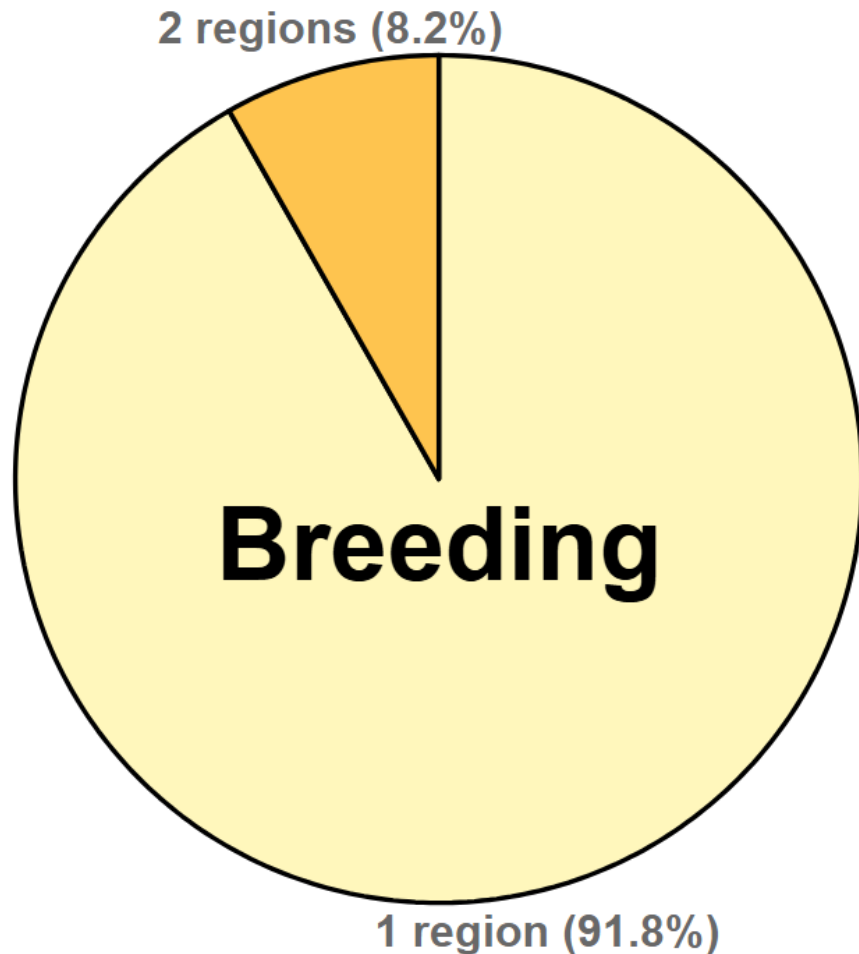


**A**

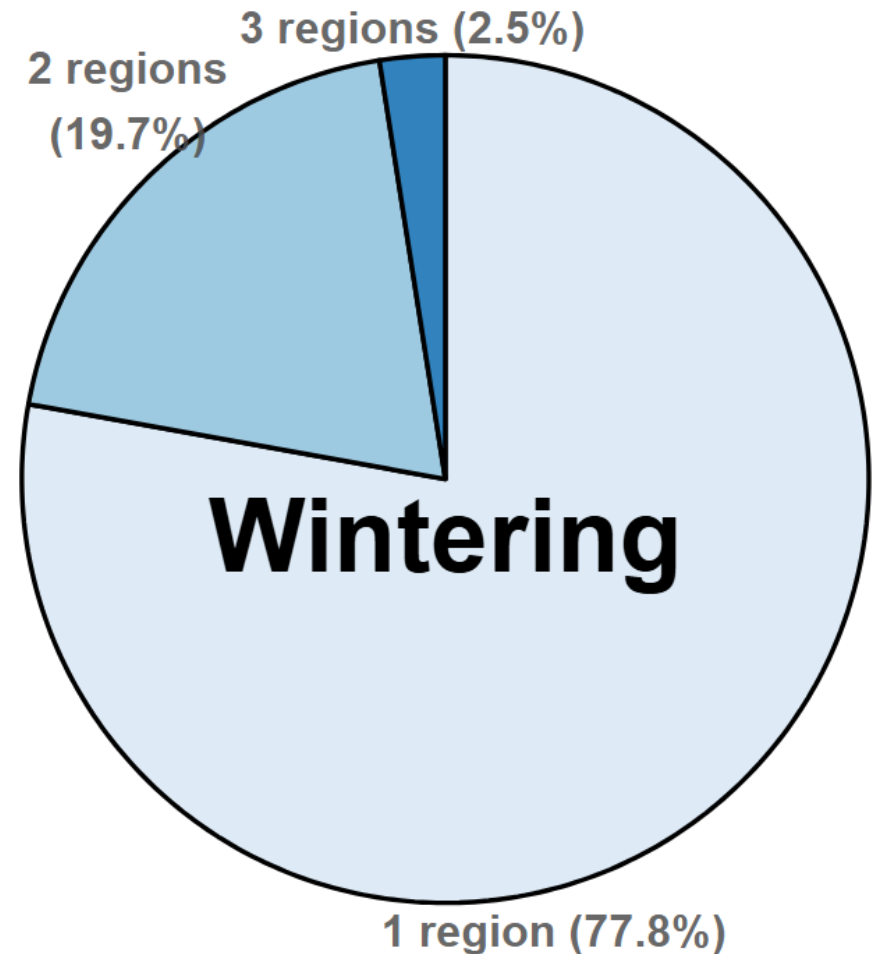


# Strong site fidelity in both breeding and wintering regions

**A**

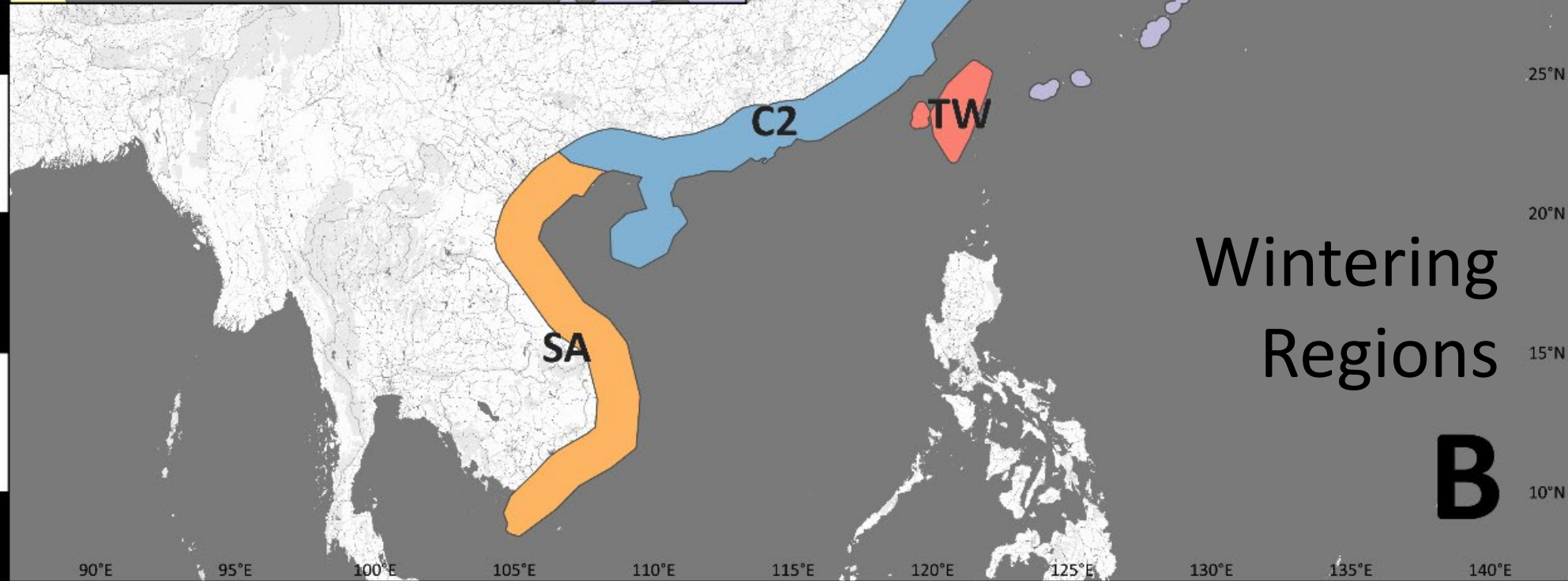
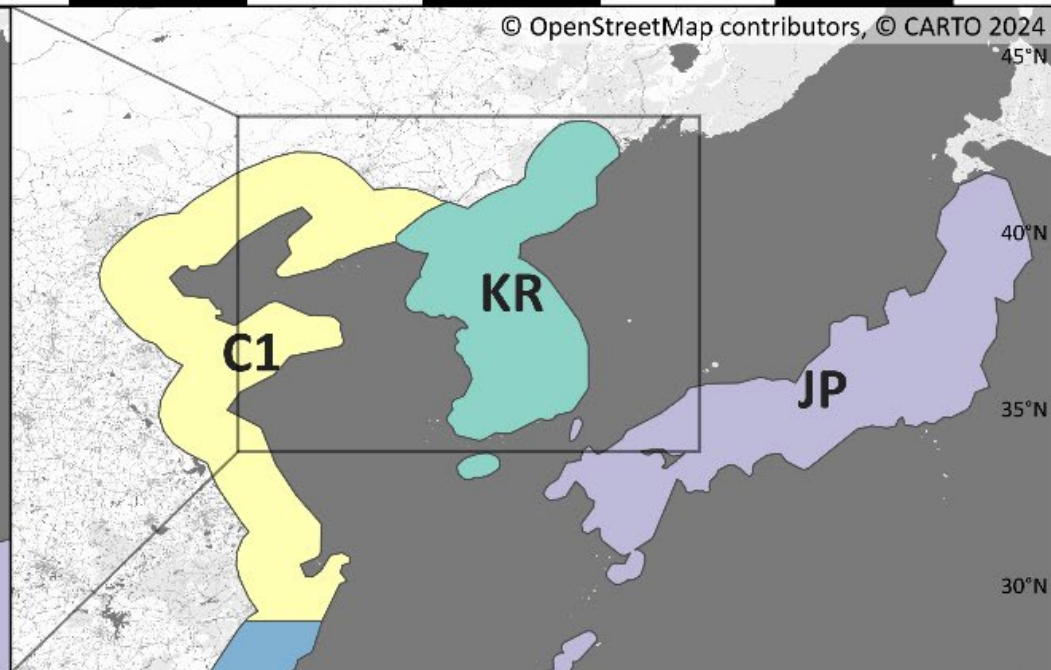
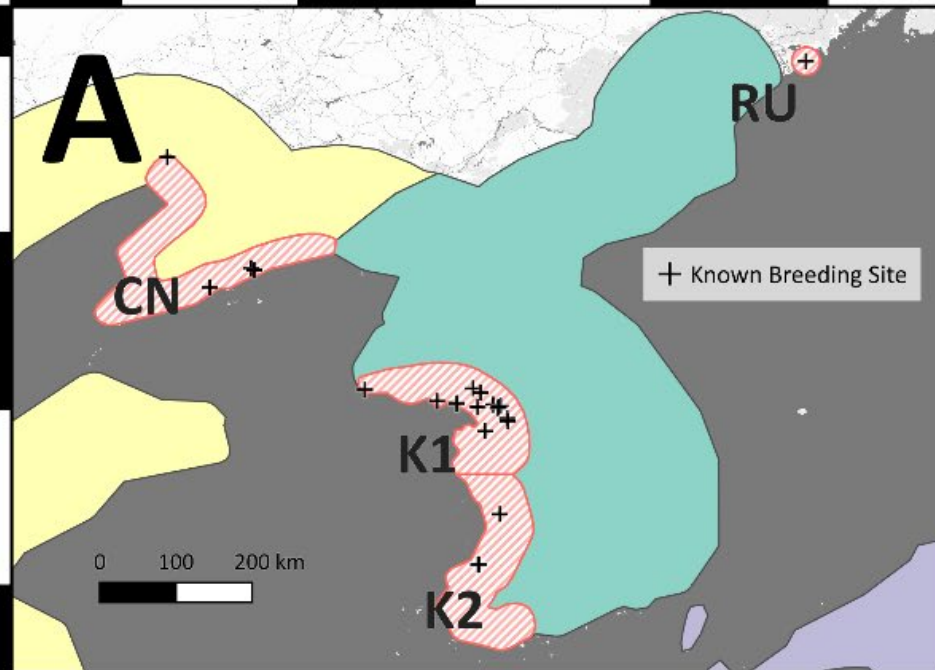


**B**





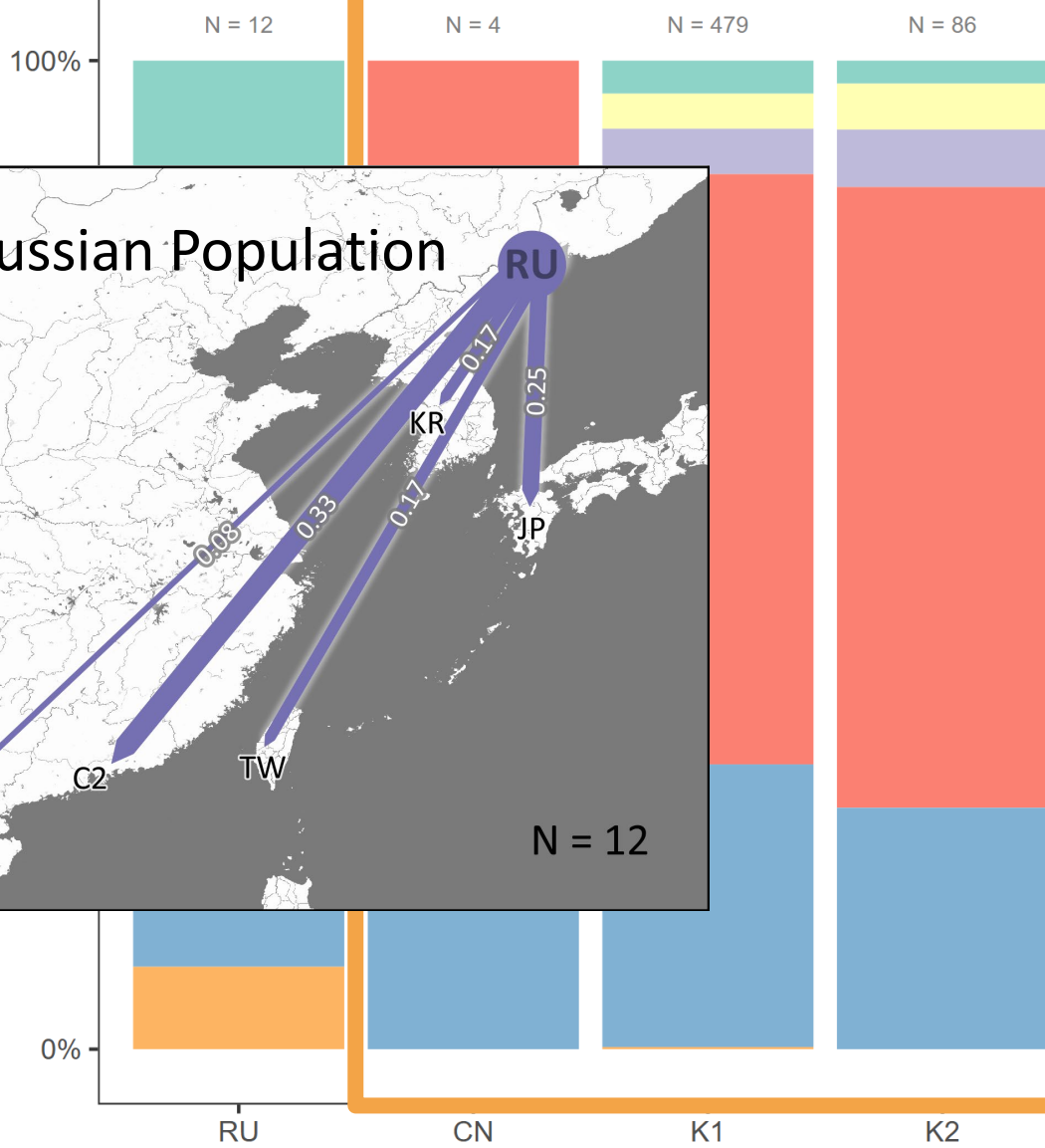
# Breeding Regions



# Wintering Regions

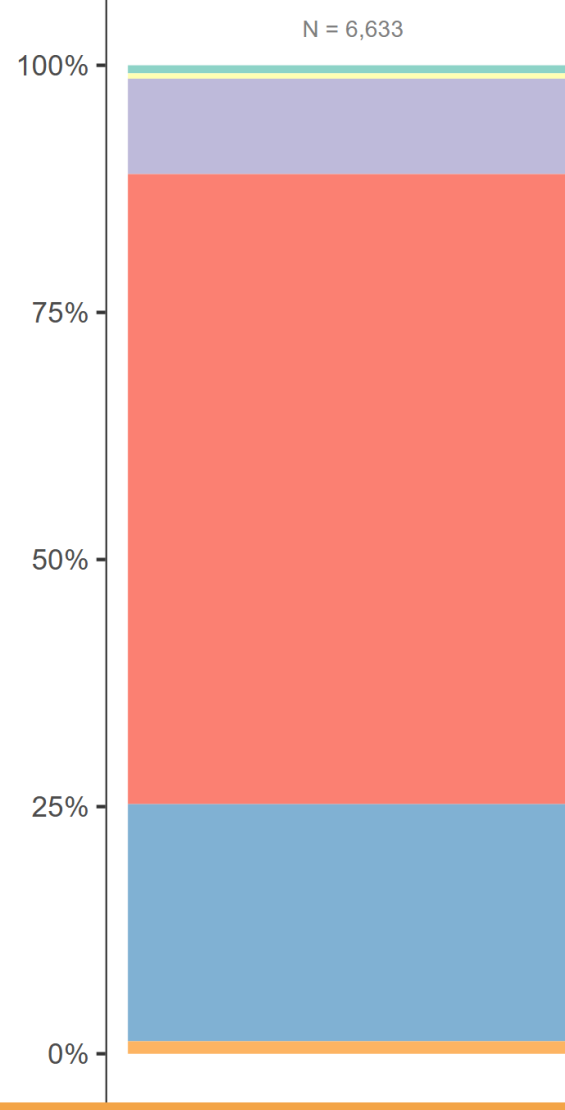


**A**



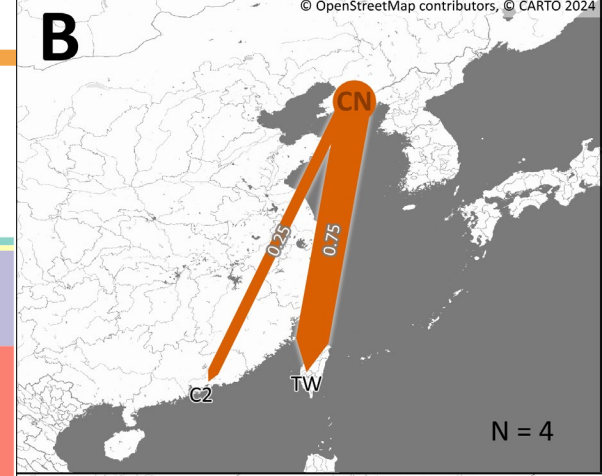
Breeding Region

**B**

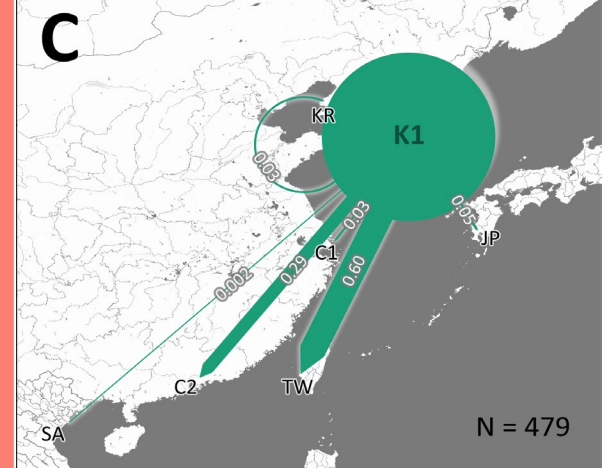


International Census  
2023

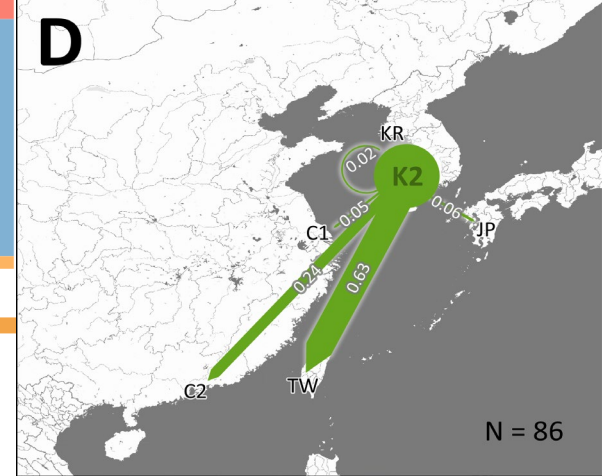
**B**



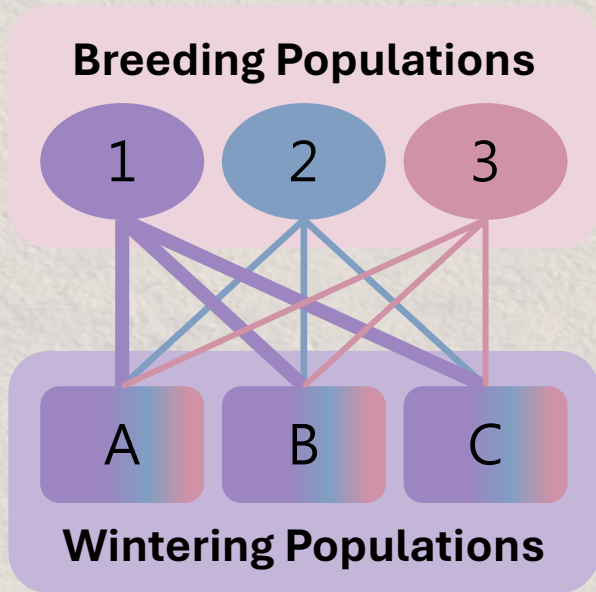
**C**



**D**

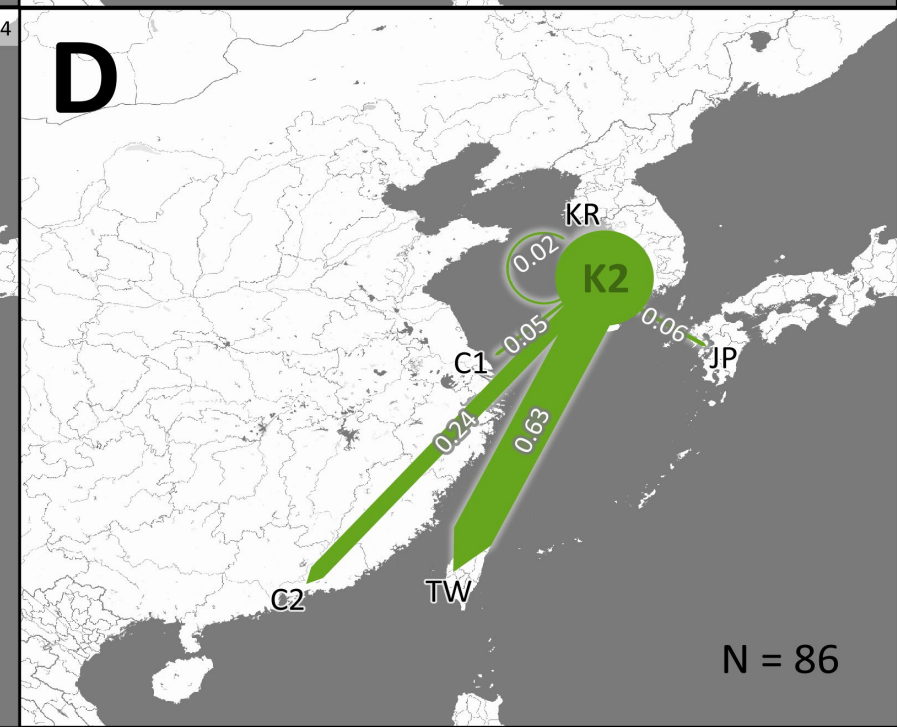
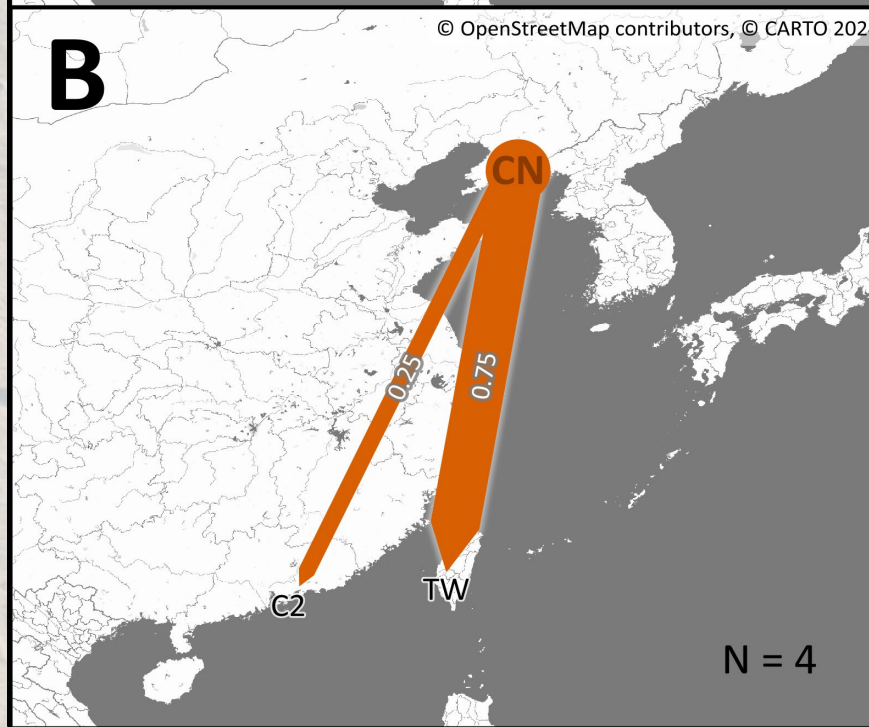
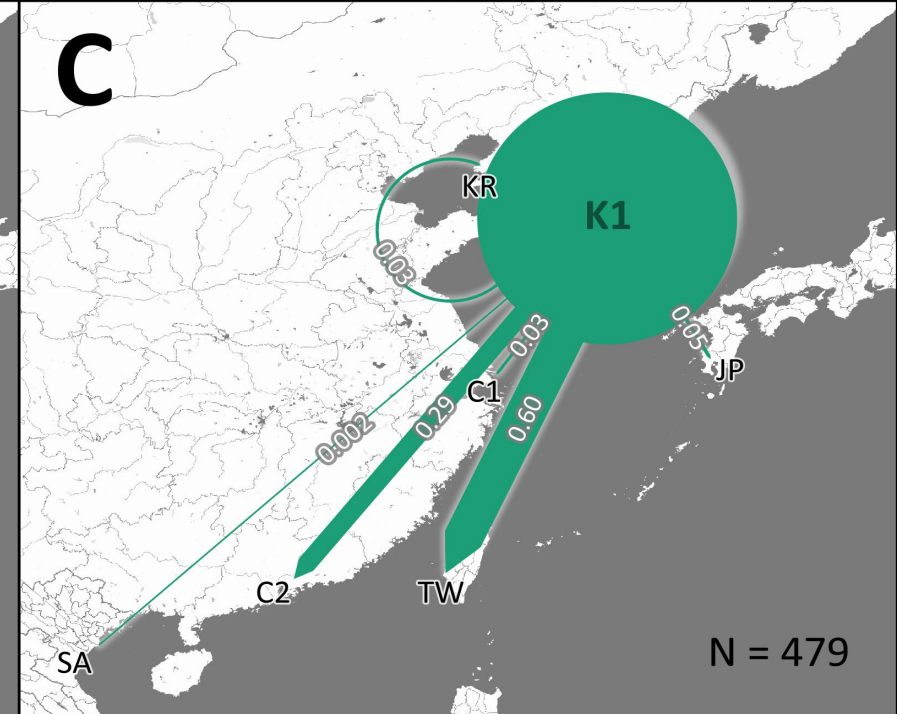
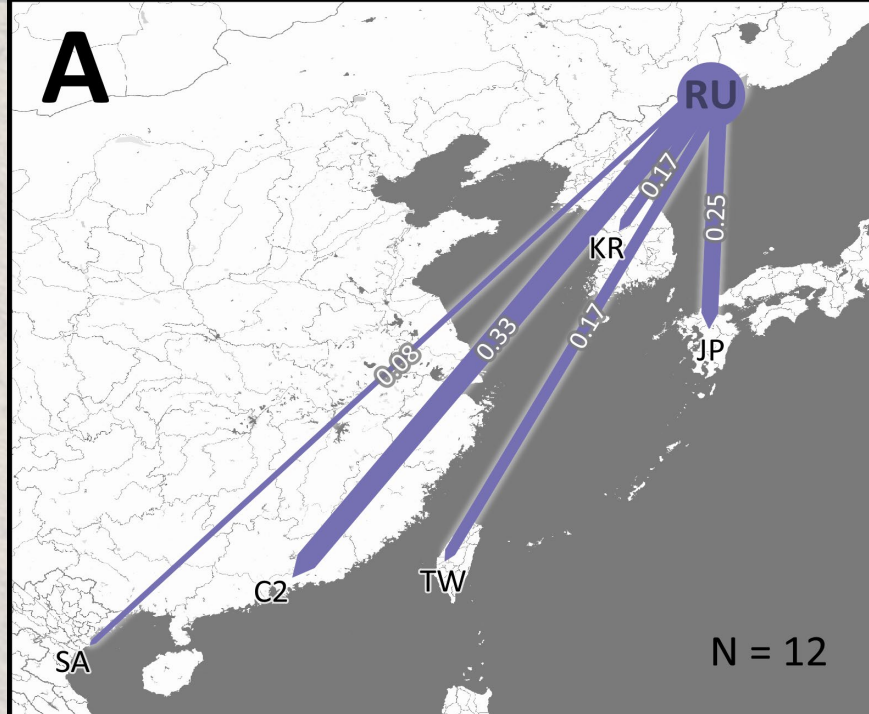






**No strong migration connectivity**

→ **Focus on effects in non-breeding ground**



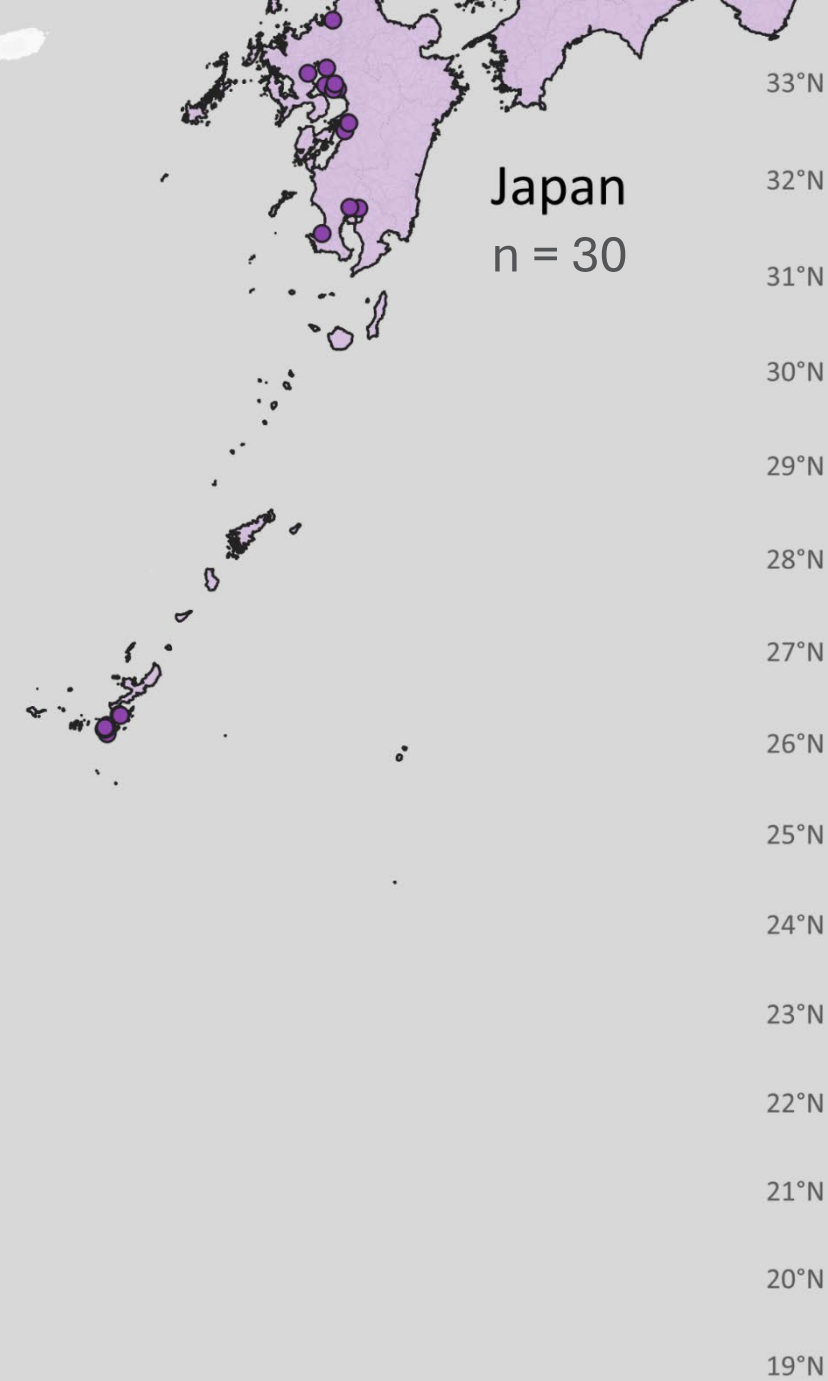
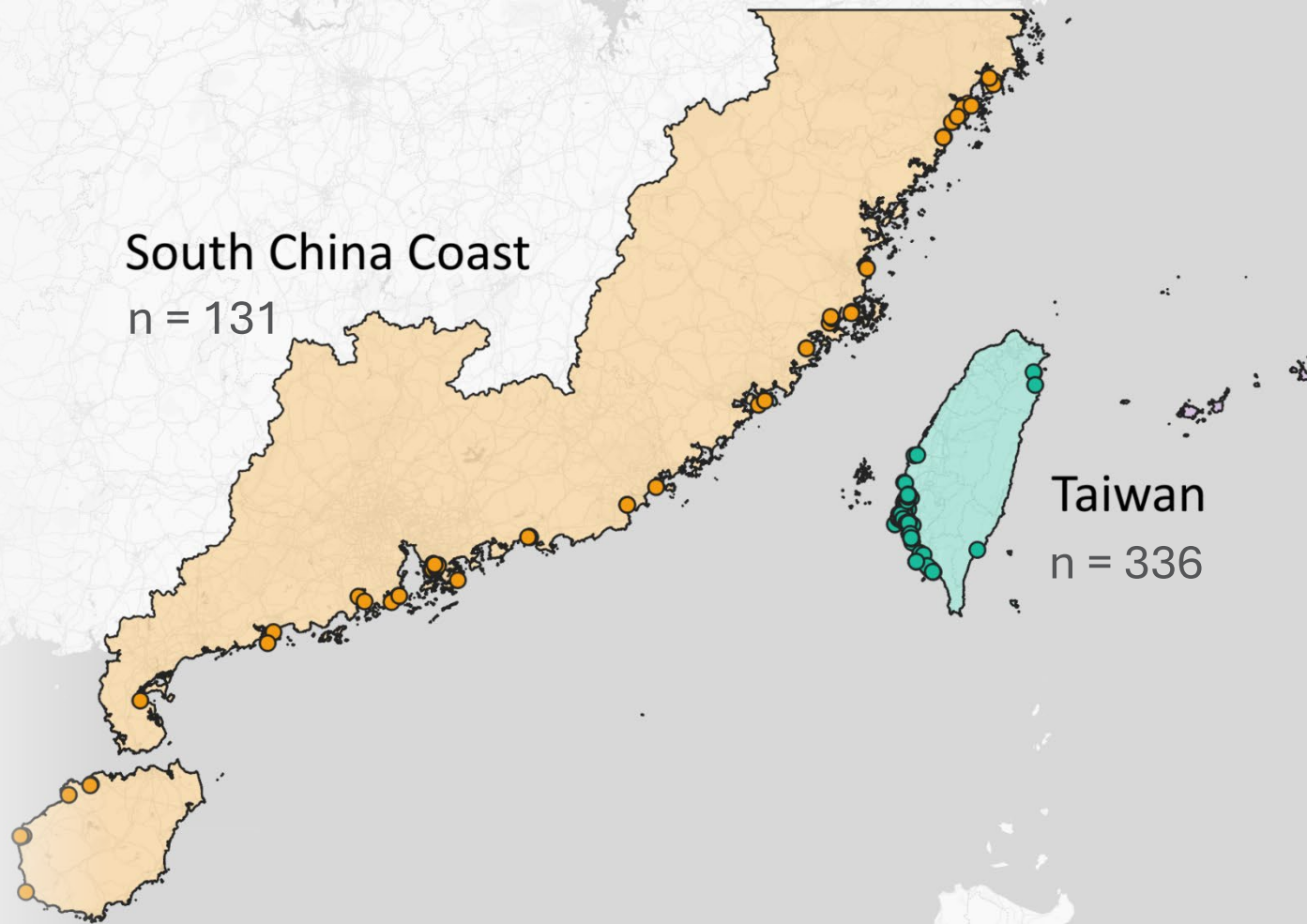


**Do some  
wintering  
grounds offer  
better survival?**





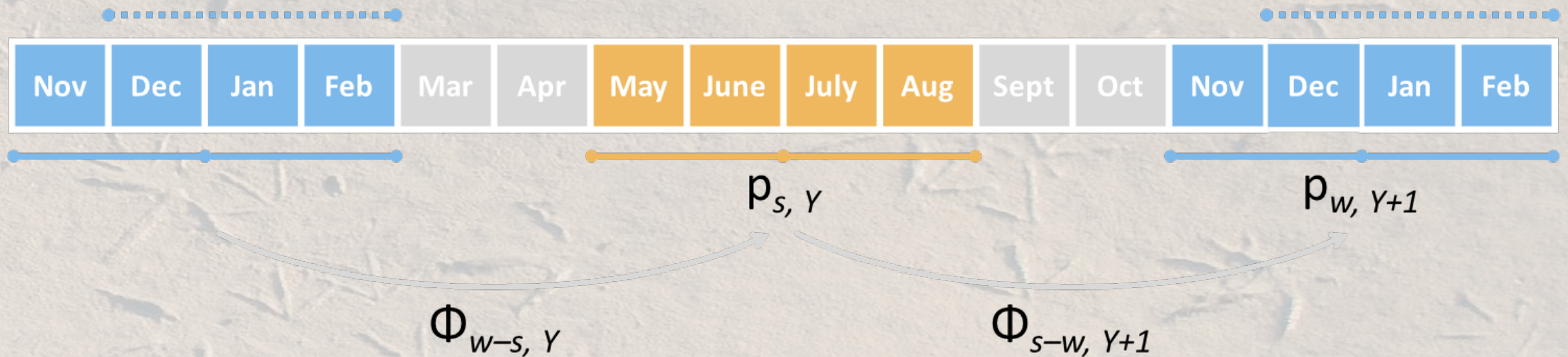
- 3 major wintering regions
- 497 banded individuals





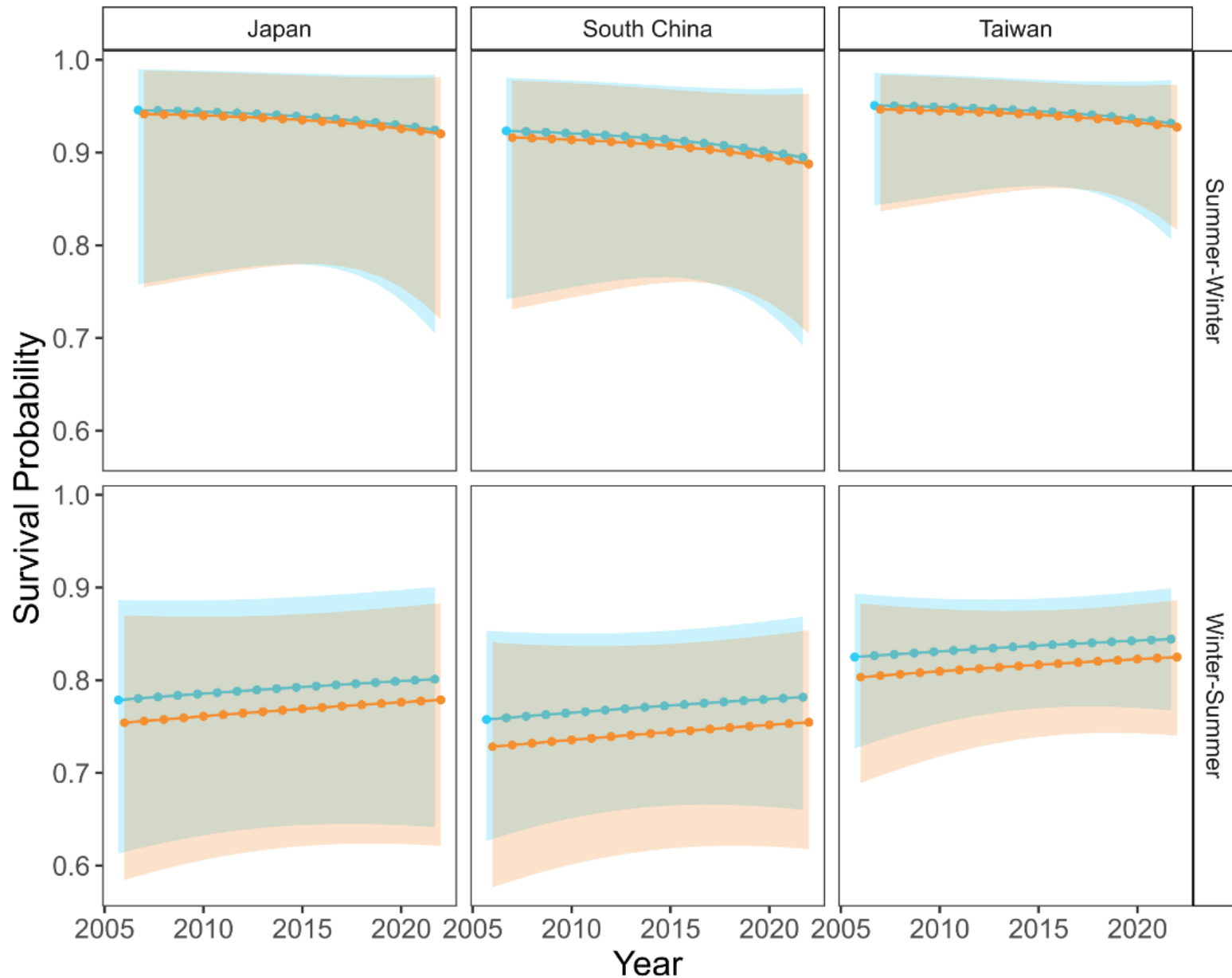
- 2006 Nov – 2023 Aug (17 years  $\times$  2 seasons = 34 sampling occasions)

- Winter sampling occasion
- Summer sampling occasion
- ⋯ Period for determining wintering region





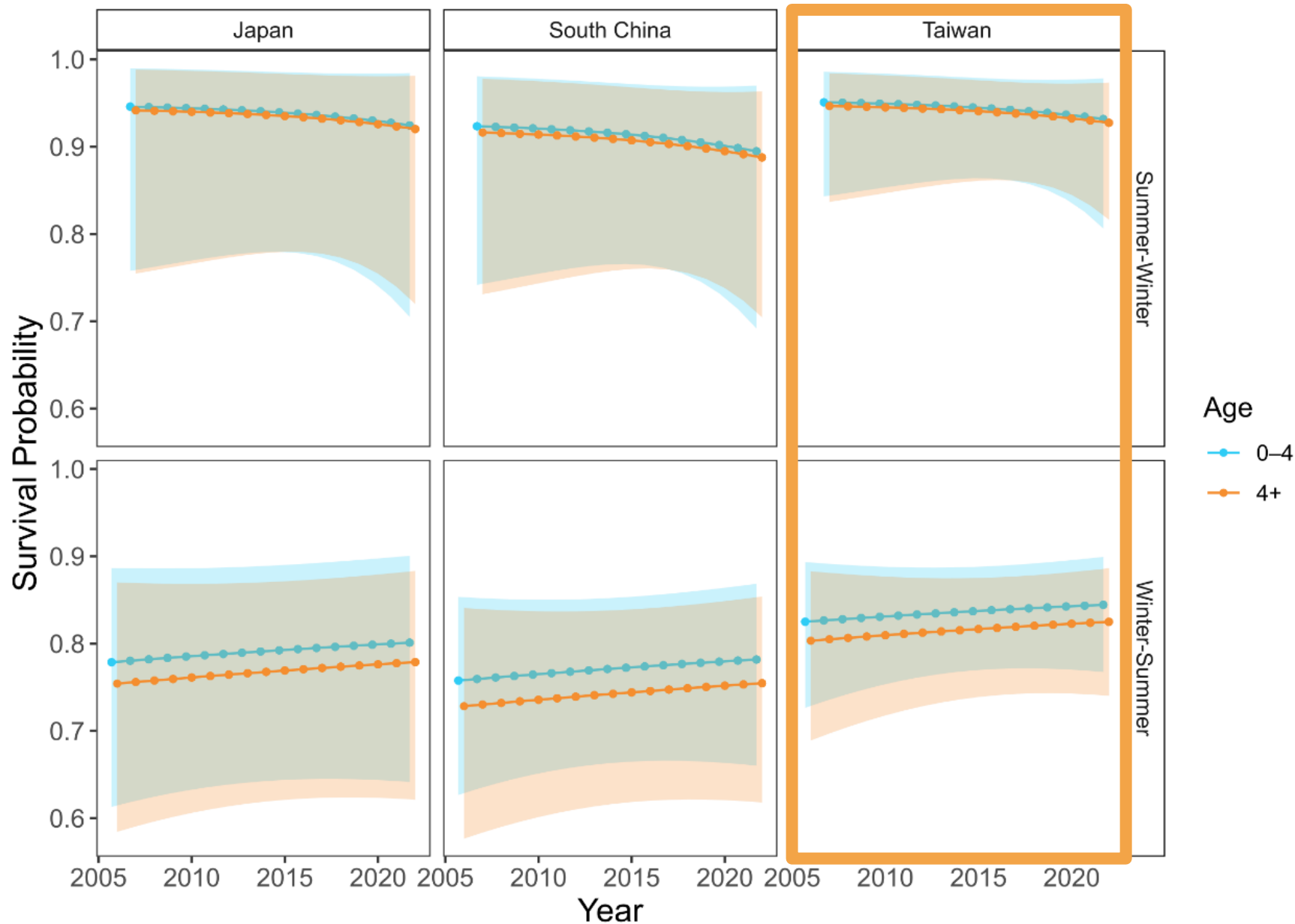
- Seasonal survival probabilities across three wintering regions



**Mortality primarily occurs from winter to summer (i.e. after wintering period)**



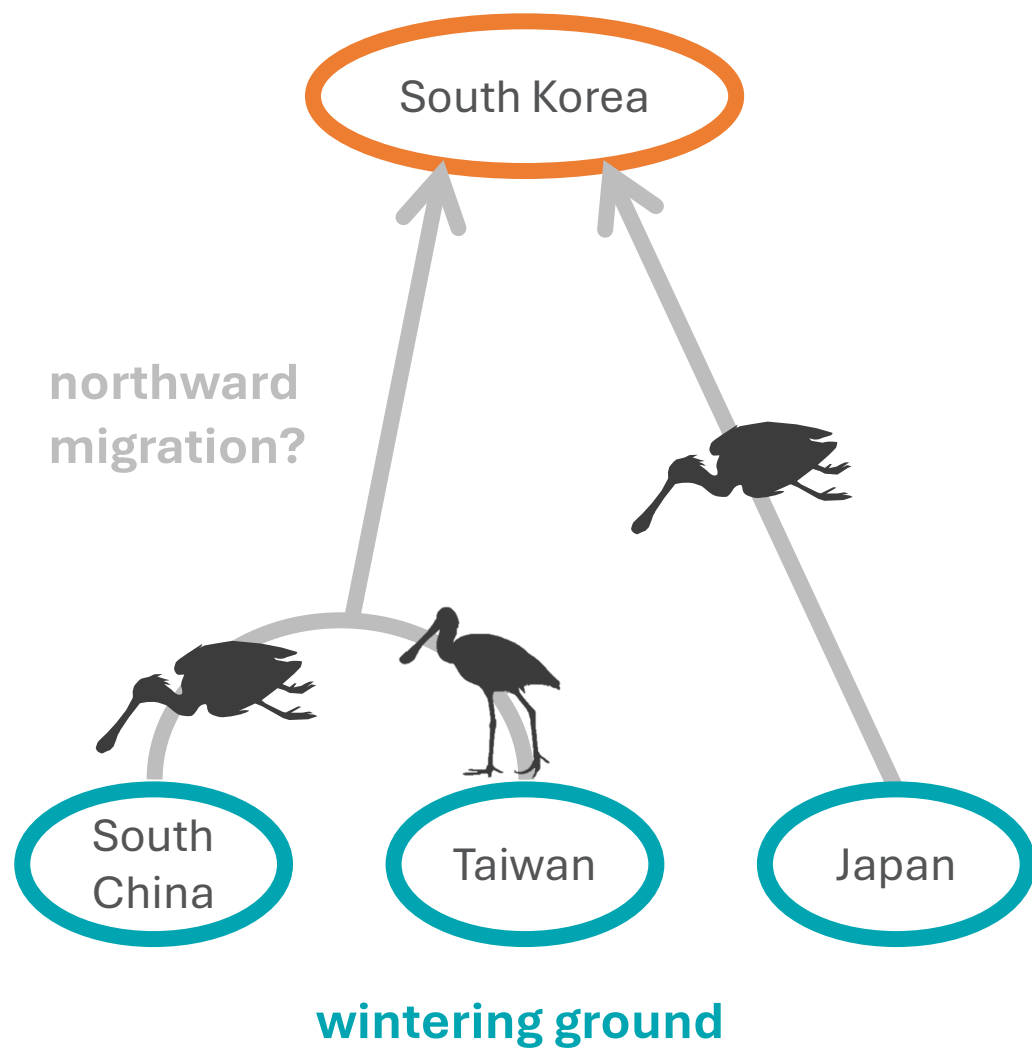
- Seasonal survival probabilities across three wintering regions



**TW survival is the highest**



## Mortalities in non-breeding ground



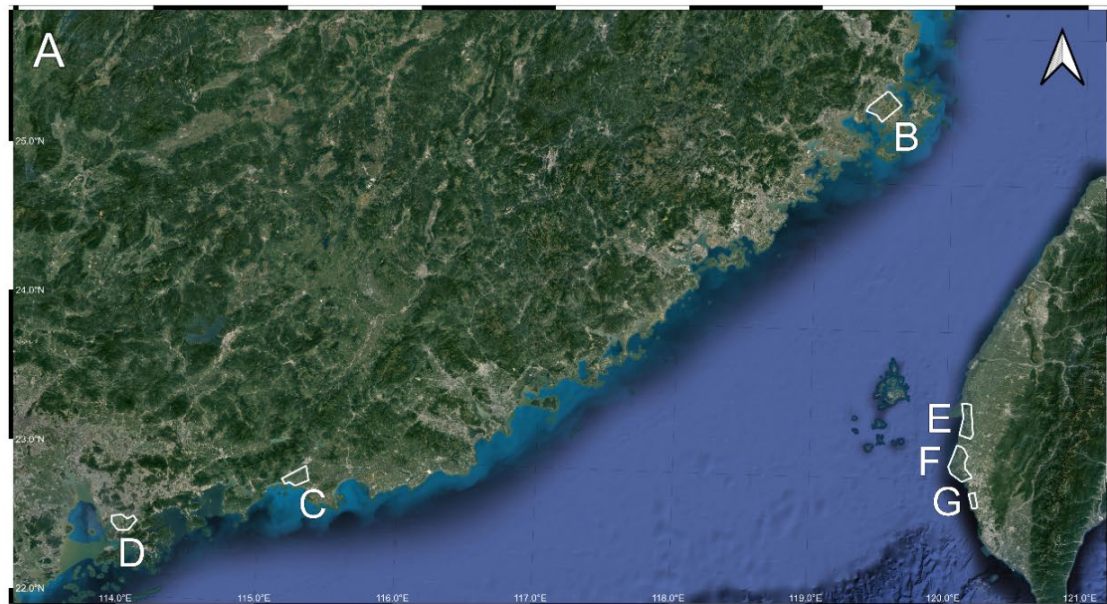
(Lin et al. 2023)



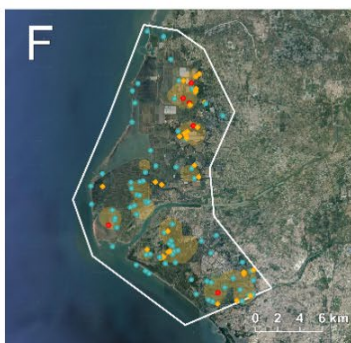
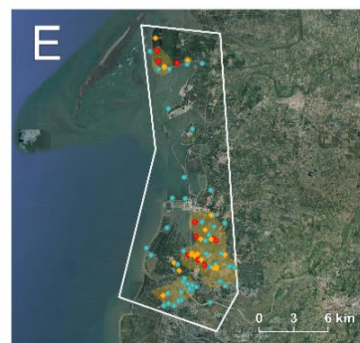
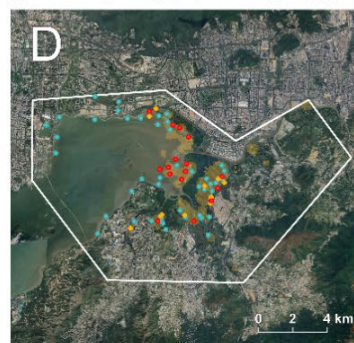
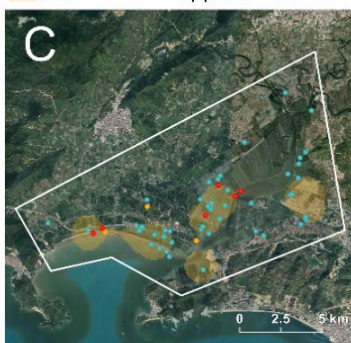
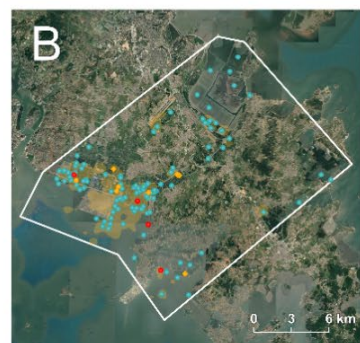
# Habitat preferences & conservation management







95% KDE • Opportunistic Sampled • BFS Present • BFS Absent



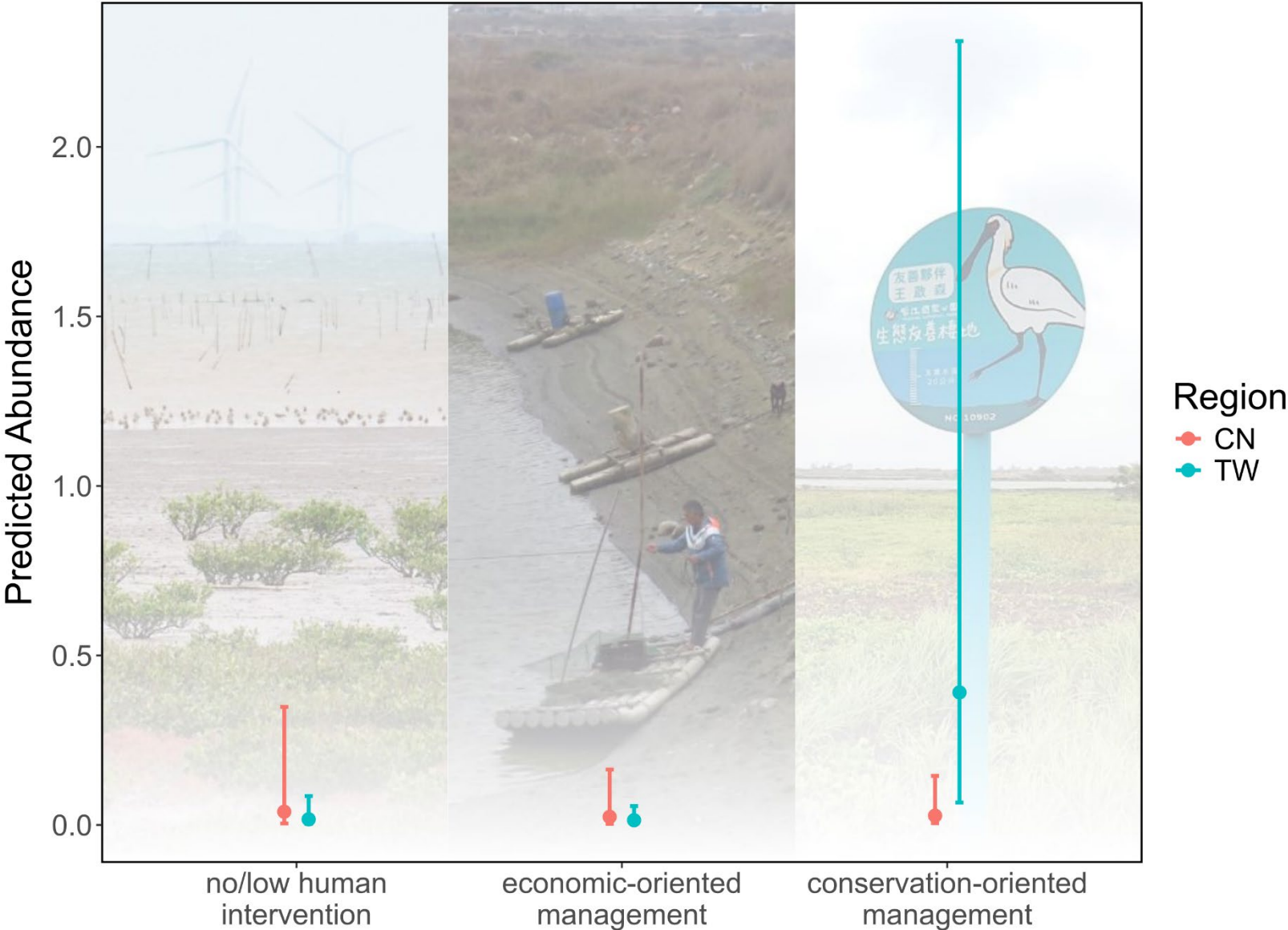




- Larger wetlands
- 10–20 cm water depths
- Natural, vegetated bunds
- **Receiving conservation interventions**



# Conservation effectiveness for attracting more spoonbills



(Lin et al. 2024)





**Would Red List  
downlisting  
compromise the  
recovery of  
threatened  
species?**





- Although downlisting reflects population improvement, it often raises concerns about declining funding, policy support, or public interest.
- Case studies of the BFS and other flagship species reveal both the challenges and opportunities associated with downlisting.
- Stakeholder engagement and clear communication are essential; the Green Status of Species complements the Red List by highlighting ongoing conservation needs.
- Downlisting is a scientific assessment, but its impact depends on how it is interpreted and communicated.





## Key Findings

- **Spatial Structuring**
- **Limiting Factors**
- **Habitat Preferences**
- **Conservation**

Strong site fidelity and weak migration connectivity suggest limited influence from breeding grounds.

Primarily in the non-breeding season, likely driven by variation in habitat quality and resource availability in wintering grounds.

Larger wetlands with 10–20 cm water depth, vegetated natural bunds, and conservation intervention.

Downlisting has been proposed, but ongoing conservation remains critical—especially given the regional differences in conservation effectiveness.



# Black-faced Spoonbill: A Flagship for Wetland Conservation

- Future research
  - Identify limiting factors in wintering grounds
  - Adapt effective conservation on regions with slower recovery
- How to maintain the 'success'?
- Inform conservation of other migratory waterbirds along the EAAF





# Offshore Wind Energy (OWE)

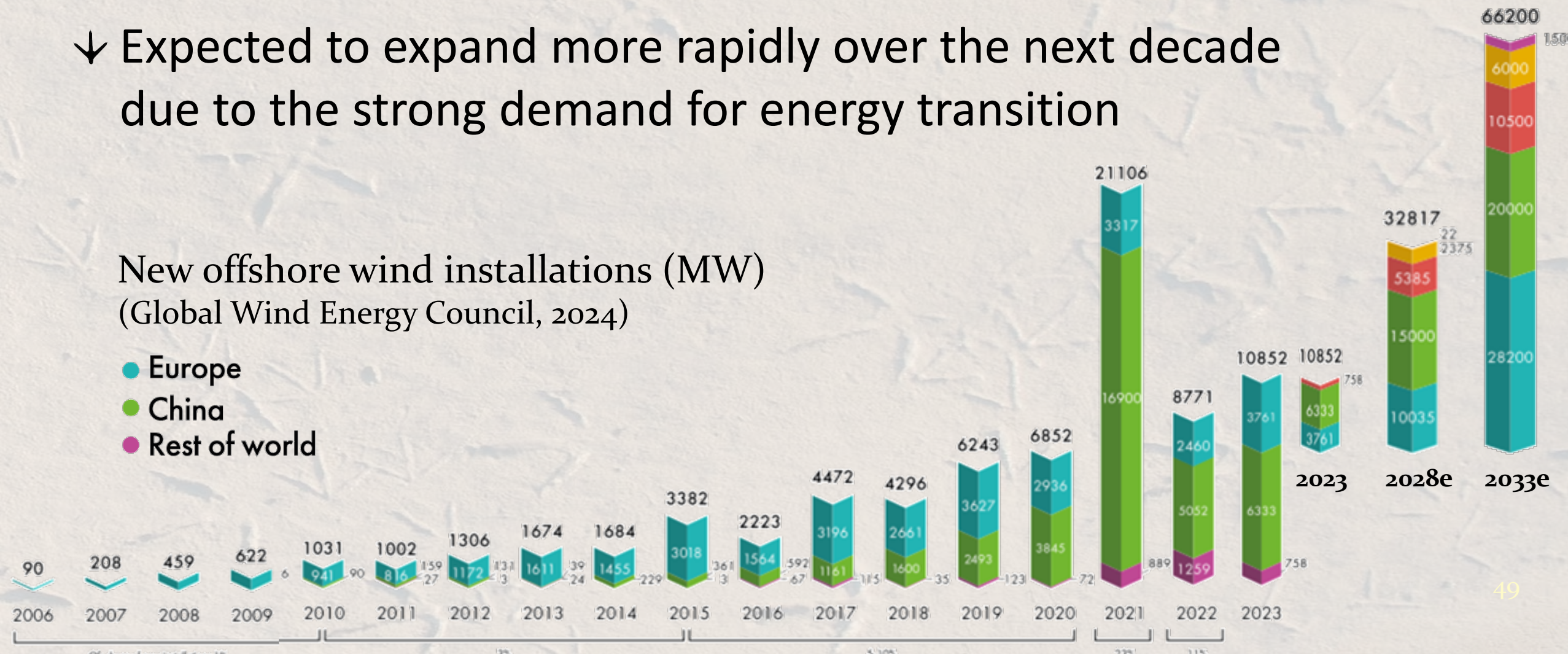
↓ Rapid growth of OWE in China, especially in 2021

↓ Expected to expand more rapidly over the next decade due to the strong demand for energy transition

- Europe
- China
- Asia Pacific ex China
- North America
- Other

New offshore wind installations (MW)  
(Global Wind Energy Council, 2024)

- Europe
- China
- Rest of world





# Impact of renewable energy infrastructures

- ↓ Limited to EU experiences
- ↓ Based on direct observation
- ↓ Low spatial and temporal tracking data
- ↓ Tracked mostly adults



**Difficult to evaluate the actual impact**



# BFS is the ideal species

- ↘ BFS is the flagship species for wetland conservation in East Asia, it migrates along the coast, having a high spatial overlap with coastal wind farms



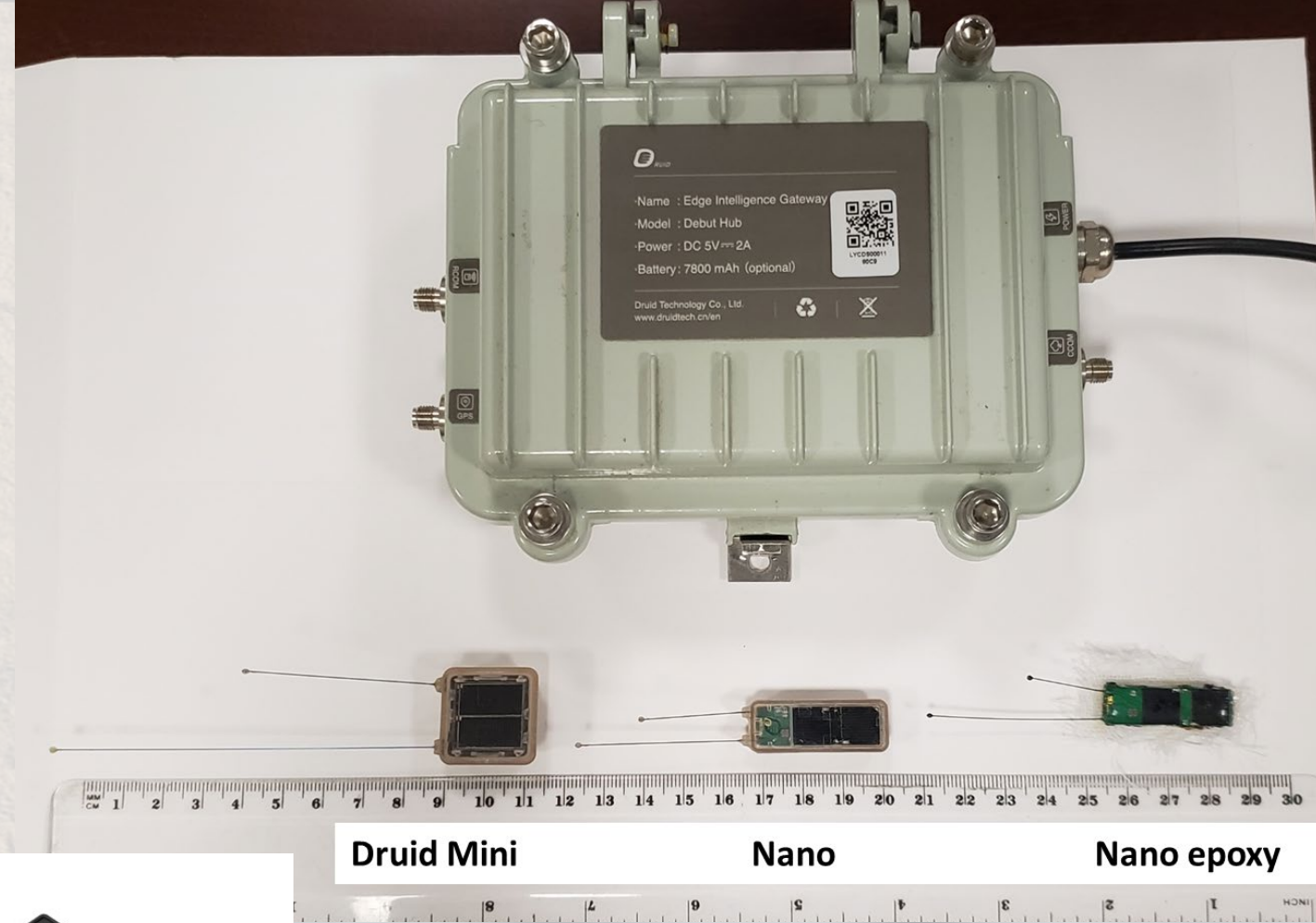
Lai et al.  
(2025) *Ecology*





# Satellite tracking

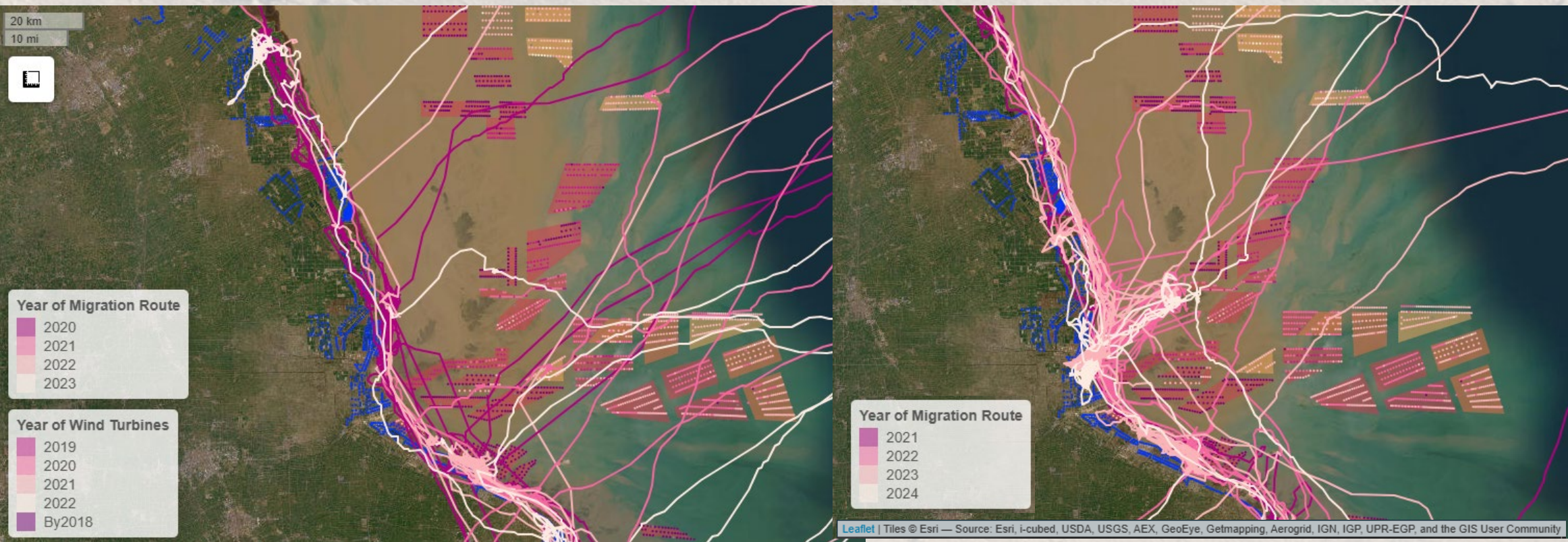
- ↘ Location fixes
- ↘ Temperature (env, body)
- ↘ Speed, altitude, direction
- ↘ Behaviour





# Prediction: Barrier effect

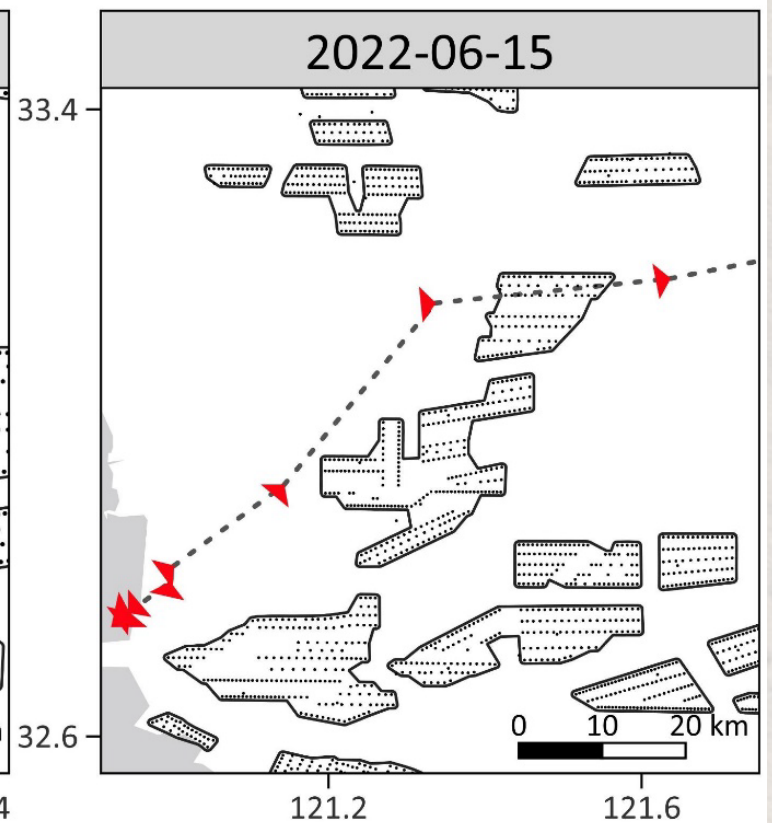
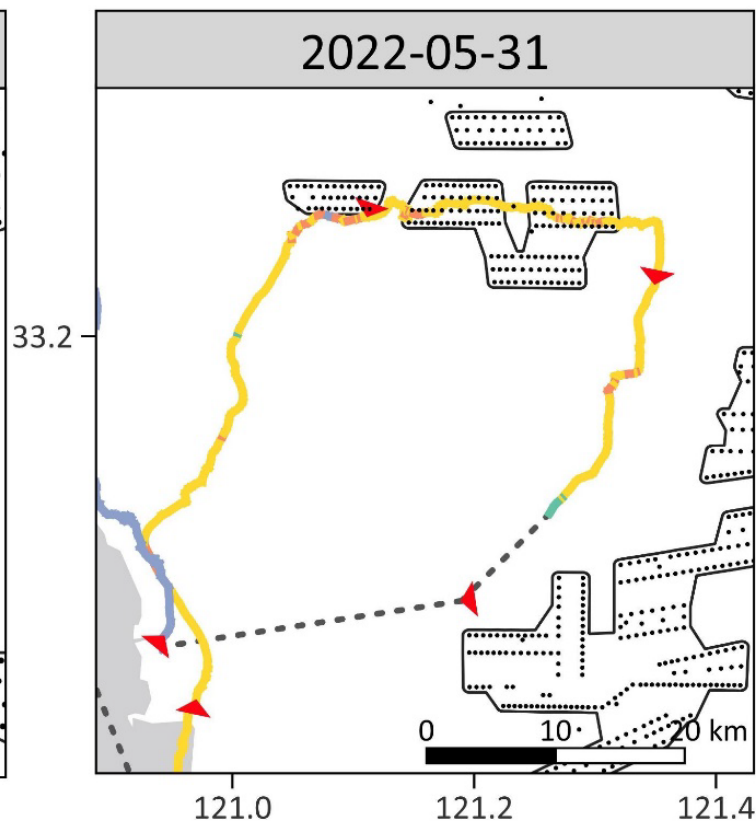
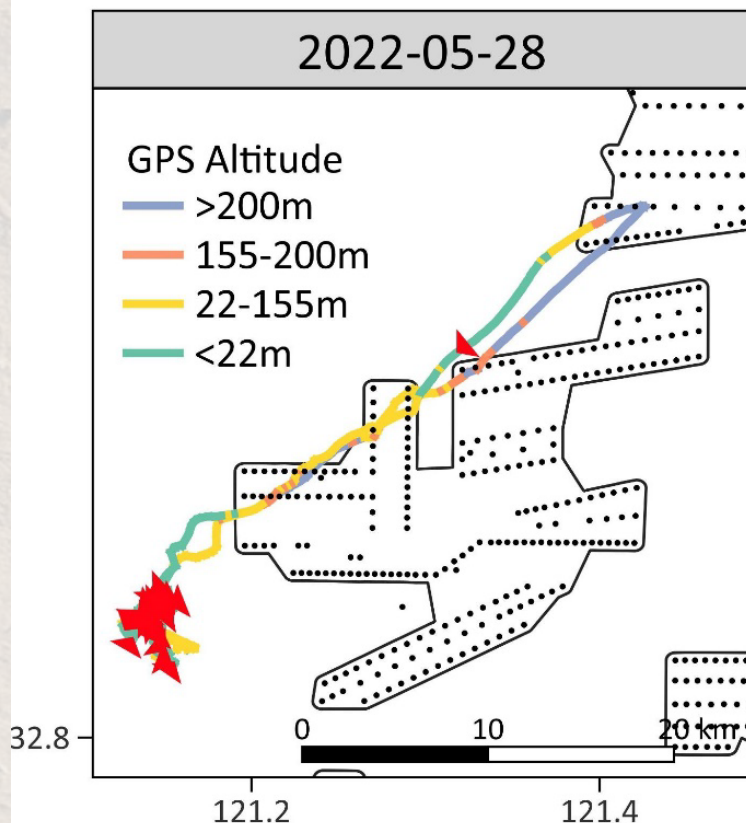
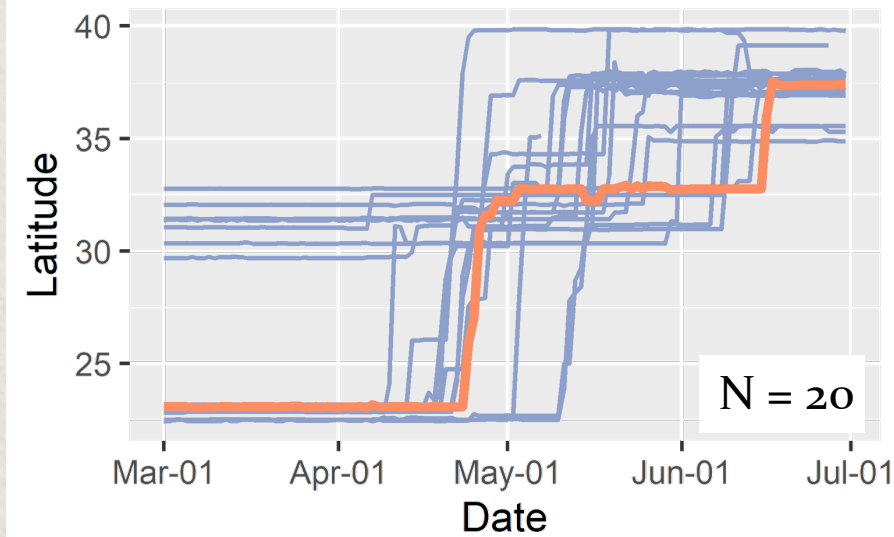
- ↓ As a relatively large-sized waterbirds, BFS will show avoidance behaviour
- ↓ This could lead to the low collision rate, but with the potential of accumulation effect





# Results: Barrier effect

- ↓ OWF affected BFS migration
- ↓ Y70 northward migration was delayed





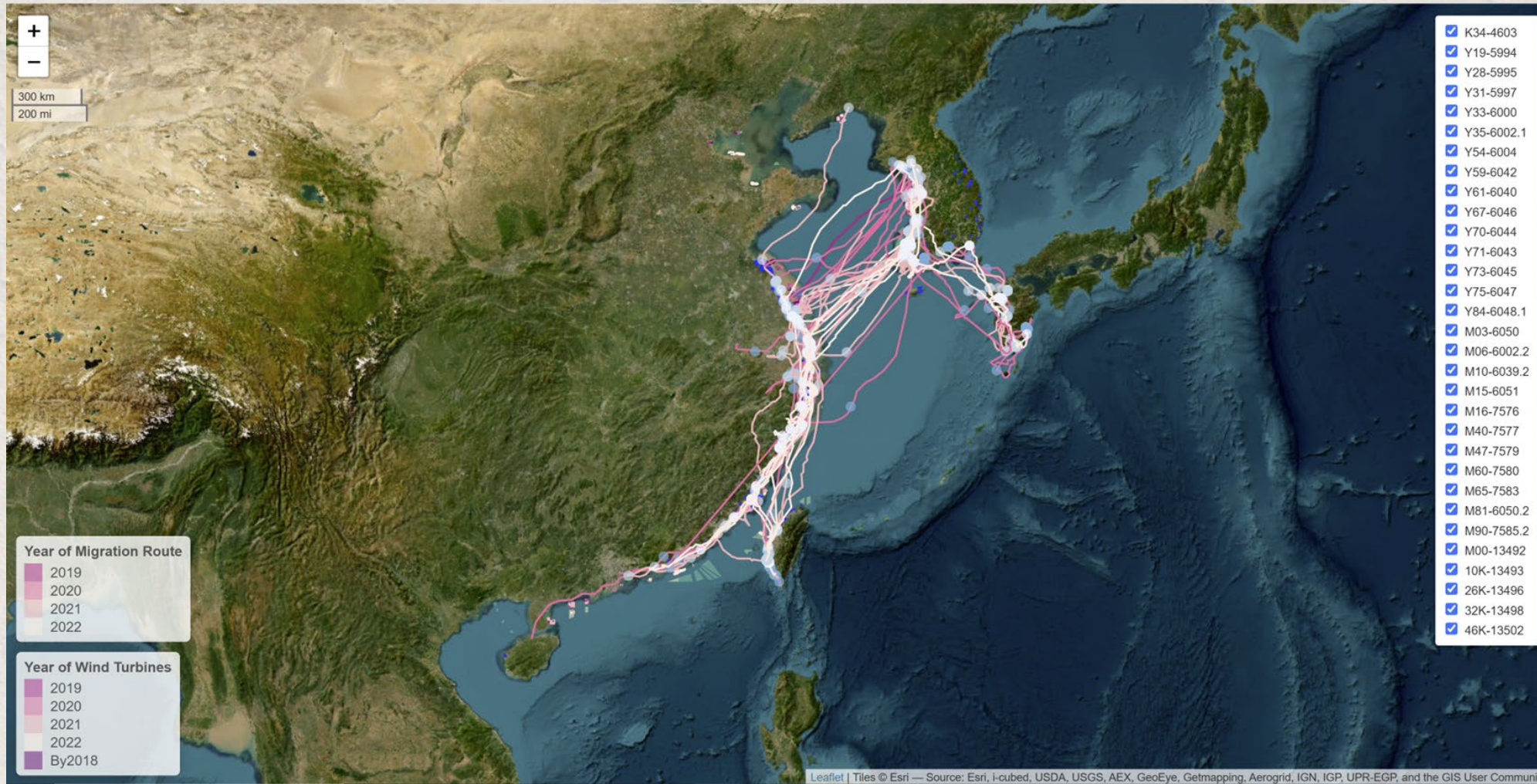


↓ Cumulative impact of multiple wind farm and poor weather led to the migration failure of M03



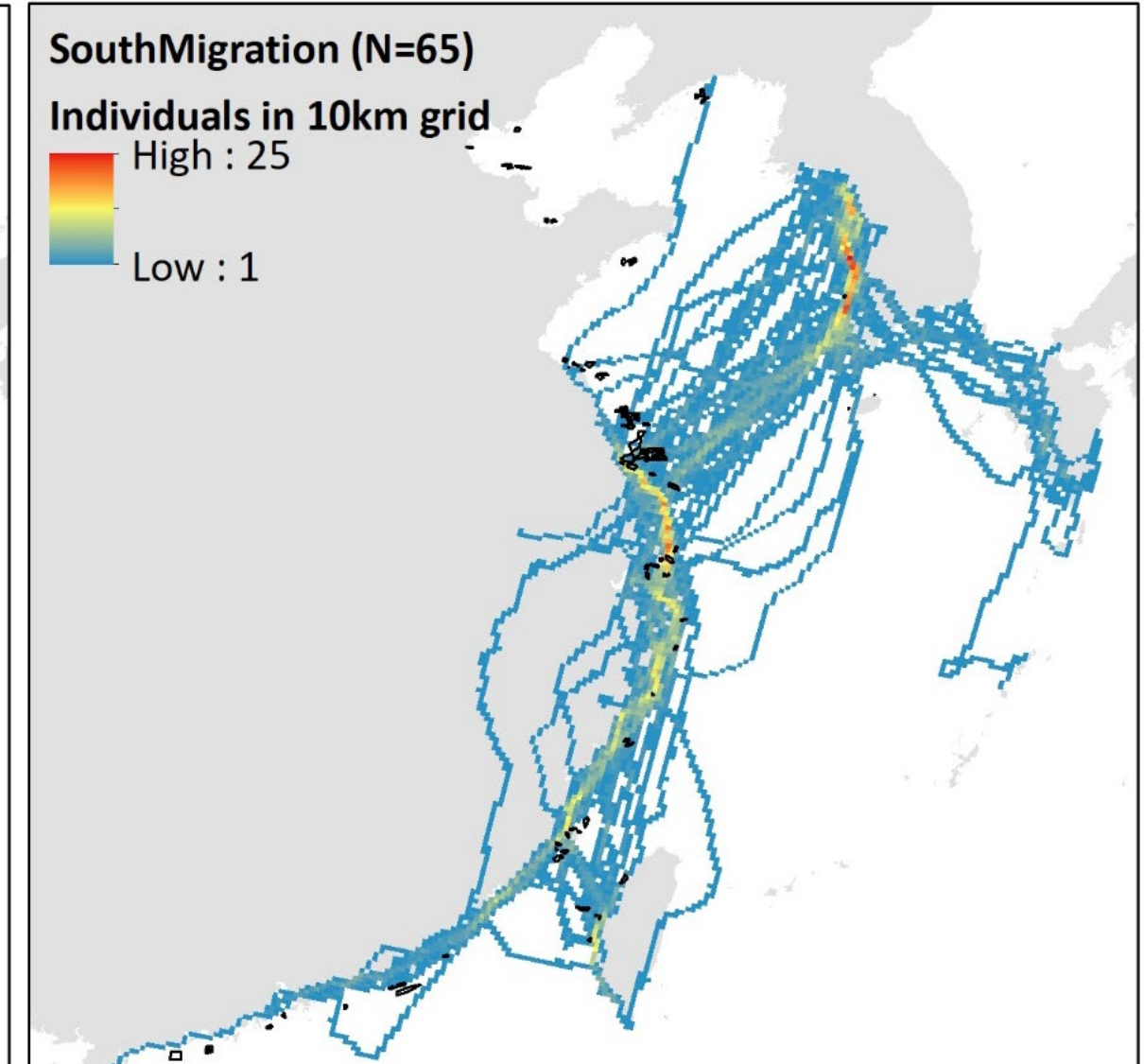
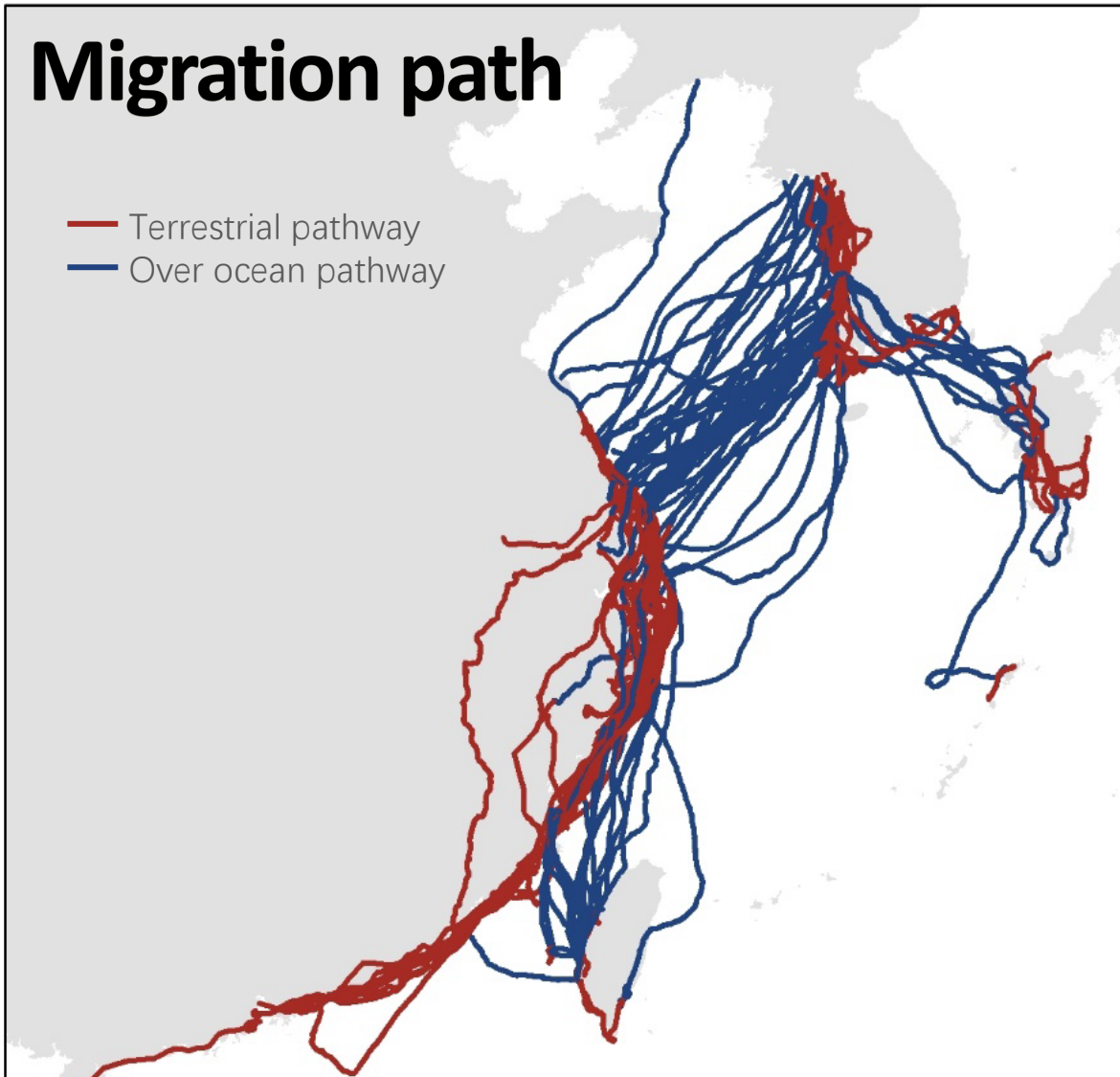
# How can we reduce the impact?

↓ Is there any clear migration pathway / corridor?



Lai *et al.* in  
Prep.



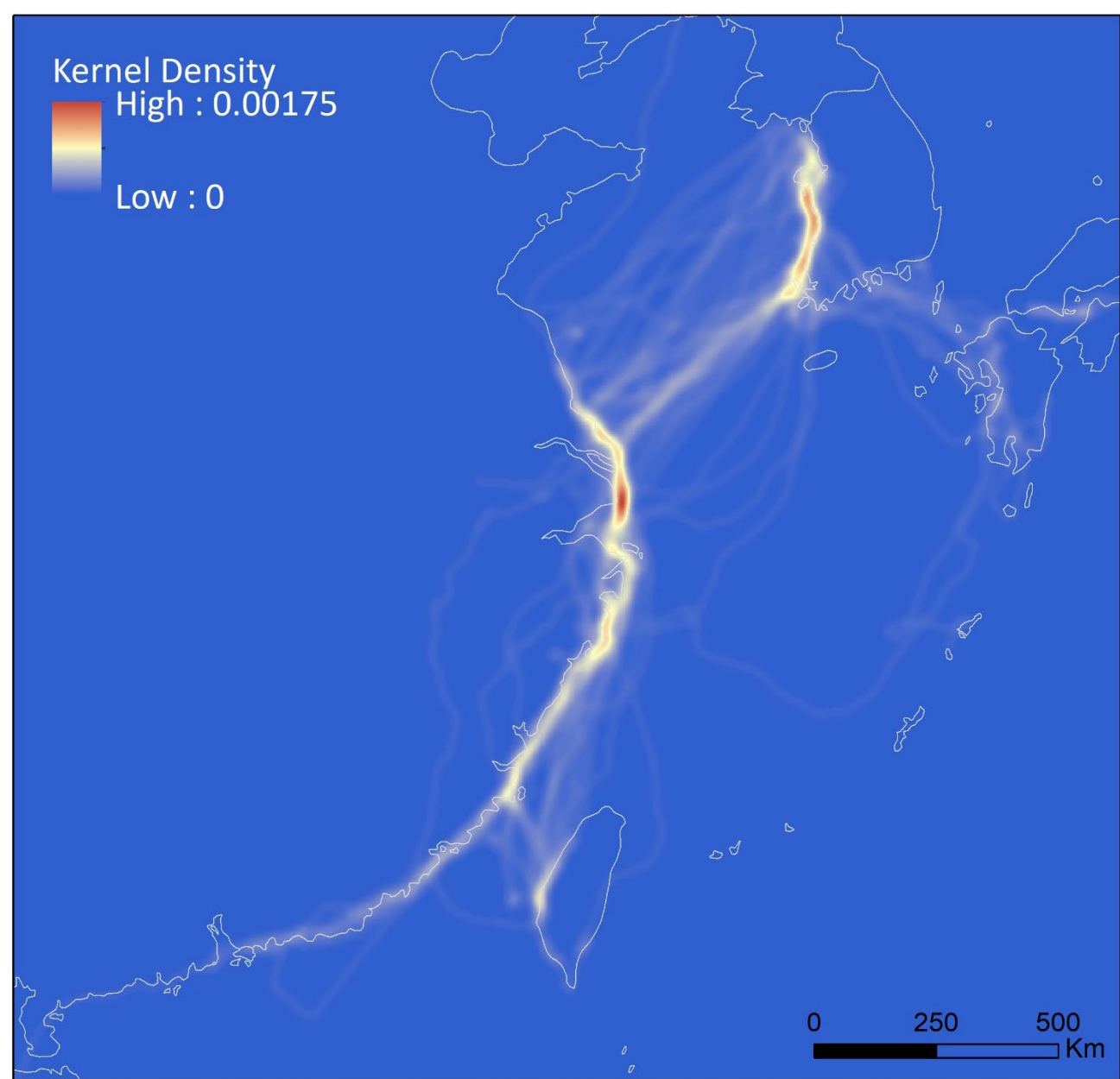


Preliminary findings indicate that coastal areas form part of the BFS migration route during land-based migration; at sea, there is only one distinct hotspot stretching from the southern tip of South Korea to the southern coast of Jiangsu, but the overall migration path is relatively broad



# Migration pathway

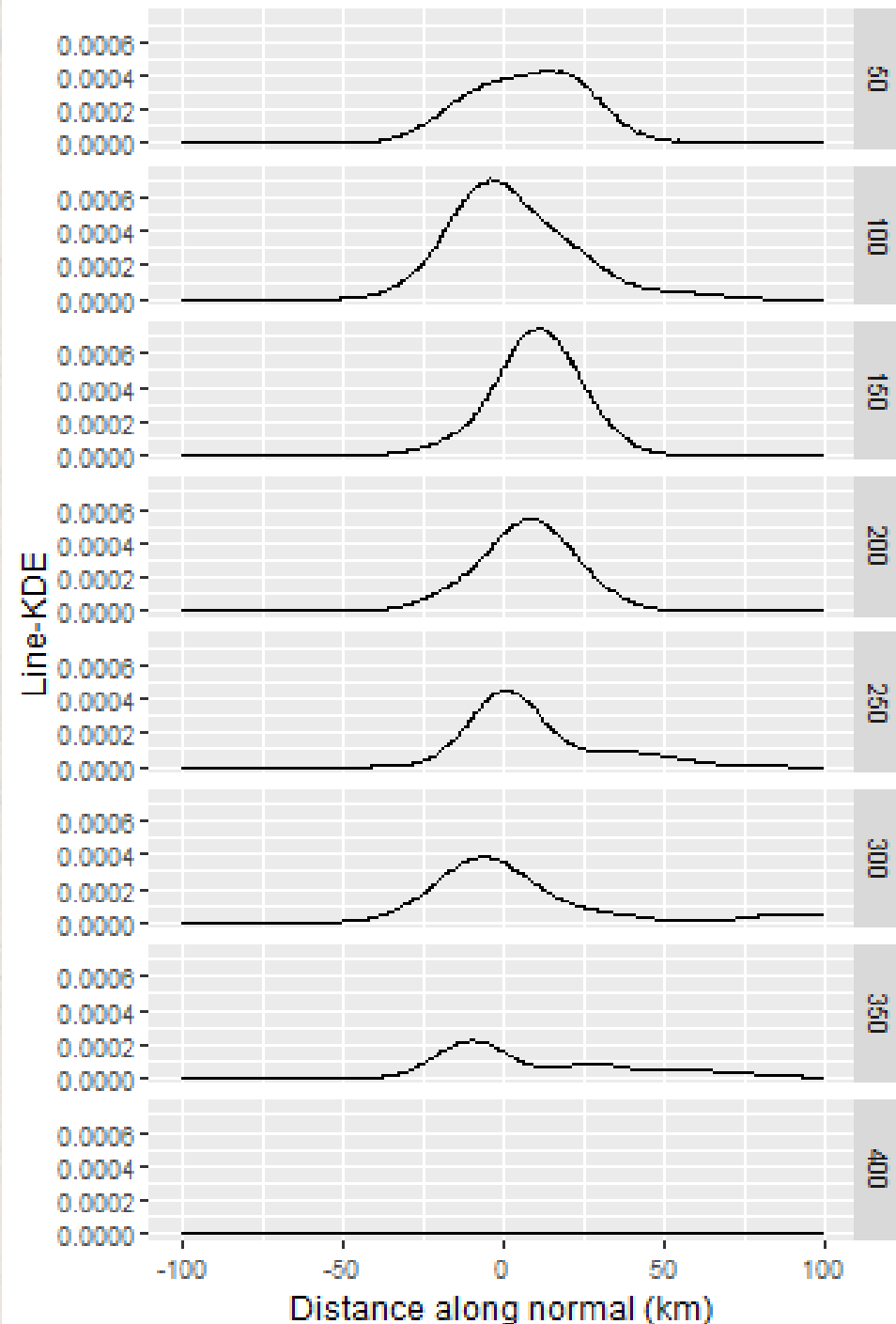
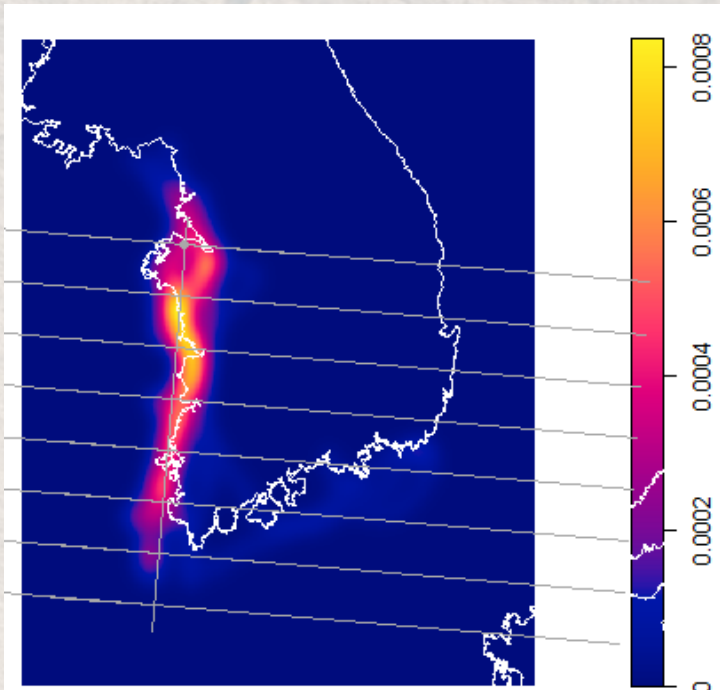
- ↯ Retained only the migration flight path
- ↯ Exclude repeated path
- ↯ Line-based Kernel Density Estimation (KDE)





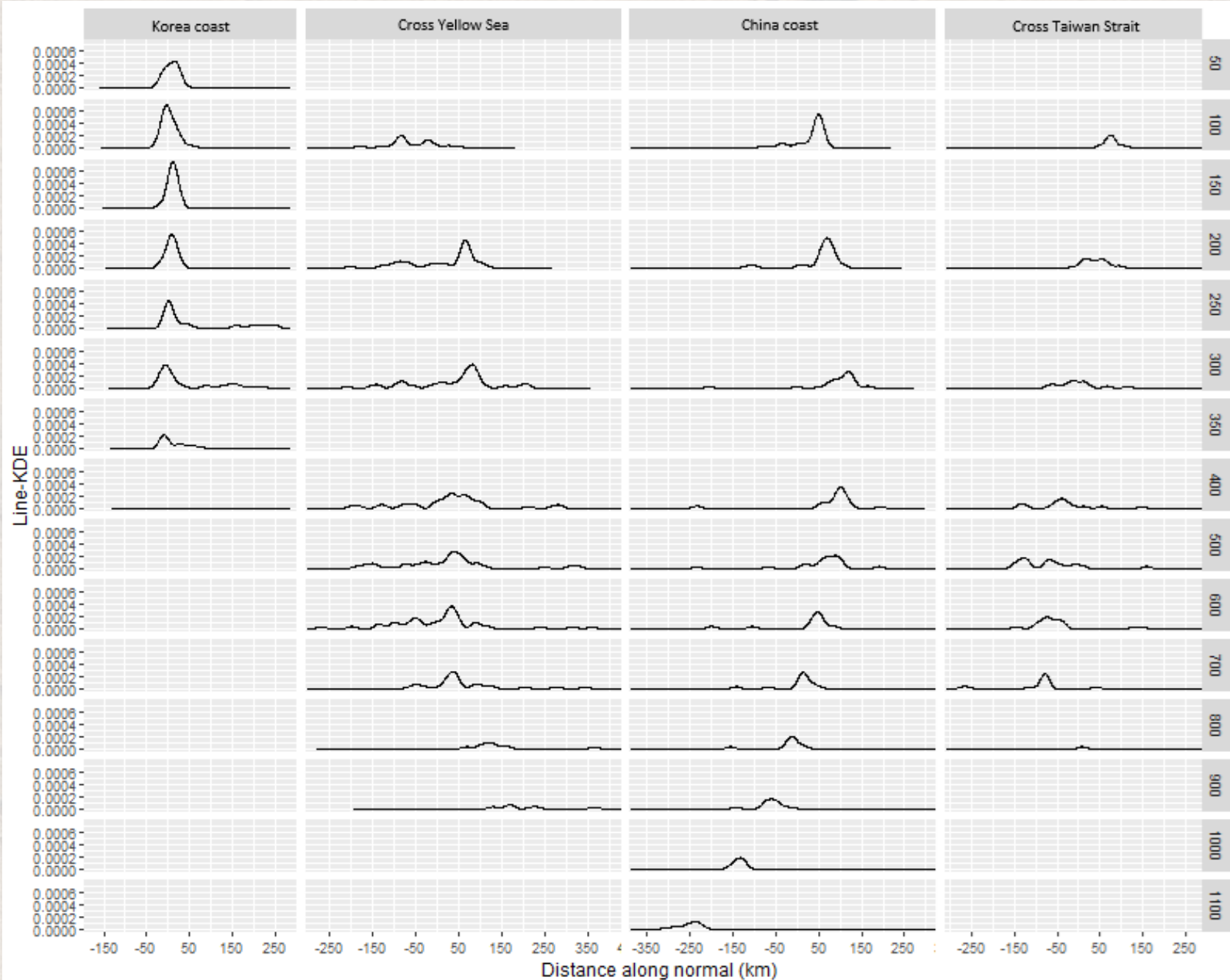
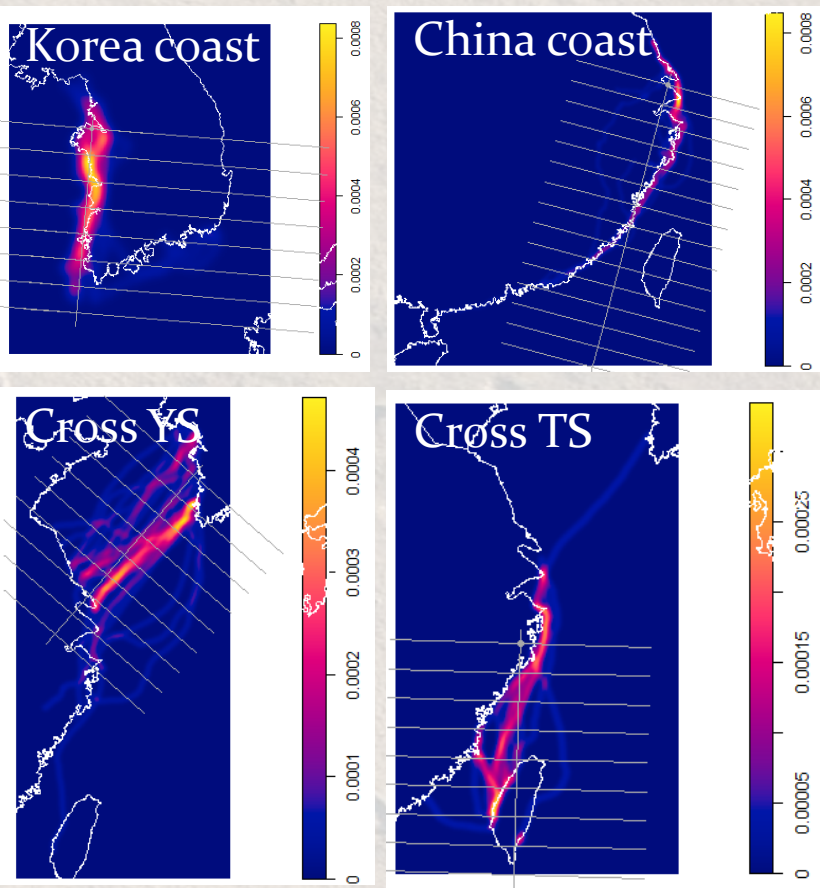
# Characterize the width of the pathway

- ↓ Acquire Line-based KDE values at regular distance interval, analyze the change in density





# 迁徙路径宽度估算



- ↘ Highest density along the Korean coast
- ↘ Another pathway during the YS crossing
- ↘ Terrestrial (Korea/China coast) pathway are often concentrated ;  
Sea crossing (Cross Yellow Sea/Taiwan Strait) pathway is less clear and often wider

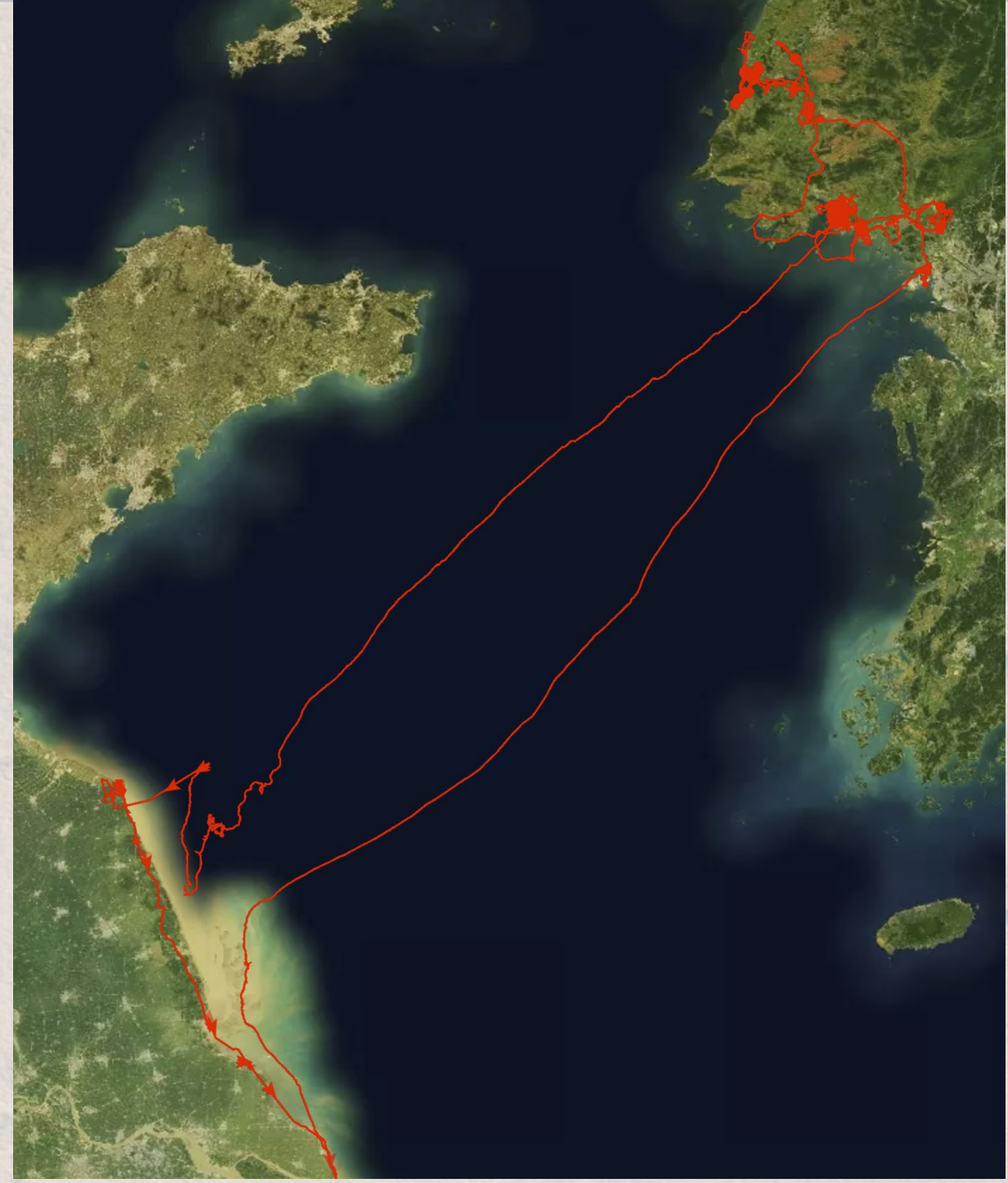
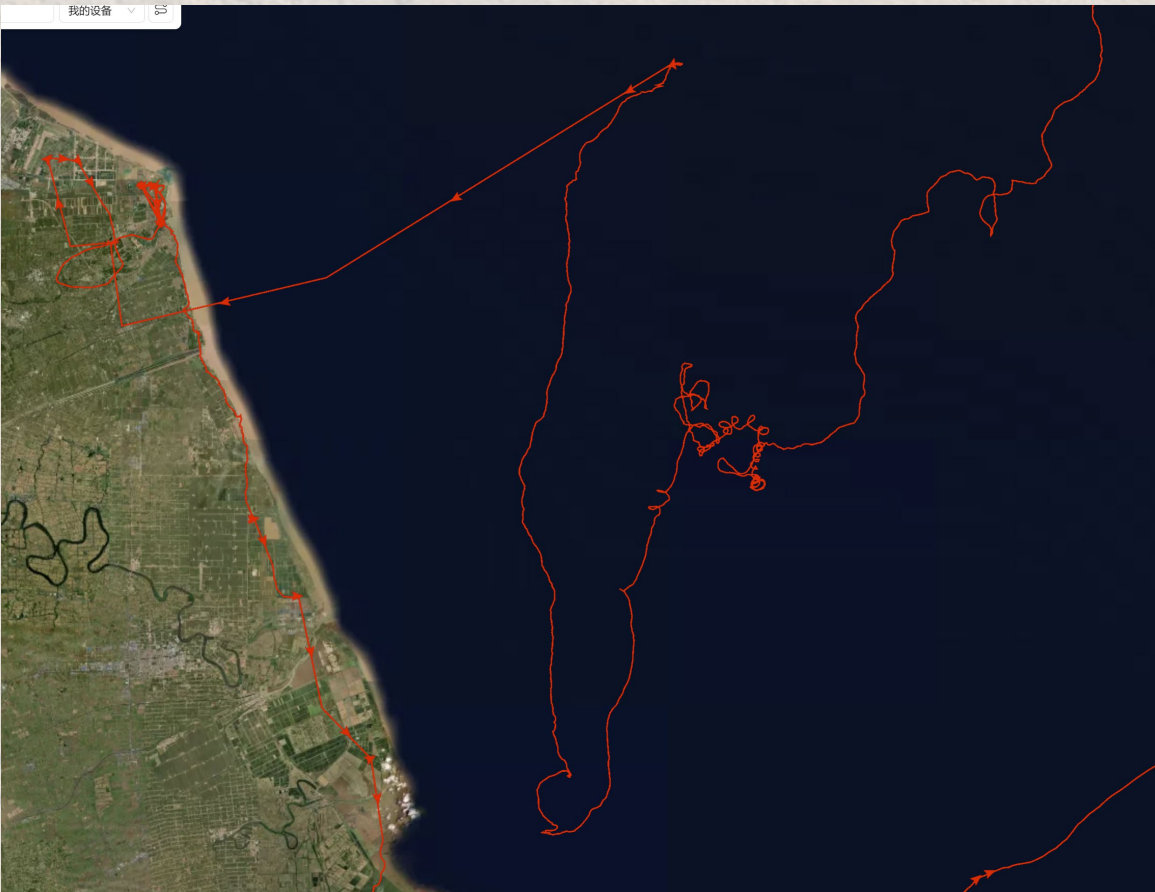


# Take home messages

- ✚ Traditional assessment methods may underestimate the impact of wind farms on migratory birds (failed migration, delays, and mortality).
- ✚ During coastal flights, migration routes tend to be relatively concentrated, whereas during offshore flights, routes are broader and less distinct, making it easier to avoid coastal routes when selecting sites for wind farms
- ✚ Combine bird tracking data with mitigation measures to demonstrate the effectiveness of mitigation efforts

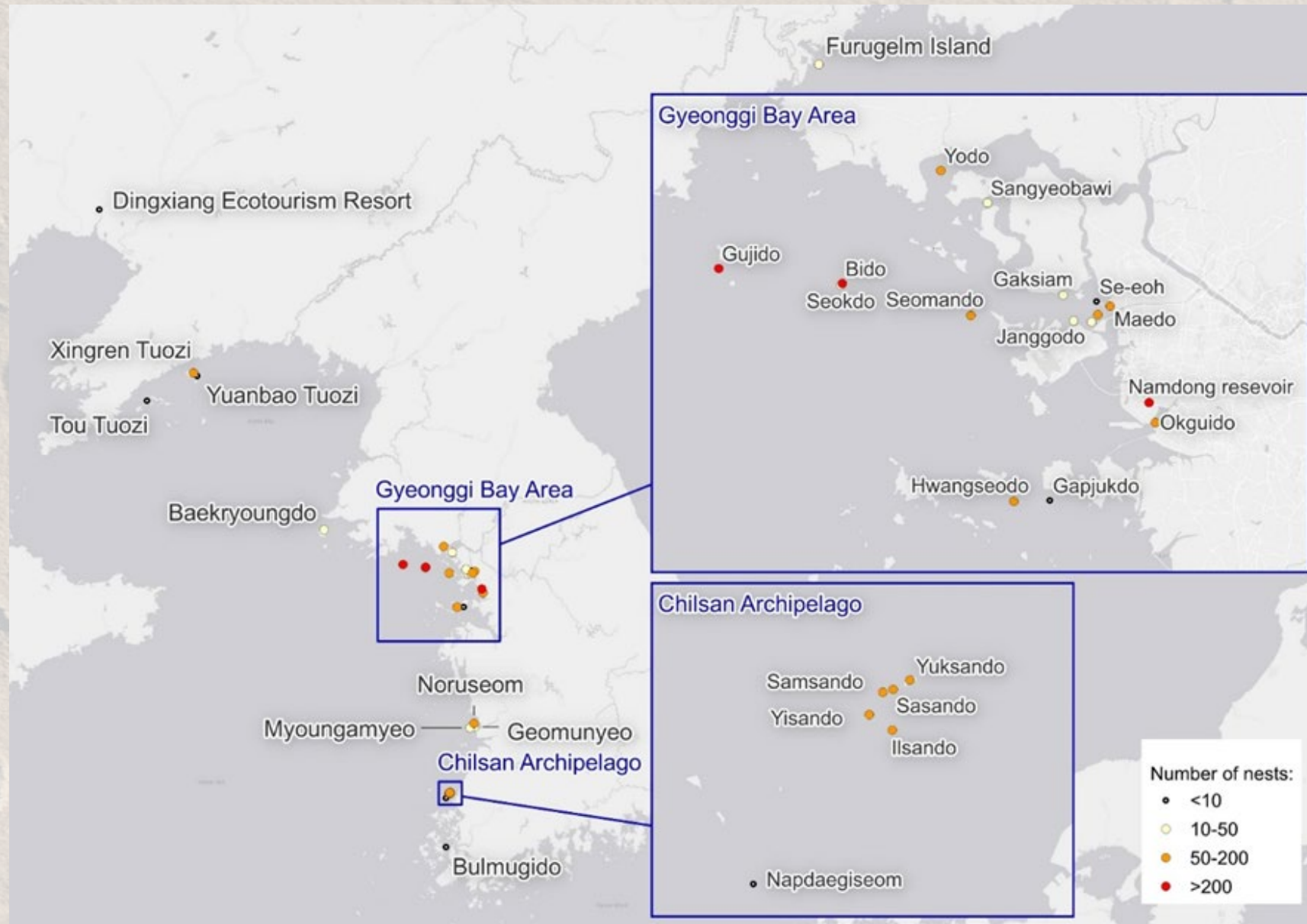


Many more interesting ecological stories to be discovered – Black-faced Spoonbill M90 **strange flight pathway during southward migration from Yancheng to Lianyungang**





# BFS breeding study in the Republic of Korea









# Namdong Reservoir





# Furugelma Island BFS – RU24



choicy

註冊成員

Logout

English

HOMEPAGE

ABOUT US

MAP

LIST

Migration Track

Obesrvation Report

MY FRIENDS

MY FAVORITES

MY RECORDS

MY COMMENTS

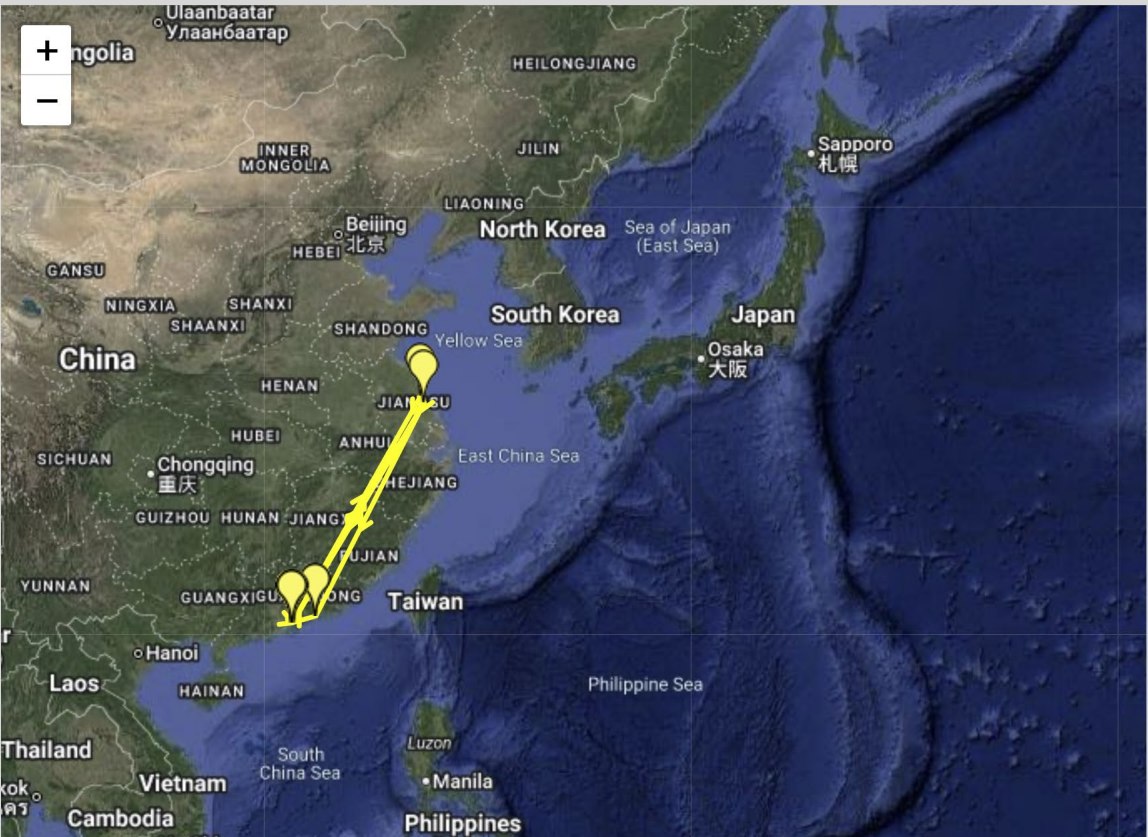
Date: 1990-01-01 ~ 2026-05-17

Choose a Spoonbill

RU24

定位

Google Hybrid衛星



21 records(2 page), This is 1 page

| Date           | Location                             | Quan<br>tity | Rings                                           |
|----------------|--------------------------------------|--------------|-------------------------------------------------|
| 2023-1<br>1-13 | Mai Po Nature Reserve, BW            | 147          | A44,E29, <b>RU24</b> , S66, 8K, E34, SX1        |
| 2023-1<br>1-12 | Mai Po Nature Reserve, BW            | 120          | A44, <b>RU24</b> , 88K, 44K, E02                |
| 2022-1<br>1-08 | 深圳市福田区红树林自然保护区                       | 101          | <b>RU24</b> , S66                               |
| 2022-1<br>1-07 | 深圳湾红树林公园海滨                           | 50           | A43, <b>RU24</b> , Y29, M01                     |
| 2021-1<br>2-04 | Mai Po Nature Reserve, GW<br>13      | 70           | <b>RU24</b>                                     |
| 2021-0<br>3-25 | Tiaozini                             | 87           | <b>RU24</b>                                     |
| 2021-0<br>1-16 | Guangdong Haifeng                    | 280          | V85, E27, S96, <b>RU24</b> , S55, Y61, H62, H88 |
| 2020-0<br>1-11 | 廣東海豐 Haifeng, Guangd<br>ong Province | 50           | <b>RU24</b> , V85                               |
| 2019-1<br>1-24 | 中国广东省深圳市福田区红树林自然保护区                  | 1            | <b>RU24</b>                                     |
| 2019-0<br>4-14 | 大丰区川东闸附近                             | 70           | <b>RU24</b>                                     |
| 2018-1         | Mai Po Gei Wai #18                   | 1            | <b>RU24</b>                                     |

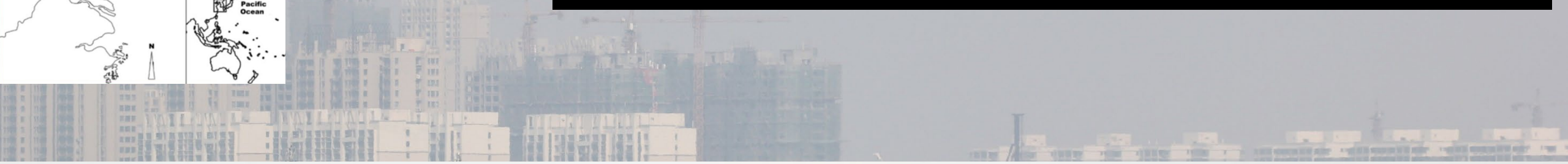




## The importance of Lianyungang tidal flats

- Supported at least 200,000 waterbirds;
- 17 Threatened or Near-threatened species;
- More 90% of global Asian Dowitcher population in spring

Yang et al. 2021 Avi. Res.; Choi et al. 2020 CCWC

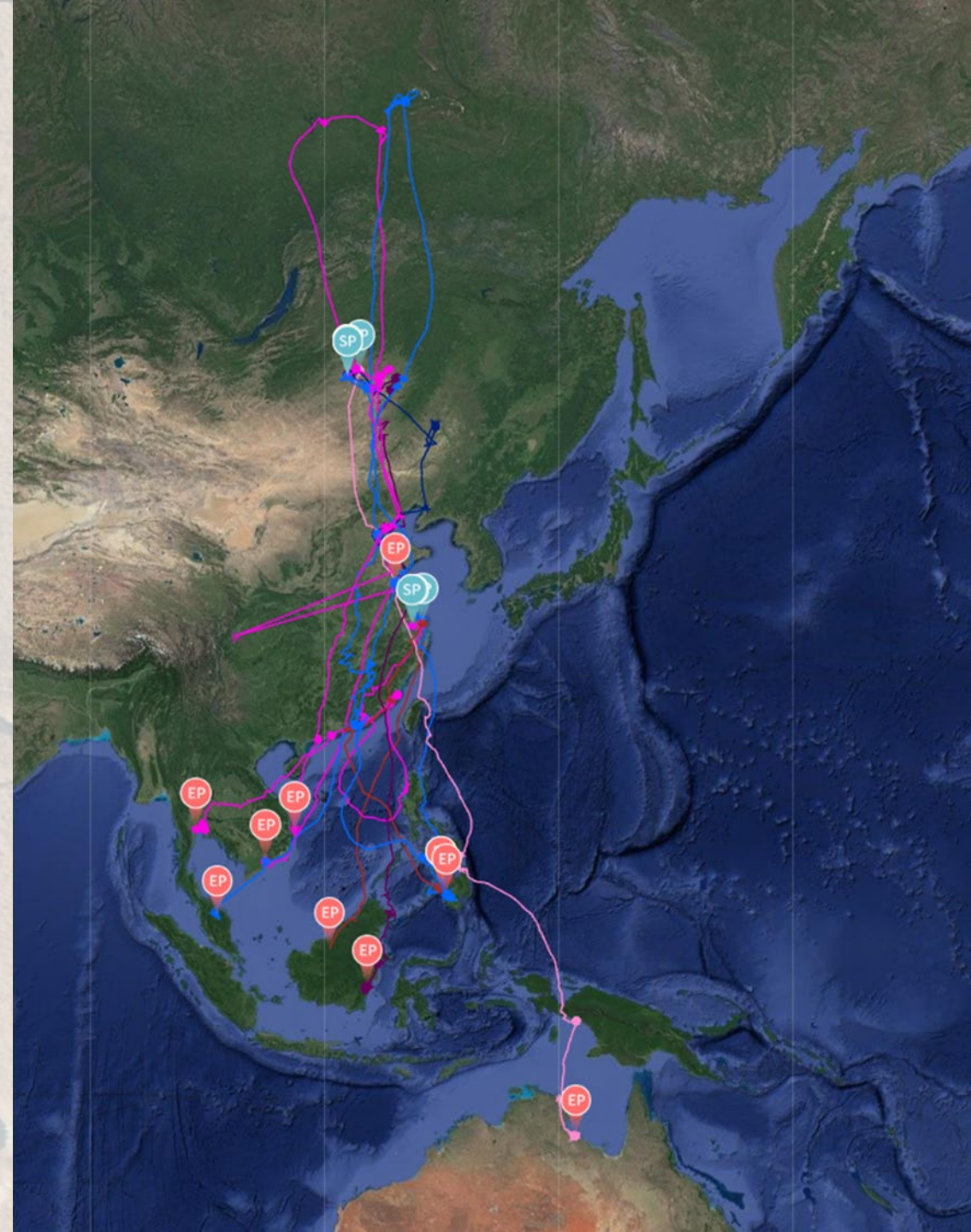
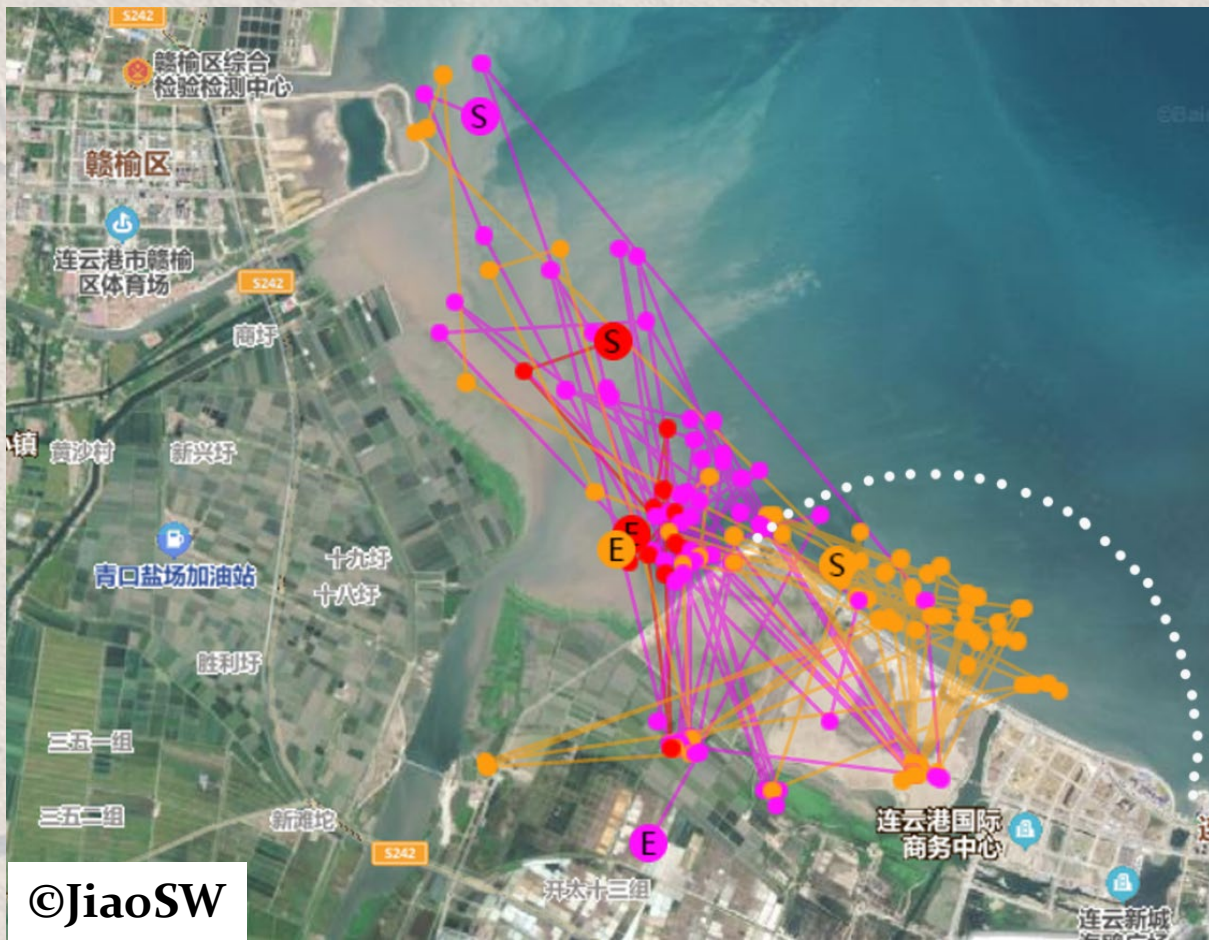


2018 Oct – Blue bay project began  
2019 June – official start  
2022 Jan – temporary suspension





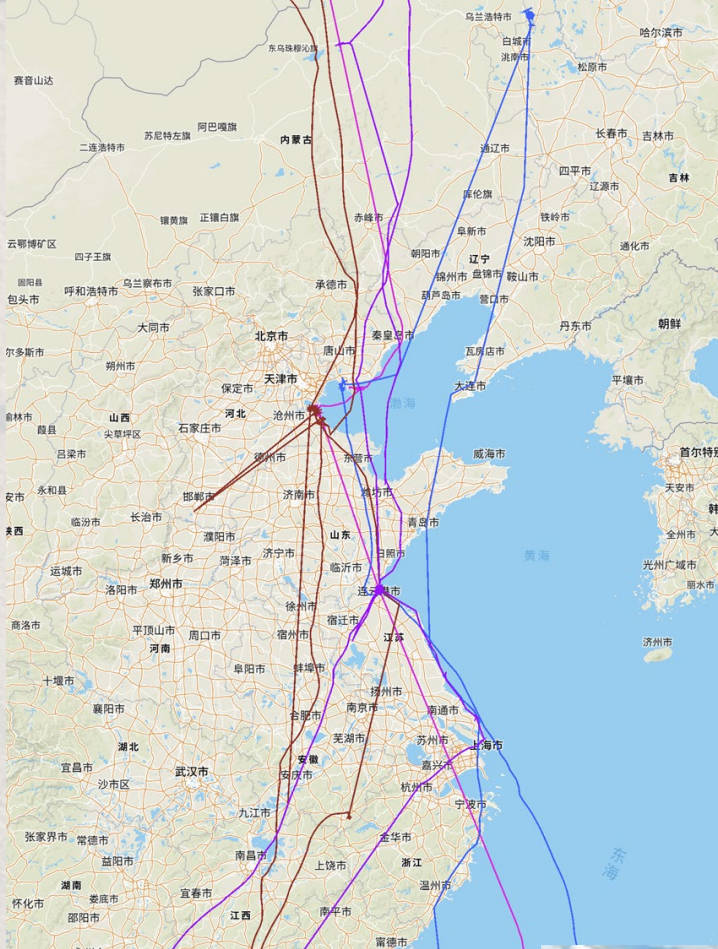
# Urgent need to evaluate the impact of the Blue Bay Ecological Restoration project on Asian Dowitchers





# Collaborative effort

↓ Asian Dowitchers tagged from Mongolia



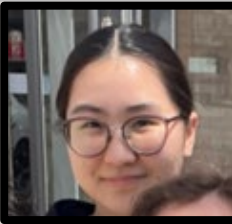
| Project name | Deployment location | Deployment date |
|--------------|---------------------|-----------------|
| ASDO         | Buir                | 17/7/2025       |
| ASDO         | Buir                | 13/6/2025       |
| ASDO         | Buir                | 17/7/2025       |
| ASDO         | Chukh Lake          | 8/8/2025        |





# Impact of the Blue Bay project

Altangerel *et al.* in Prep.



↓ Overlap with project area: Decreased from 6.14% to 3.79% after construction

↓ Total activity area: Shrank from 4,140.55 ha to 3,472.12 ha (16% decline)

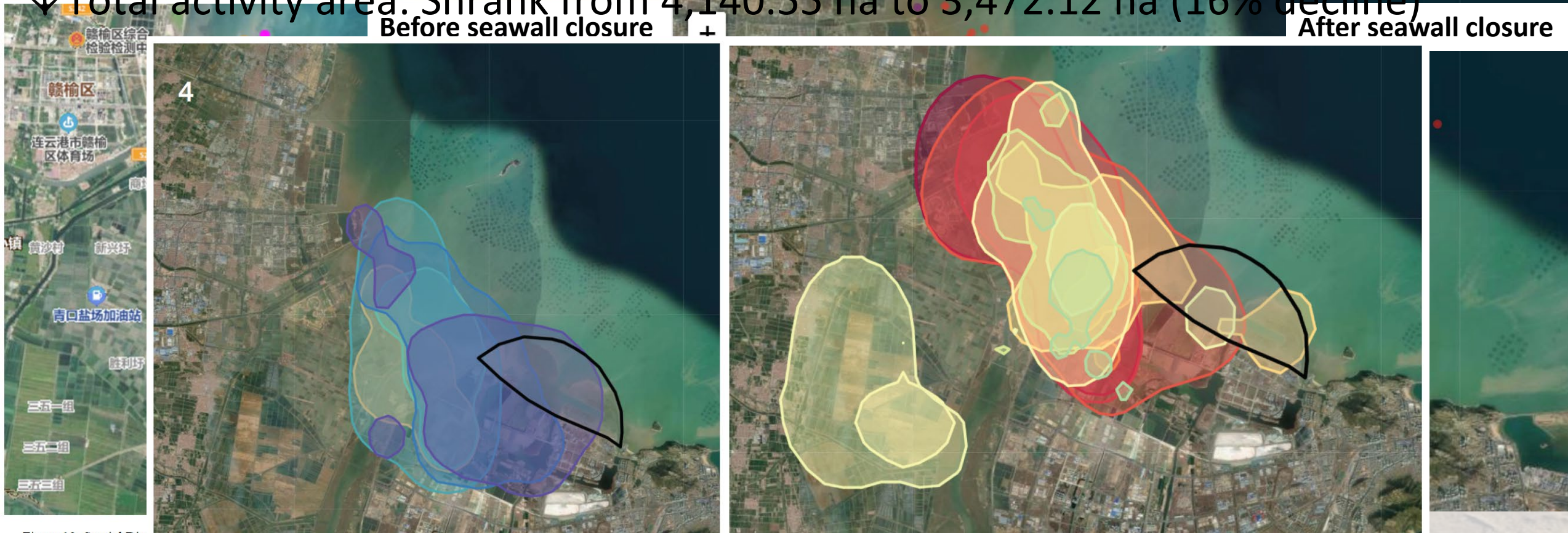


Figure 19: Spatial Dis

Figure 1-2. 95% kernel density estimation (KDE) home ranges of Asian Dowitchers before (2019–2020, left) and after (2021–2025, right) construction. Different colors represent individual birds, and the black semicircle denotes the construction area.



**Collaborative effort  
and open-access data  
sharing mechanism is  
critically important**



呼伦湖南部半蹼鹬孵蛋（左边蹲下来的那只）的情况。

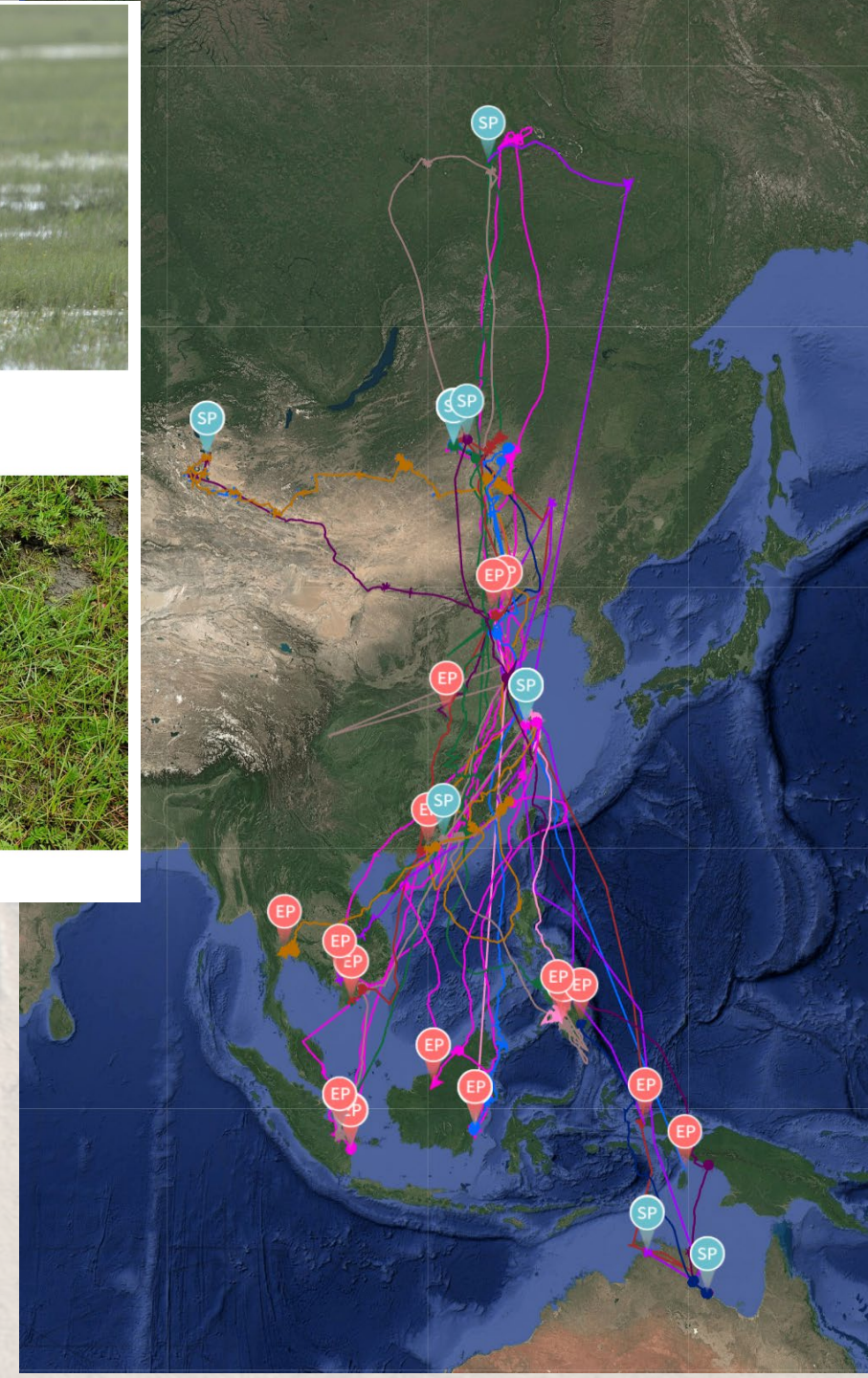


呼伦湖南部发现的其中一个半蹼鹬的鸟巢。

**Mongolian Bird Conservation Center**

**Wildlife Science and Conservation Center of Mongolia**

**Eugene Shemyakin Russian Academy of Sciences**





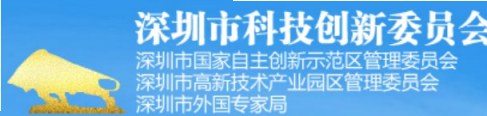
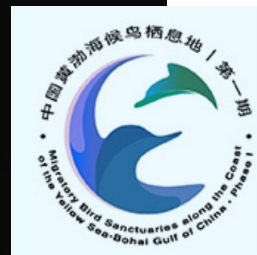
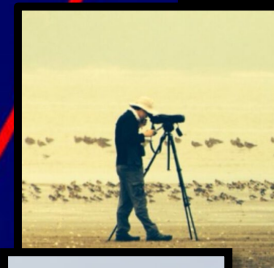
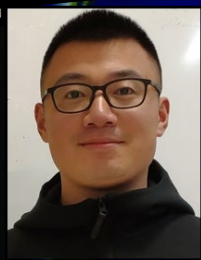
# Take home messages – Ringing and movement data

- ↓ inform us where the birds go and sites to protect
- ↓ identify limiting factors, monitor survival
- ↓ evaluate the effectiveness of restoration efforts (e.g. *Spartina* eradication); impact of land-use change (green energy infrastructures)
- ↓ YET, more open-access data will boost the effectiveness and impact of such use of data – especially to the end users from resource-limited areas!!!





# Invisible connection



Contact:  
choimo@yahoo.com

PRBO Conservation Science  
USGS Alaska Science Center





## An International Journal of Ornithology

- ❑ **EiC:** Prof. Fumin Lei (IOU president)
- ❑ **Scope:** All subjects in ornithology
- ❑ **Open Access:** ScienceDirect (Elsevier)
- ❑ **APC:** Waived !!!
- ❑ **Rapid** online publishing  
(**within 1 week** after acceptance)
- ❑ **2023 IF:** 1.7, rank 5/29 (Ornithology, Q1)

[www.sciencedirect.com/journal/avian-research](http://www.sciencedirect.com/journal/avian-research)



## Identification Steps

### A. Bill tip pink, completely smooth (no wrinkles) → 0–1 year old

*Additional traits: Secondary and tertiary flight feathers with black markings; iris dark brown; no yellow patches around eyes; short white breeding plumes on back of head.*

### B. Bill tip black, wrinkles appear at the base of the bill →

#### 1. Bill wrinkles $\leq 3/4$ of the bill length (or nearly smooth); outer four primary flight feathers with black markings → 1–2 years old

*Additional traits: Iris turning red; some individuals with faint yellow eye patches; some with yellow breeding plumes on back of head and chest.*

#### 2. Bill wrinkles $> 3/4$ of the bill length; black-marked outer primary flight feathers $< 4$ (or $> 4$ but the markings are very narrow) →

##### a. Flight feathers not entirely white →

#### 1. Outer 1–2 primary flight feathers with noticeable black markings → 2–3 years old

*Additional traits: Iris red; yellow breeding plumes on head and chest; most individuals with yellow eye patches.*

#### 2. Outer 1–2 primary flight feathers with black markings restricted to the rachis → 3–4 years old

*Additional traits: Iris red; yellow breeding plumes on head and chest; most individuals with yellow eye patches.*

##### b. Flight feathers entirely white → 4+ years old

*Additional traits: Yellow breeding plumes on head and chest; most individuals with prominent yellow eye patches; some with yellow markings on bill tip.*

### C. Some features do not match or insufficient information for classification → Unknown



0-1 year old





1-2 year old





2-3 year old





4+ year old

