조사 방법 워크숍



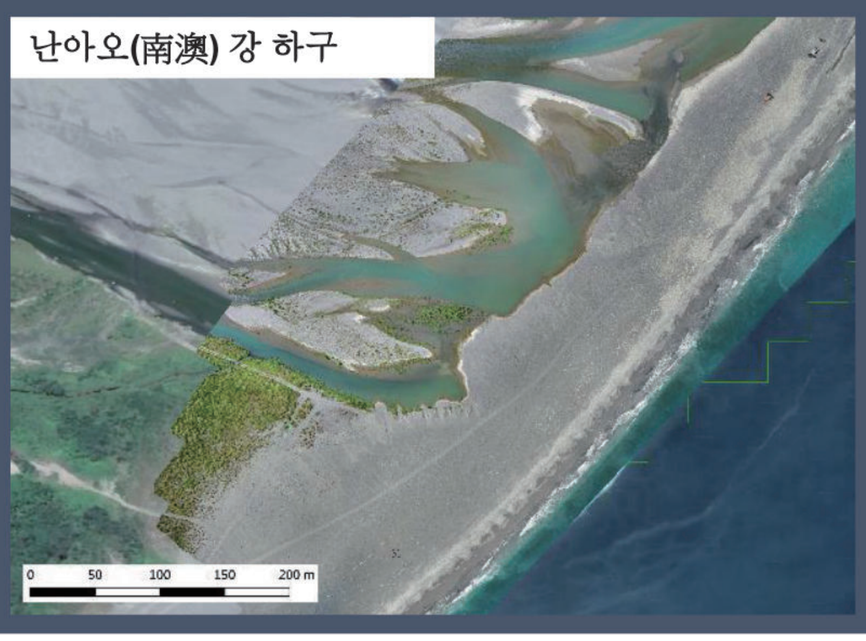






번식 서식지 관리

✓지역 관리인 배치
✓포식자 제거 (쥐, 들고양이, 개 등)
✓식생 관리
✓은신처 제공





16




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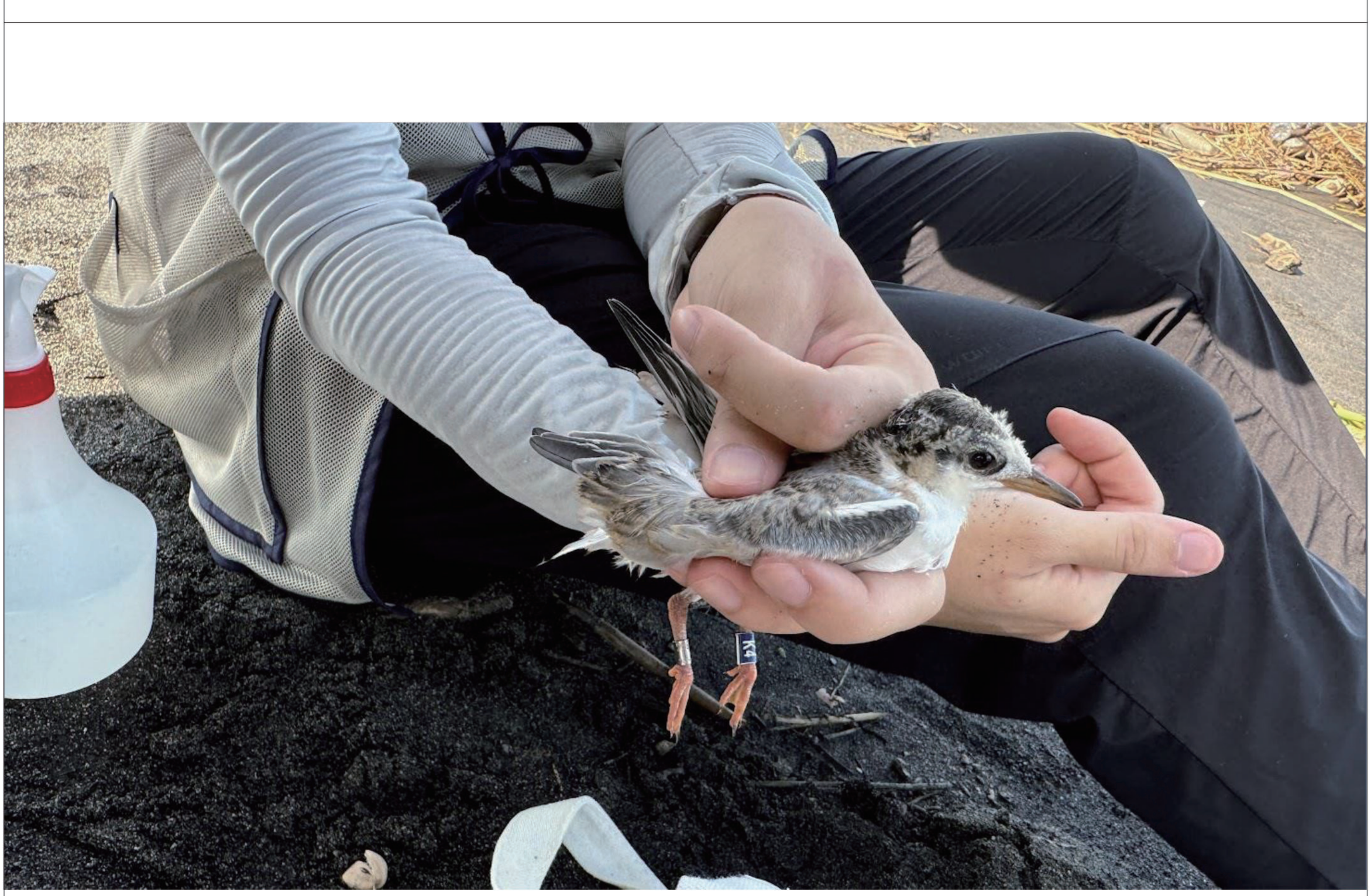

公告
本區域為保育類動物「小
燕鷗」繁殖棲息地，
請勿進入
宜蘭縣政府


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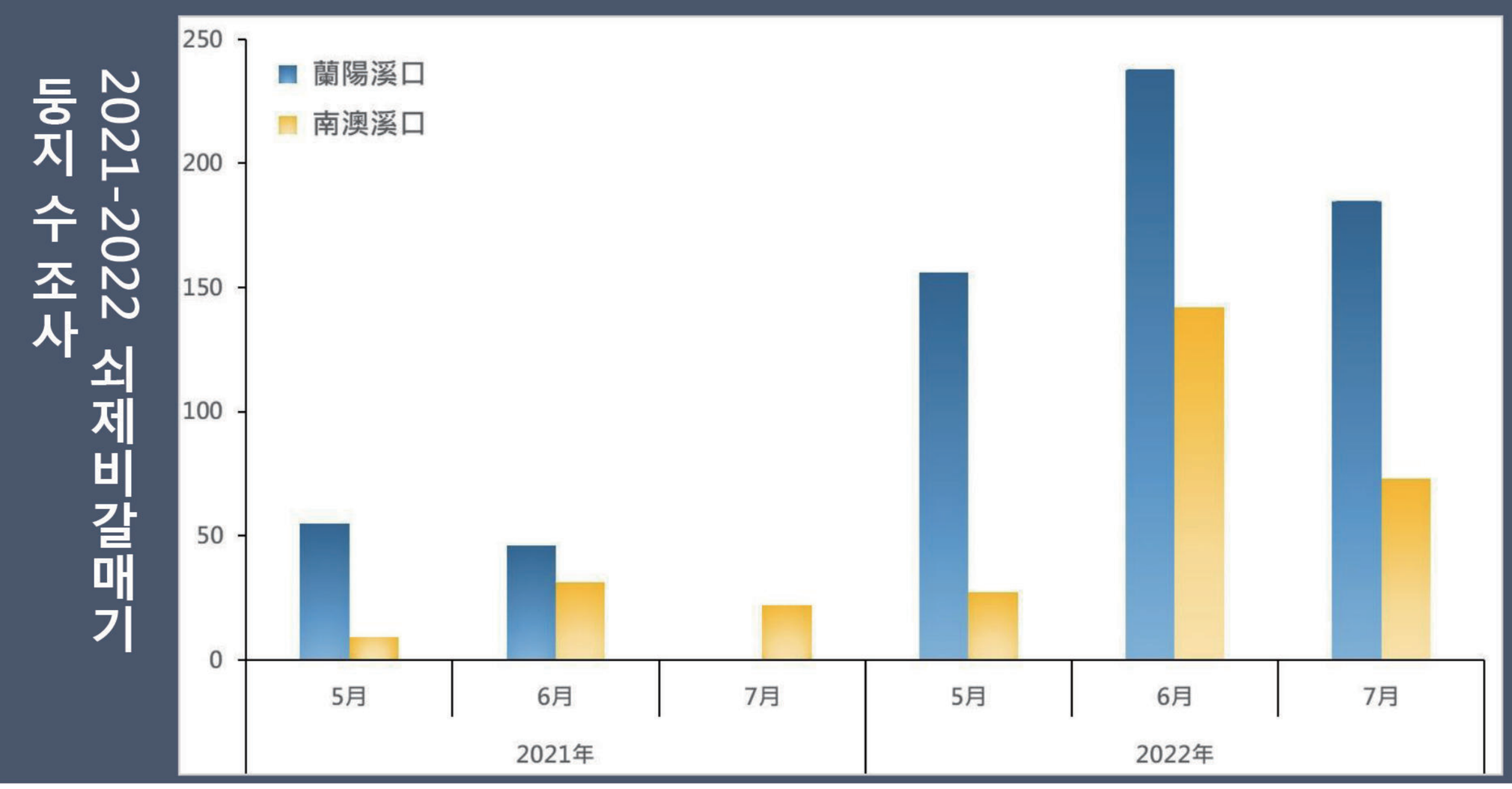






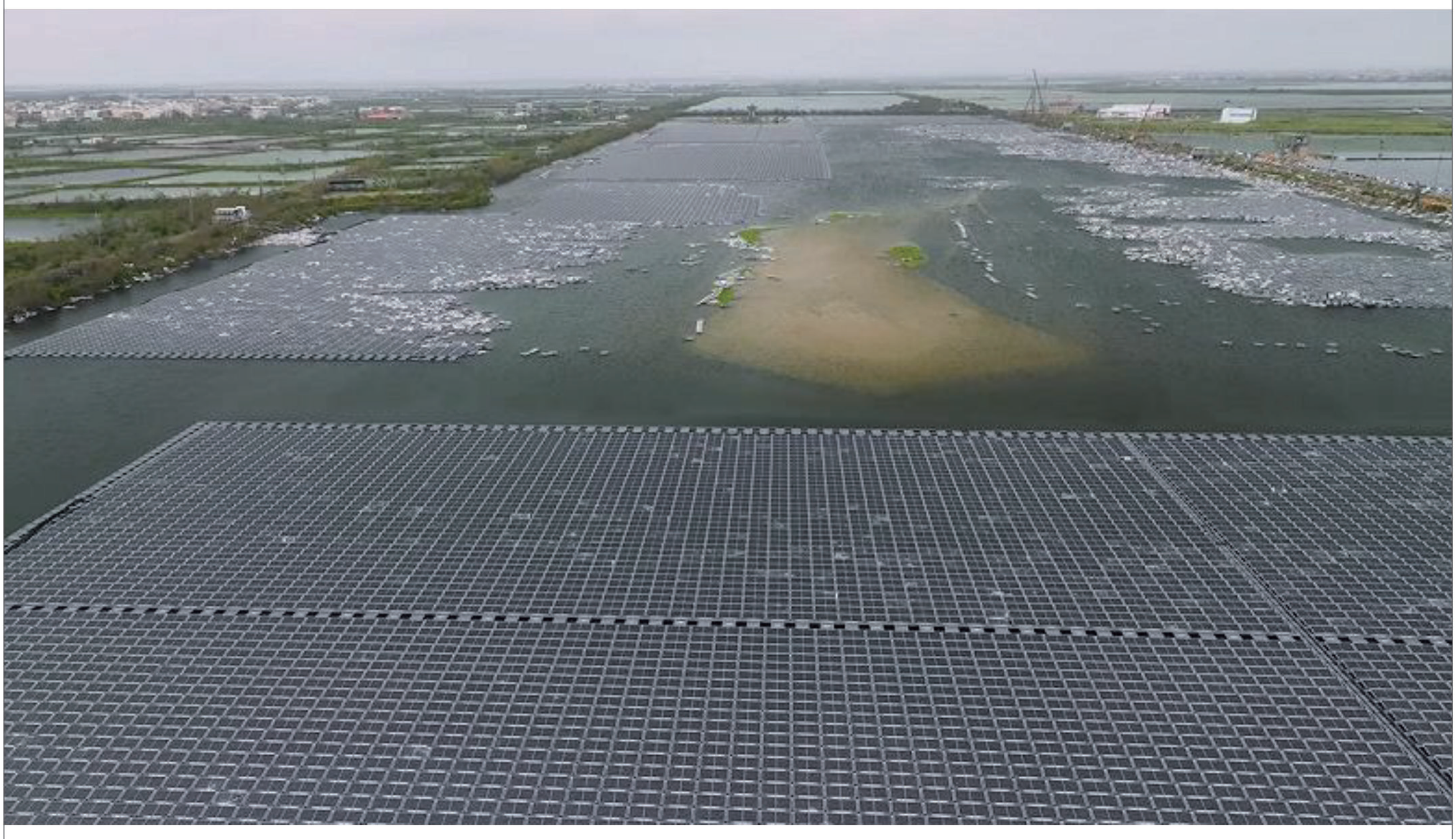


서식지 관리 후 둥지 수 증가



태풍








中能發電 Zhong Neng
發電廠
崙尾區海堤
崙尾區海堤護岸
八支水劍
崙尾區海堤
崙尾區海堤
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崙尾區海堤
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提供意見
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ESG

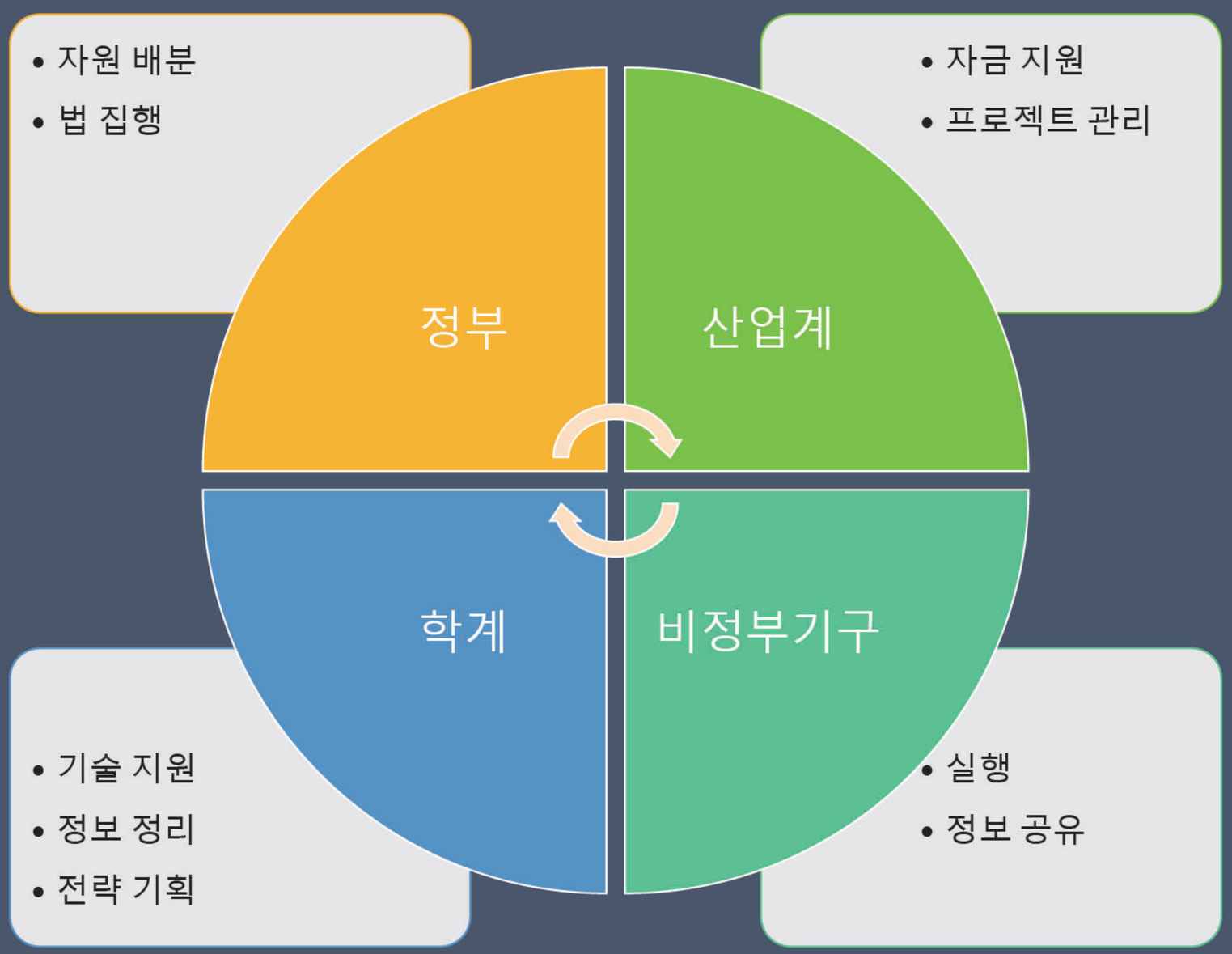




쇠제비갈매기 후원기업



33





中華民國野鳥學會
Taiwan Wild Bird Federation

Ørsted

海洋委員會海洋保育署
OCEAN CONSERVATION ADMINISTRATION,
OCEAN AFFAIRS COUNCIL

Change of Seabird Diversity and Abundance at Offshore Windfarms and Compensation Strategy in the Taiwan Strait



Chung-Hang, Hung

chrancor@gmail.com

Nation Taiwan University
Hydrotech Research Institute
Assistant Research Fellow



Dr. Chung-Hang, Hung

M.S. – Environmental Science, Tunghai University

Ph.D. – School of Forestry and Resource Conservation, National Taiwan University

M.S. Thesis: Factors Influence the Hatching Success of **Little Terns** in Lun-Wei Industrial Park, 2009

PhD. Thesis: Conservation biology of **Chinese Crested Tern** and **Greater Crested Tern** in Matsu Island Tern Refuge, 2019

Pacific Seabird Group. Asia/Oceania Representative (2019-2021)

Ceta Explorers Co., Ltd. Consultant (2022-now)

Agreement on the Conservation of Albatrosses and Petrels, MoP8. Taiwan Representative (2025)



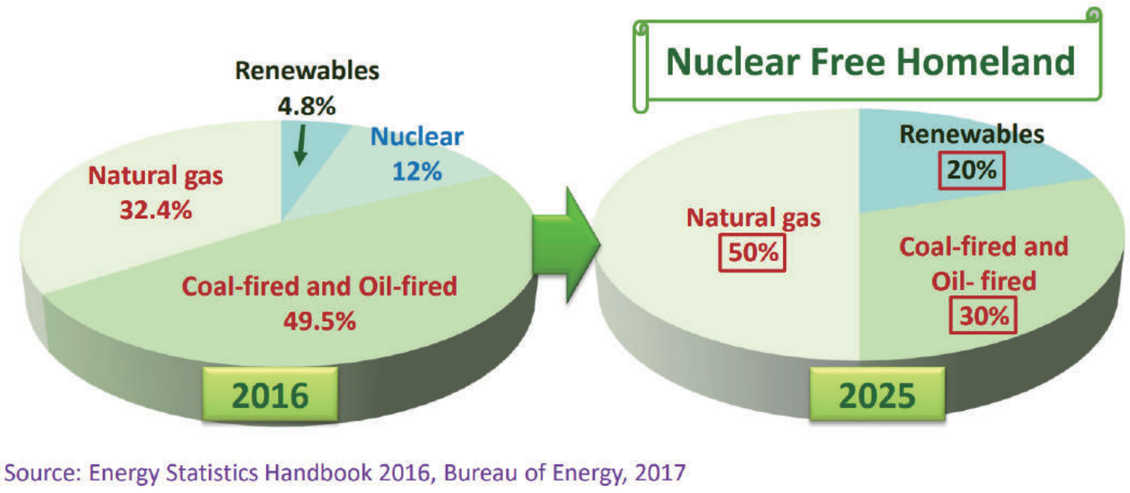
The Energy Transition Principle

Nuclear-free homeland by 2025

Reach the nameplate capacity of **20 GW solar power** and **5.6 GW offshore wind power** by 2025

Net-Zero Emissions by 2050

- **Green energy is the core of energy transition in Taiwan**
  Raising energy security, building sustainable environment and green economy, including promoting jobs opportunities and industrial upgrading.



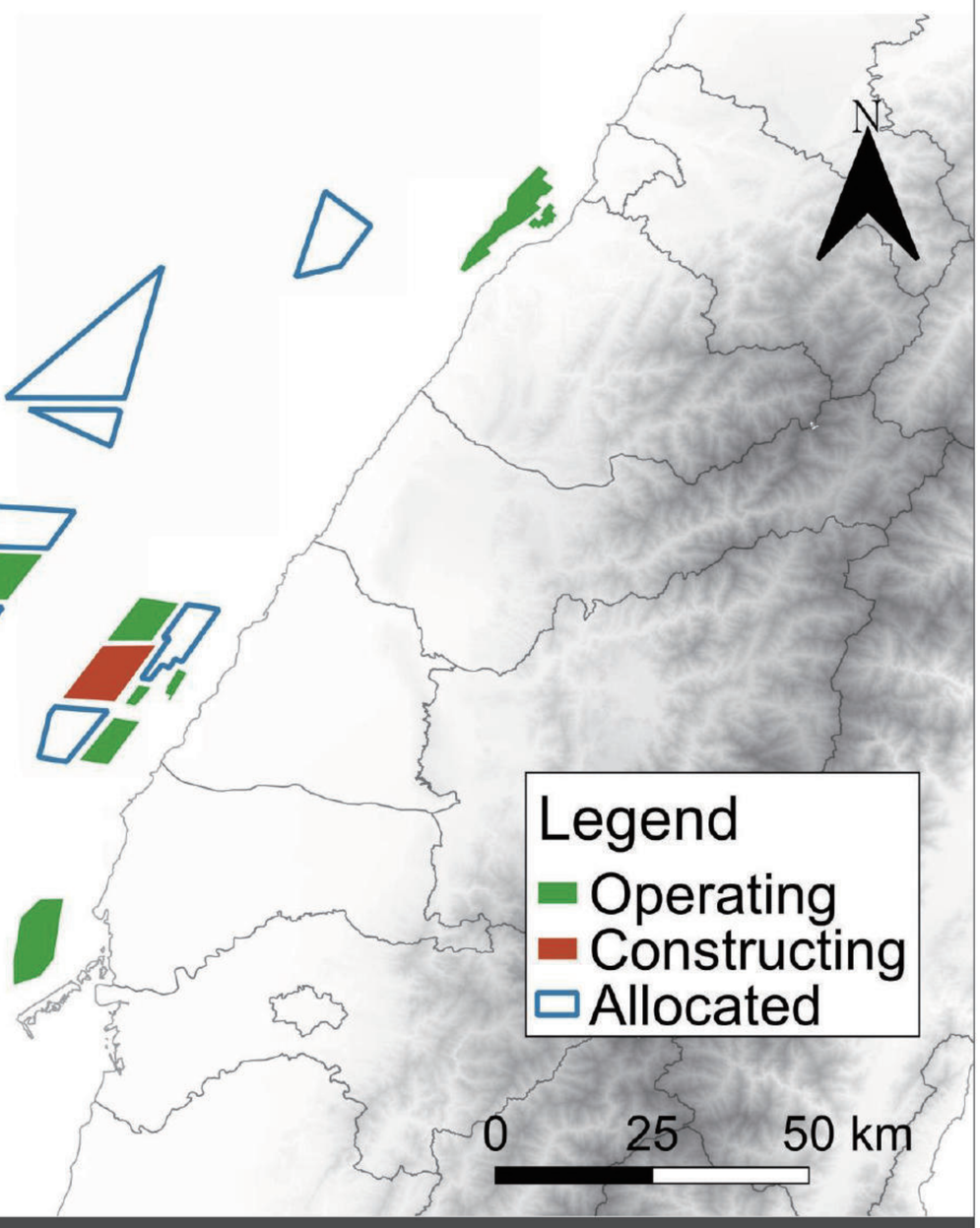
Source: Energy Statistics Handbook 2016, Bureau of Energy, 2017

Offshore Windfarm Plan and Progress by 2025

First offshore windfarm were deployed since 2016, around 3 GW under operation by 2024

2.3 GW under construction, expected to complete parallel connection by 2026

Allocated additional 4.4 GW capacity in 2025

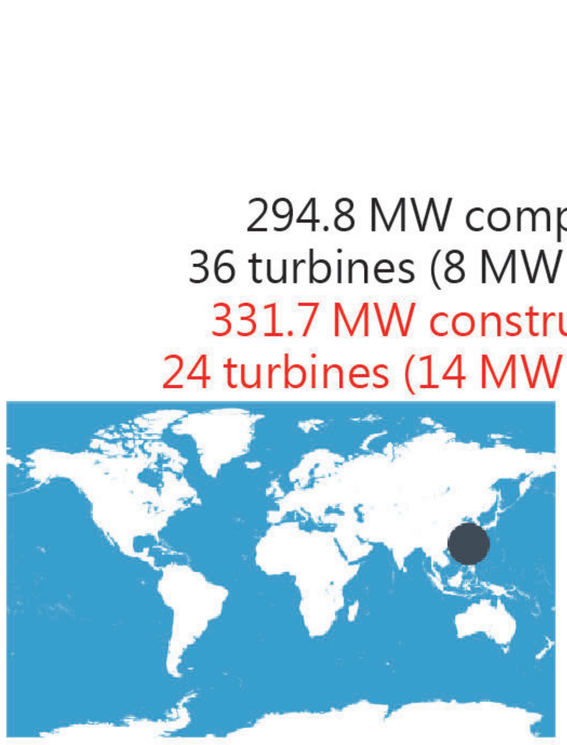


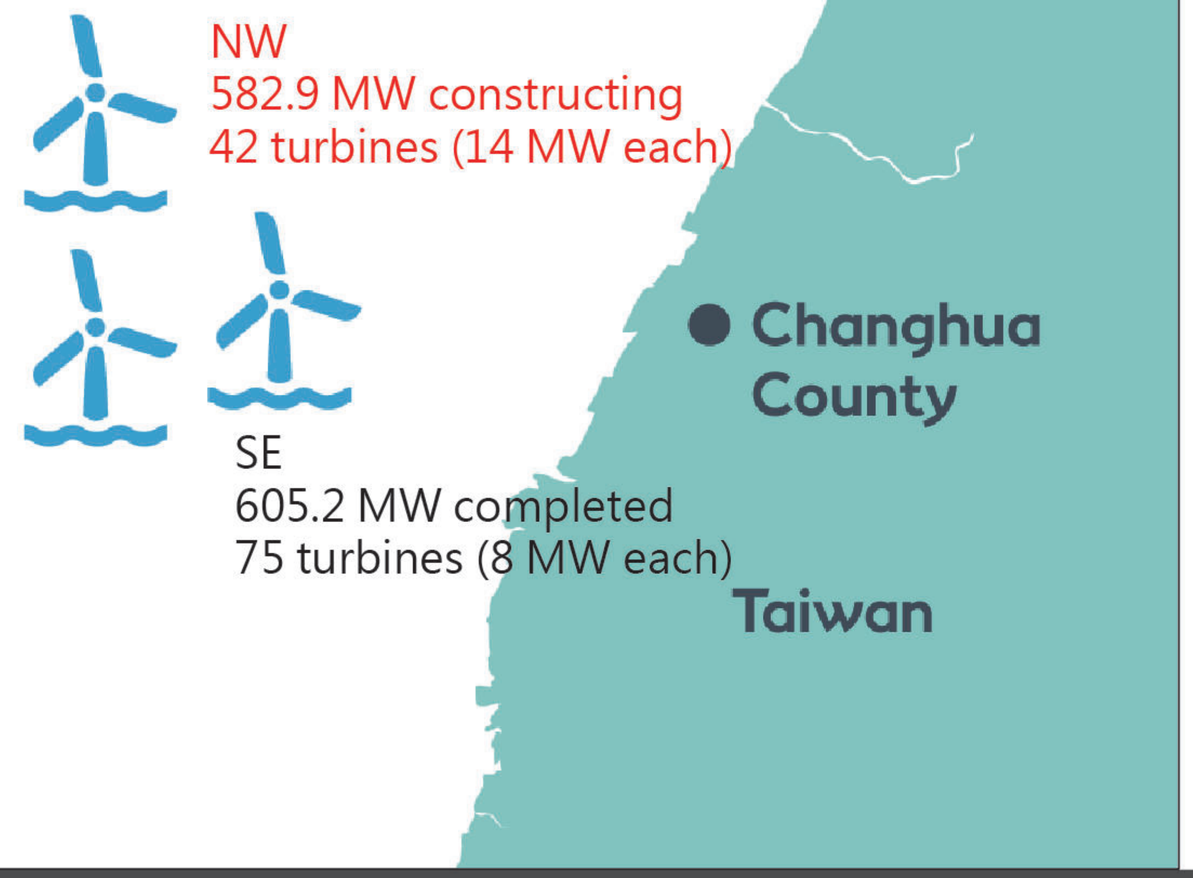


Greater Changhua (GCH)

Offshore Windfarm Project by Ørsted

The largest nameplate capacity offshore windfarm in Taiwan Strait





Ship transect seabird survey Since 2019 March



Spring(Mar-May): 3/season x 2019-2024
Summer(Jun-Aug): 3/season x 2019-2024
Autumn(Sep-Nov): 3/season x 2019-2024
Winter(Dec-Feb): 1/season x 2019-2024

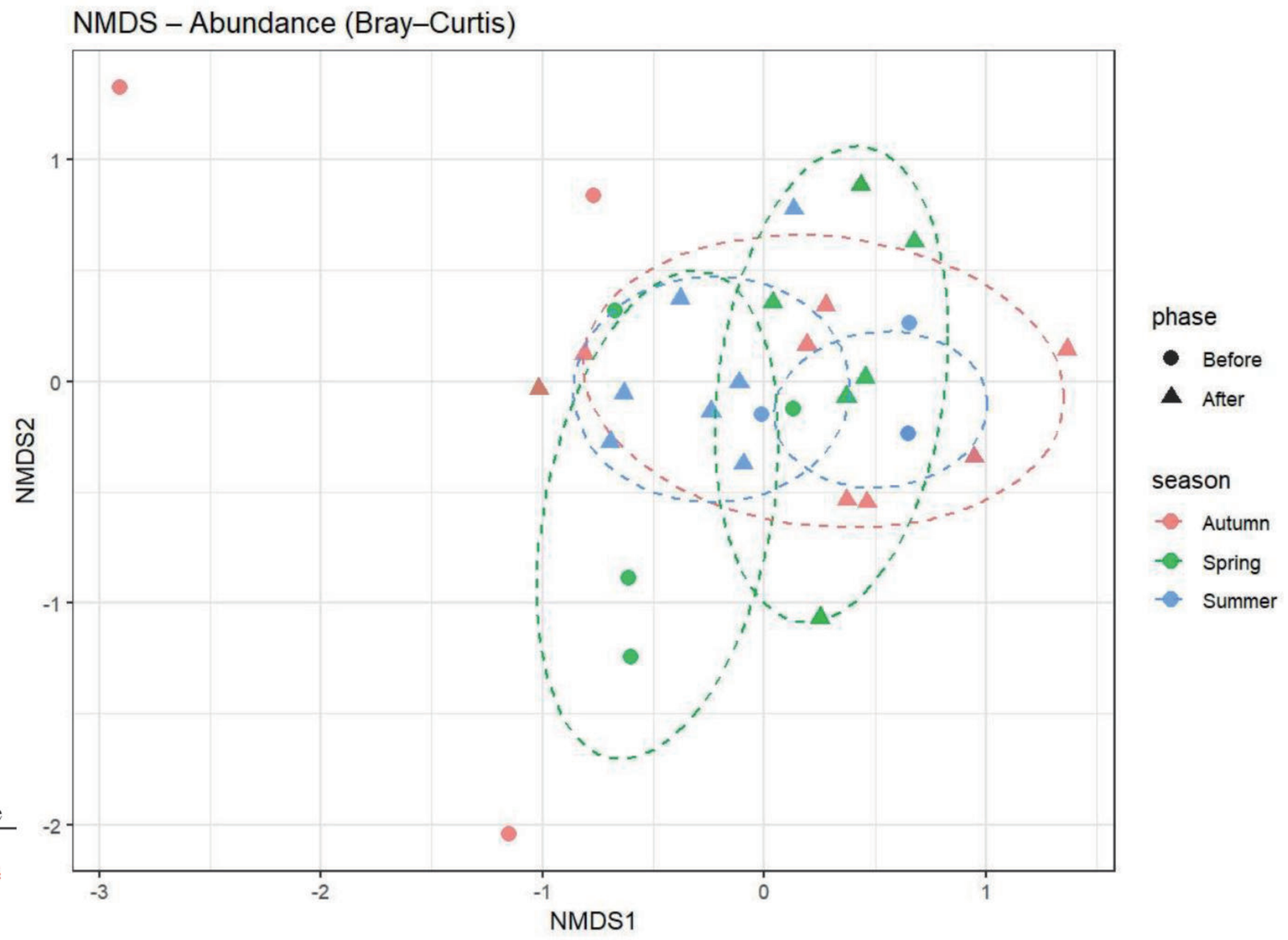
Before: 2019-2020
After: 2021-2024

◆ Method

1.Community Composition	• Bray–Curtis distances PERMANOVA • Non-metric multidimensional scaling (NMDS)
2.Species Occurrence	• Bootstrap(balance unequal sample sizes) • Generalized linear mixed model (GLMM): $\text{presence} \sim \text{phase} + (1\|\text{site}) + (1\|\text{year})$ • Odds ratio (OR) with forest plot

Community Structure by NMDS & PERMANOVA

- 16 species included in the analysis
- Seabird community difference are season-dependent
- were mainly structured by season
- **Summer showed a significant phase effect** (R^2 = 0.276, p = 0.012) in PERMANOVA

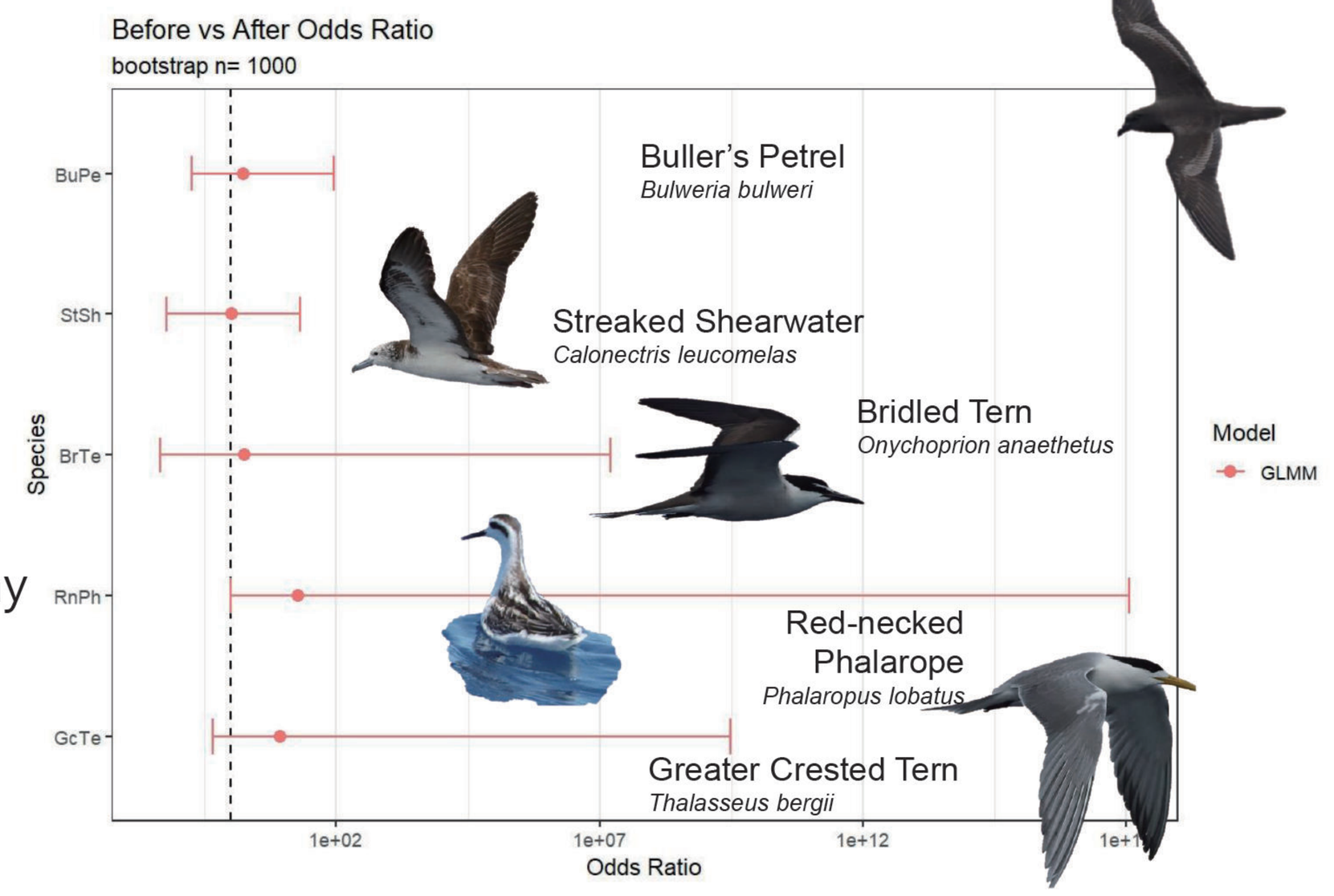


Seasonal PERMANOVA

Season	df	Sum of Squares	R^2	F-value	p-value
Spring	1	0.595	0.138	1.60	0.116
Summer	1	0.968	0.276	3.82	0.012 *
Autumn	1	0.623	0.136	1.58	0.093

Dominant Seabird Species Occurrence

- StSh, BuPe & BrTe showed little to no response
- RnPh & GcTe suggested possible increases
- Changing of GcTe may due to increasing breeding population nearby

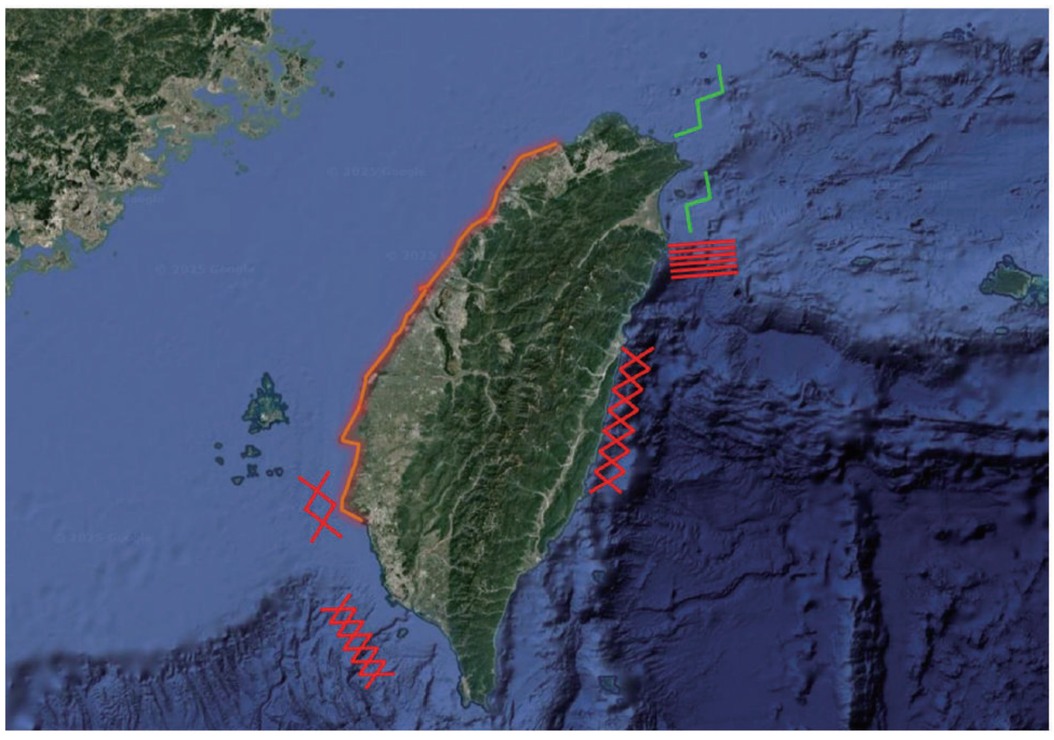


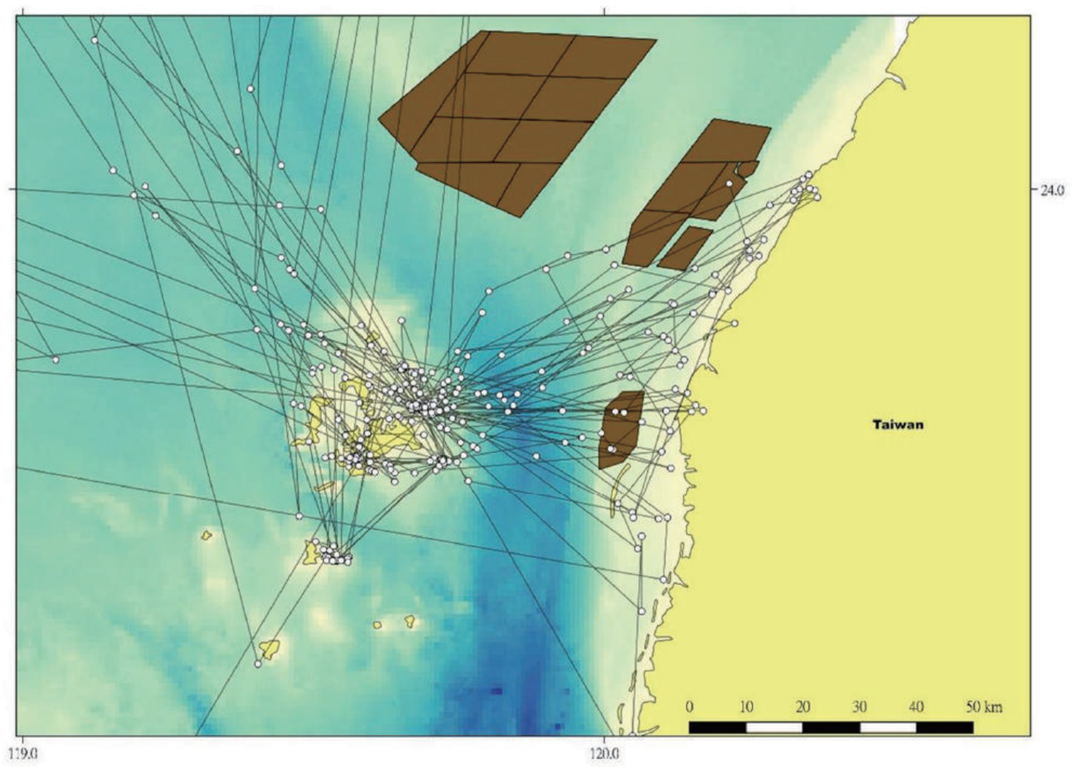
Taiwan’ s Strategies to Mitigate Wind Farm Impacts on Birds (Draft)

1) Operational Phase
2) Maintain bird passage corridors between wind farm blocks — approx. **2 km wide**.
3) Maintain a tip-to-tip distance of approximately **400** meters between turbines.
4) During operation, deploy **high-tech monitoring station**: marine radar, infrared cameras, and acoustic (microphone) sensors to track bird activity.
5) Within 6 months after commissioning, submit a feasible turbine **curtailment (shutdown) mechanism** for review and approval.

Compensation Strategy

- Baseline seabird survay – Seabird sensitive map
- GPS tracking of seabirds
- Little Tern conservation network





Little Tern
Sternula albifrons

- Widespread across the Eurasian continent
- Feeds primarily on freshwater or saltwater fish
- Breeds in environments near open water



POPULATION TREND

Decreasing

2021-2026 Little Tern population survey project

海洋委員會海洋保育署
OCEAN CONSERVATION ADMINISTRATION, OCEAN AFFAIRS COUNCIL

Since 2018

國立臺灣大學 人與自然保育協會

中華民國野鳥學會
Taiwan Wild Bird Federation

宜蘭縣野鳥學會 WILD BIRD SOCIETY OF I-LAN
花蓮縣野鳥學會 WILD BIRD SOCIETY OF HUALIEN
彰化縣野鳥學會 WILD BIRD SOCIETY OF CHANG HWA
屏東縣自然生態保育協會 Pingtung Nature Ecology Society
社團法人台灣野鳥協會 WILD BIRD ASSOCIATION OF TAIWAN
社團法人高雄市野鳥學會
台東縣野鳥學會
WILD BIRD SOCIETY OF TAINAN

Survey method workshop



Breeding habitat management

- ✓Local warden
- ✓Predator free (rats, feral cat & dog)
- ✓Vegetation control
- ✓Shelter





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小告
本區為鳥類保育動物「小燕鷗」繁殖地，禁止進入或干擾，違反野生動物保育法規定者，處新台幣壹百萬元以下有期徒刑或罰金。
宜蘭縣政府 敬


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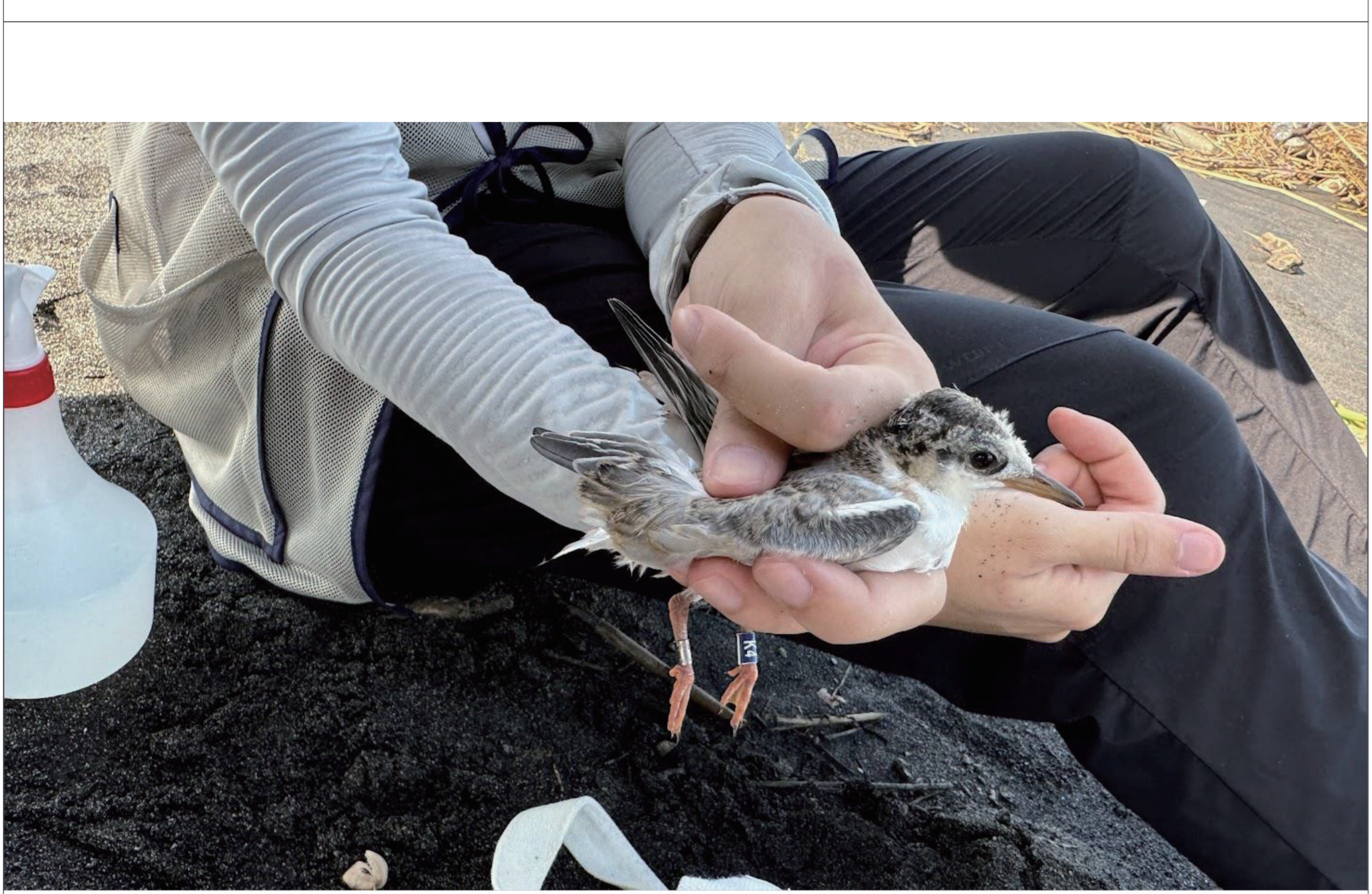



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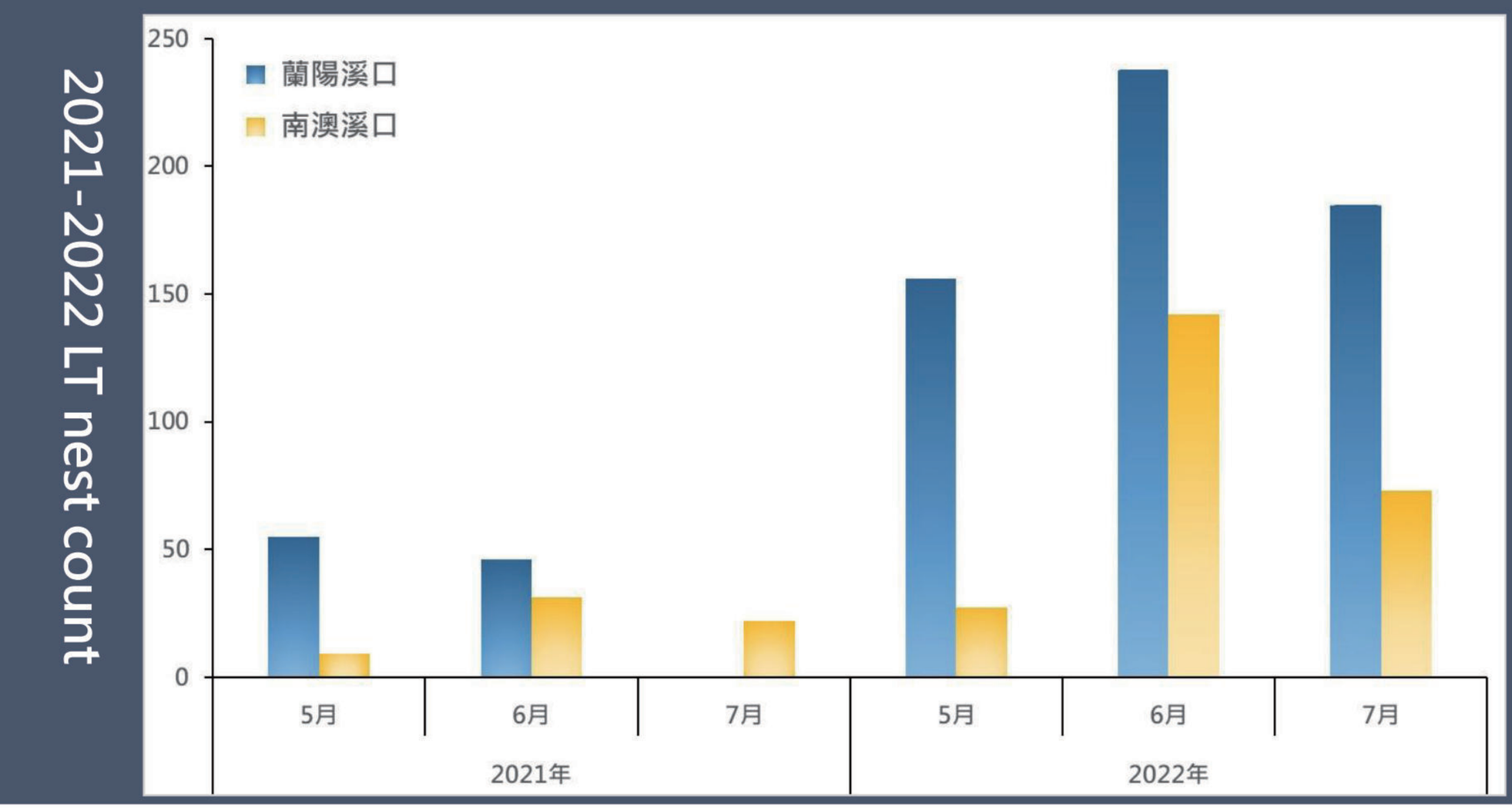






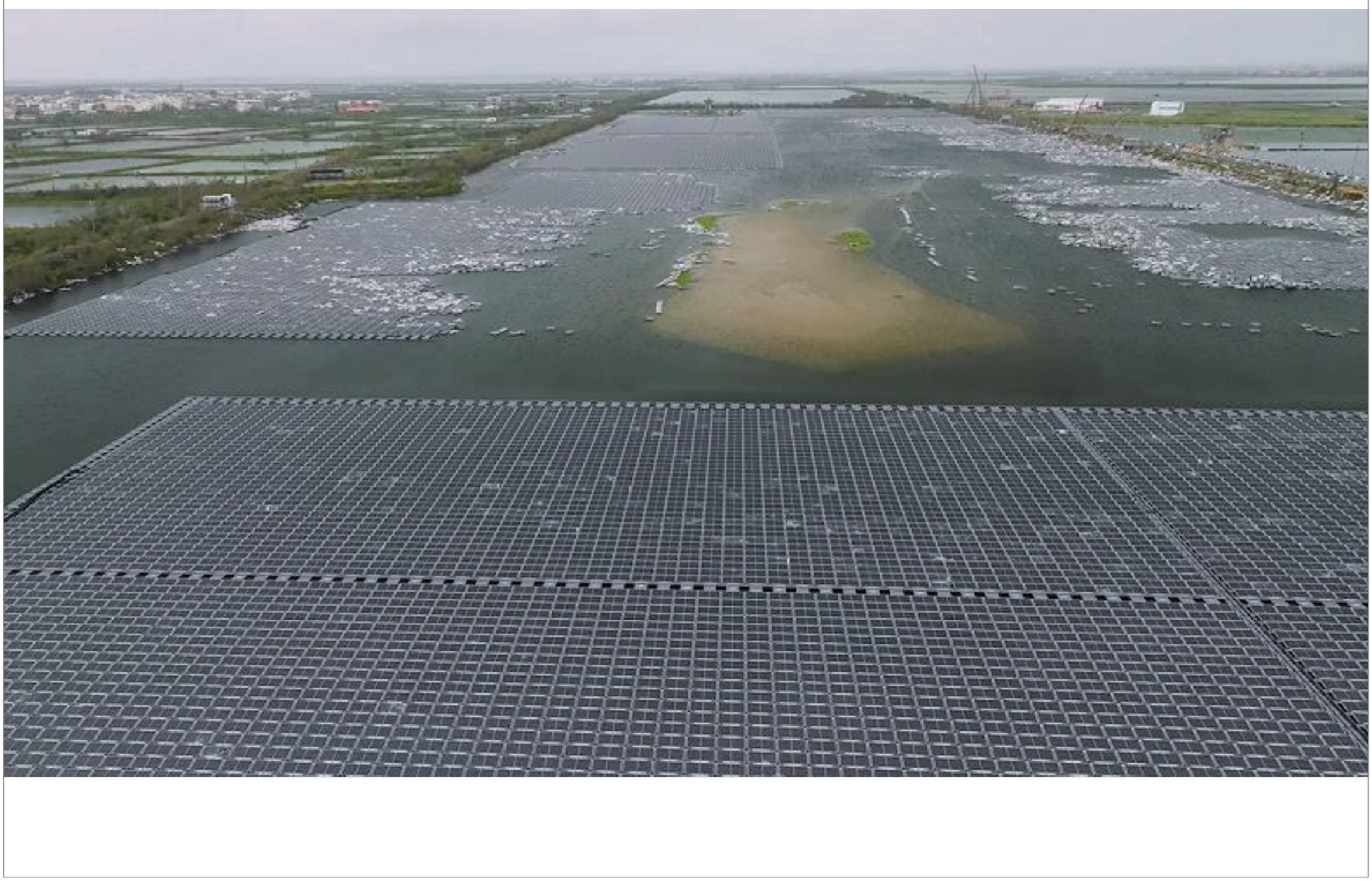


Nests increase after habitat management



Typhoon







中能發電 Zhong Neng
發電廠
崙尾區海堤
崙尾區海堤護岸
八支水劍
崙尾區海堤
崙尾區海堤
崙尾區海堤
崙尾區海堤
崙尾區海堤
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