10th Our Ocean Conference

Identification of Marine Ecological Corridors

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Busan, Korea

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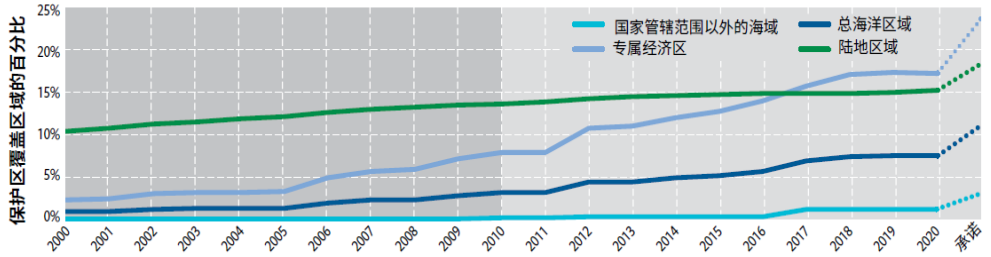
Background

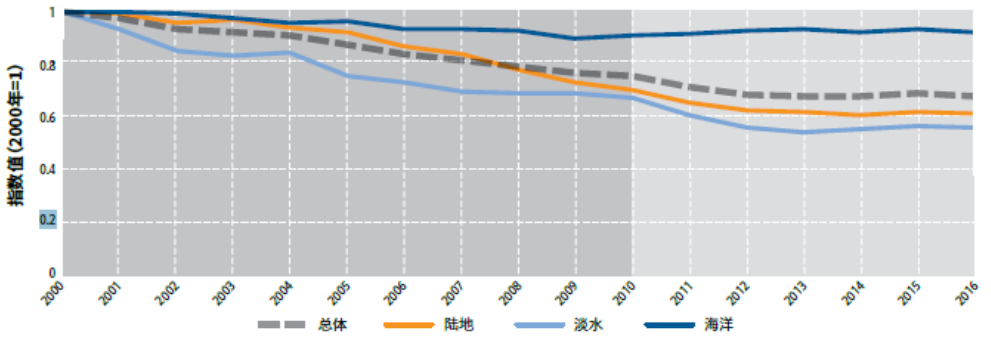
- Protected areas are the foundation of nature conservation. However, despite PAs and other effective area-based conservation measures (OECMs) being essential, they are no longer considered sufficient in many places (IUCN, 2019).
- Active measures must be taken to maintain, enhance, or restore ecological connectivity between protected areas (Tabor, 2019).
- Maintaining and increasing ecological connectivity can improve ecosystem resilience and reduce the impact of climate change, which has become one of the important strategies for biodiversity conservation (Bernhardt et al., 2013; Littlefield et al., 2019)
- Ecological corridors and networks are considered important means to protect ecological connectivity and are essential components of biodiversity conservation and ecosystem protection.

图 11.1. 全球保护区的覆盖范围和未来的承诺。[19] 虚线表示如果履行承诺，每个类别的保护区覆盖范围水平。

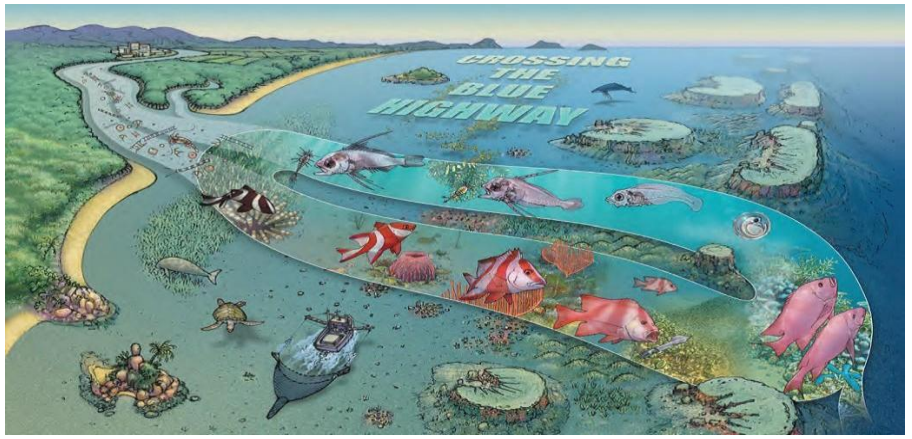


Increased coverage of land and Marine protected areas

图12.3. 显示2000-2016年全球所有生态系统（总体）以及海洋、陆地和淡水生态系统趋势的地球生命力指数。



The decline of the Earth's vitality index.



Crossing the Blue Highway

Background

June 2019	September2020	December 2022
《Gandhi-Nehru Declaration》（CMS）	《Global Biodiversity Outlook (5)》	CBD Kunming-Montreal Framework
The declaration commits to upholding and restoring ecological connectivity as one of the primary tasks of CMS. It calls for the effective incorporation of ecological connectivity and the important role of the CMS.	Taking action to address degradation and fragmentation issues, including establishing green corridors and promoting ecosystem connectivity.	Many countries are calling for the protection and conservation of 30% of land and sea areas by 2030 through the establishment of a **well-connected protected area system** and other effective regional conservation measures.

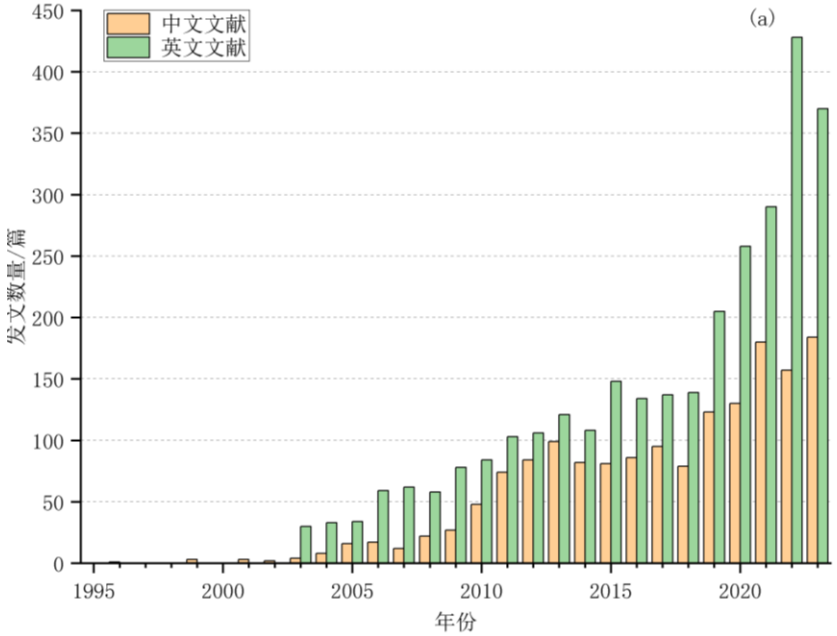
Supporting governments and other actors to identify and monitor ecological corridors, supported by the new World Database on Ecological Corridors

Background

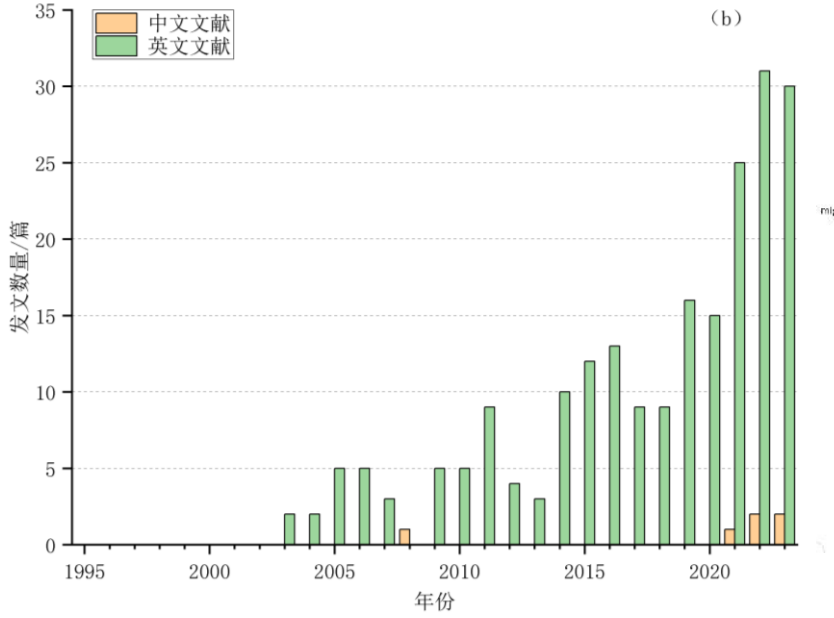
October 2017	May 2019	June 2020	October 2021	January 2024
The Report of the 19th National Congress of the Communist Party	Opinions on Establishing a National Land and Sea Space Planning	Overall Plan for Major Projects for Protection and Restoration of Key Ecosystems Nationwide	Opinions on Further Strengthening the Protection of Biodiversity	The newly revised "Marine Environmental Protection Law"
Constructing ecological corridors, and establishing a network for biodiversity conservation, all aimed at enhancing the quality and stability of ecological systems.	Protecting ecological barriers, constructing ecological corridors and networks, and conducting environmental impact assessments in accordance with the law.	（1）Major projects for the protection and restoration of coastal ecosystems: Maintaining important ecological corridors in coastal areas and safeguarding biodiversity. （2）Major projects for the establishment of nature reserves and the protection of wildlife: Connecting ecological corridors.	Scientifically constructing ecological corridors that facilitate species migration and gene exchange according to local conditions, and focusing on addressing prominent issues.	The country focuses on the maintenance and restoration of important marine ecological corridors to prevent any damage to marine biodiversity.

Research progress

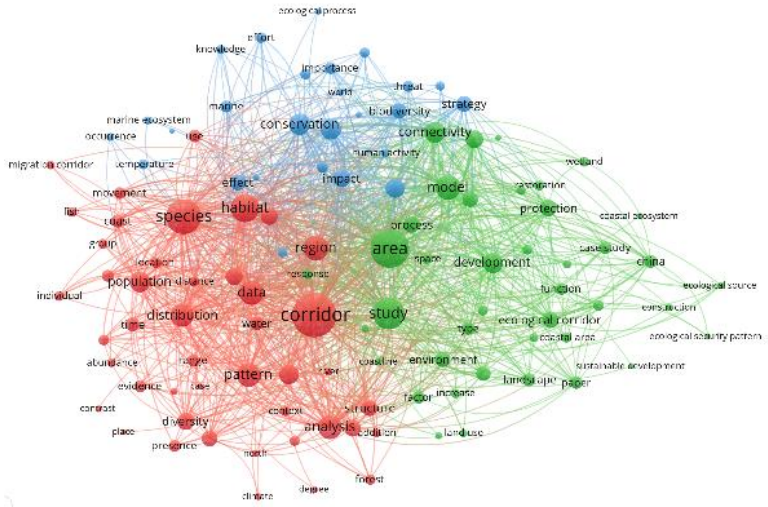
- Most of the international research focuses on terrestrial ecological corridors, and there is relatively limited theoretical and practical knowledge regarding marine ecological corridors. This greatly restricts the progress of marine ecosystem conservation and restoration efforts.



Ecological corridor 4602 articles:
English/Chinese =1617 /2985



Marine ecological Corridor 219 articles:
English/Chinese =213 /6



The main keywords and their co-occurrence relationships of the research

Using "ecological corridor" as the keyword, the number of articles published on Web of Science over the years (left);
Using "marine ecological corridor" or "coastal ecological corridor" as keywords, the number of articles published on Web of Science over the years (right) (**Du** et al., Journal of Applied Oceanography, 2025).

Research progress

IUCN

Guidelines for conserving connectivity through ecological networks and corridors

Jodi Hilty, Graeme L. Worboys, Annika Keeley, Stephen Woodley, Barbara Lausche, Harvey Locke, Mark Carr, Ian Pulsford, James Pittock, J. Wilson White, David M. Theobald, Jessica Levine, Melly Reuling, James E.M. Watson, Rob Ament and Gary M. Tabor

Craig Groves, Series Editor

Hilty et al., 2020

Best Practice Protected Area Guidelines Series No. 30

In some cases, the delineation of an ecological corridor may need to include a third, vertical dimension if biodiversity is to be effectively conserved. Some protected areas and OECMs already have vertical limits (e.g. they apply only to a certain depth underground or below the water surface). Vertical limits have become particularly controversial in marine protected areas, where vertical zoning for commercial purposes may undermine conservation objectives (e.g. by disrupting ecological connectivity), as it is extremely challenging to monitor or enforce. Examples of vertical-dimension considerations in terrestrial systems include the placement of wind turbines in flyways that intercept and kill migrating avifauna, and, in marine systems, the deployment of fishing gear (e.g. drift nets) at different levels of the water column that intercept and kill migrating pelagic species. Such considerations may also apply to surface freshwater systems, including deep-water lakes with faunal zonation, but also to subterranean freshwater systems, which require management strategies that recognise these systems might be affected by activities at the surface that are relatively remote from them. The height and depth dimensions of an ecological corridor need to allow for effective management to achieve its connectivity objectives.

Another aspect of vertical dimensionality is subsurface use rights given that accessing underground resources can harm conservation values. For example, subsurface rights to

Gravel bed river systems have riparian corridors that extend well beyond their banks into the subsurface hyporheic zones (see Hauer et al., 2016.) Tusheti, Republic of Georgia © Juraj Švajda

the seafloor vary greatly based on political jurisdictions and types of human activities (e.g. mining, laying pipelines, or constructing offshore oil extraction facilities). Planners should consider how such modifications affect the movement of species targeted for protection.

Identification of Marine Ecological Corridors in China

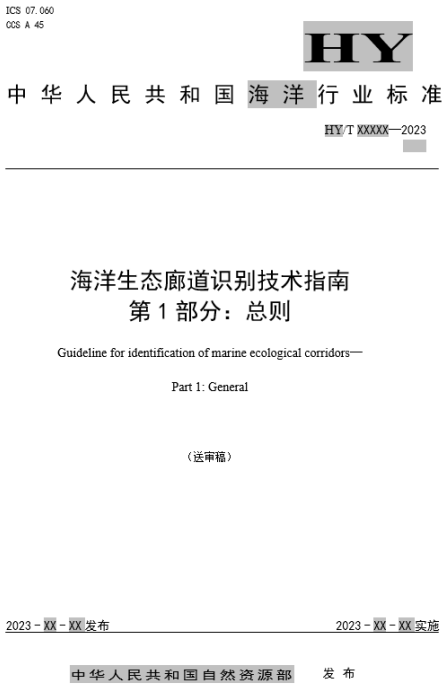
- Marine ecological corridor research and pilot projects are one of the key focus areas of the Marine Early Warning and Monitoring Division of the Ministry of Natural Resources.
- Despite the work of Marine ecological corridor has been summarized domestically and internationally, and some manuals or guidelines have been formed, there is currently a lack of universally applicable, operational, and guiding standards specifically for the identification of marine ecological corridors in China and even the world.

Guideline for indentification of marine ecological corridors

(**Du** et al., 2025, approved)

Identification of Marine Ecological Corridors in China

- Based on the research foundation of ecological connectivity and in response to the needs of ecological civilization construction in China, we have taken the lead in conducting pilot studies on the selection and delineation of marine ecological corridors.


ICS 07.060
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HY

中华人民共和国海洋行业标准

HY/T XXXXX—2023

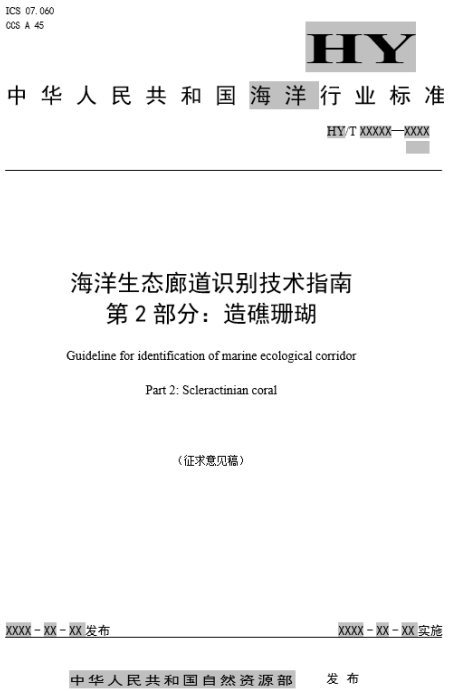
海洋生态廊道识别技术指南
第 1 部分：总则

Guideline for identification of marine ecological corridors—
Part 1: General

（送审稿）

2023－XX－XX发布　2023－XX－XX实施

中华人民共和国自然资源部　发布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中华人民共和国海洋行业标准

HY/T XXXXX—XXXX

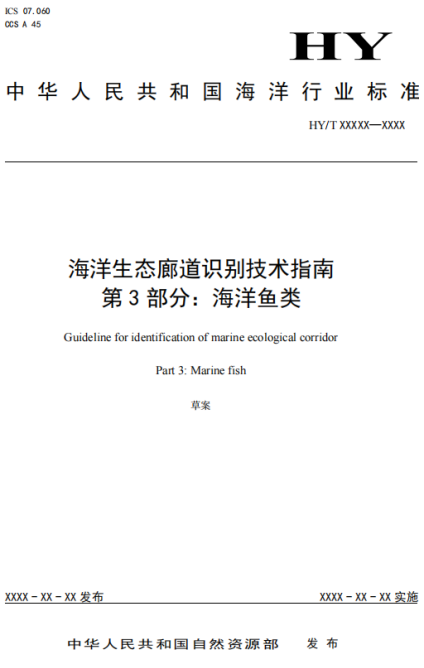
海洋生态廊道识别技术指南
第 2 部分：造礁珊瑚

Guideline for identification of marine ecological corridor
Part 2: Scleractinian coral

（征求意见稿）

XXXX－XX－XX发布　XXXX－XX－XX实施

中华人民共和国自然资源部　发布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中华人民共和国海洋行业标准

HY/T XXXXX—XXXX

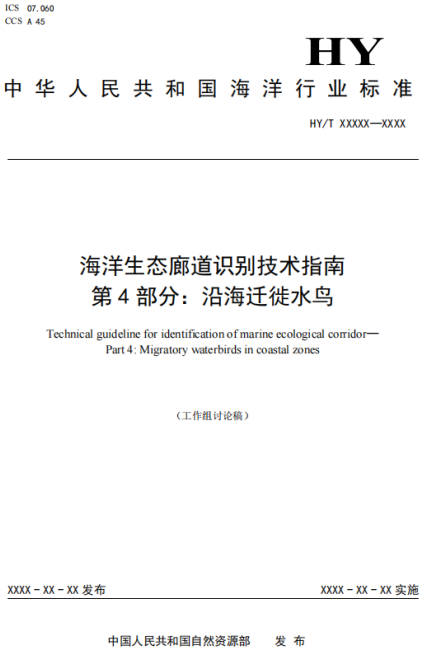
海洋生态廊道识别技术指南
第 3 部分：海洋鱼类

Guideline for identification of marine ecological corridor
Part 3: Marine fish

草案

XXXX－XX－XX 发布　XXXX－XX－XX 实施

中华人民共和国自然资源部　发布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中华人民共和国海洋行业标准

HY/T XXXXX—XXXX

海洋生态廊道识别技术指南
第 4 部分：沿海迁徙水鸟

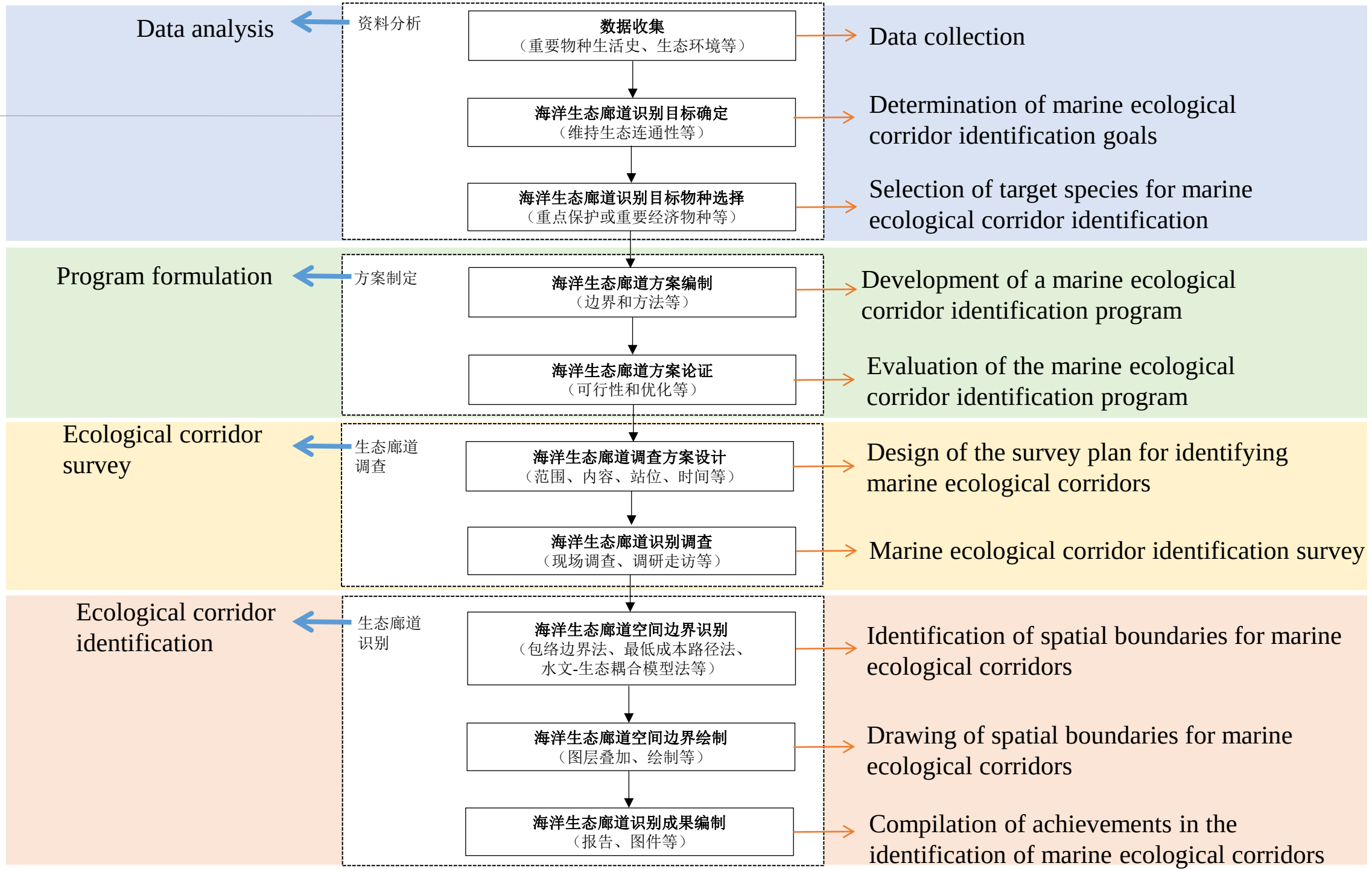
Technical guideline for identification of marine ecological corridor—
Part 4: Migratory waterbirds in coastal zones

（工作组讨论稿）

XXXX－XX－XX 发布　XXXX－XX－XX 实施

中国人民共和国自然资源部　发布

- We have compiled the Guidelines for identification of Marine Ecological Corridors, Part 1 - Part 6.
- All 6 guidelines approved by the Ministry of Natural Resource.

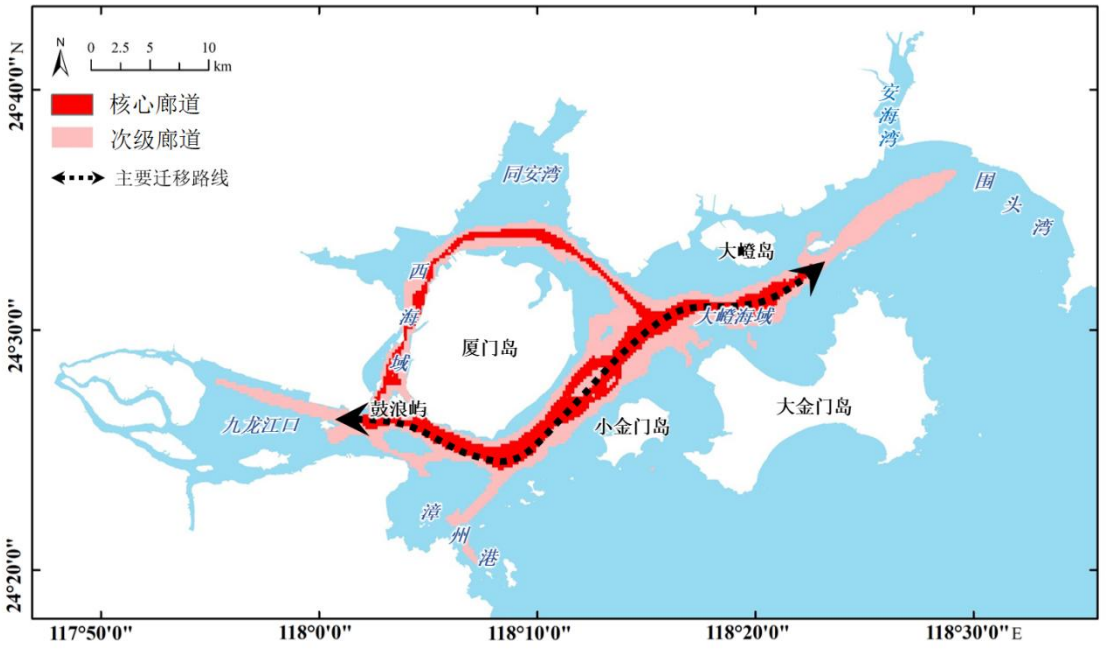

Data analysis
资料分析
数据收集
（重要物种生活史、生态环境等）
Data collection
海洋生态廊道识别目标确定
（维持生态连通性等）
Determination of marine ecological corridor identification goals
海洋生态廊道识别目标物种选择
（重点保护或重要经济物种等）
Selection of target species for marine ecological corridor identification
Program formulation
方案制定
海洋生态廊道方案编制
（边界和方法等）
Development of a marine ecological corridor identification program
海洋生态廊道方案论证
（可行性和优化等）
Evaluation of the marine ecological corridor identification program
Ecological corridor survey
生态廊道调查
海洋生态廊道调查方案设计
（范围、内容、站位、时间等）
Design of the survey plan for identifying marine ecological corridors
海洋生态廊道识别调查
（现场调查、调研走访等）
Marine ecological corridor identification survey
Ecological corridor identification
生态廊道识别
海洋生态廊道空间边界识别
（包络边界法、最低成本路径法、水文-生态耦合模型法等）
Identification of spatial boundaries for marine ecological corridors
海洋生态廊道空间边界绘制
（图层叠加、绘制等）
Drawing of spatial boundaries for marine ecological corridors
海洋生态廊道识别成果编制
（报告、图件等）
Compilation of achievements in the identification of marine ecological corridors

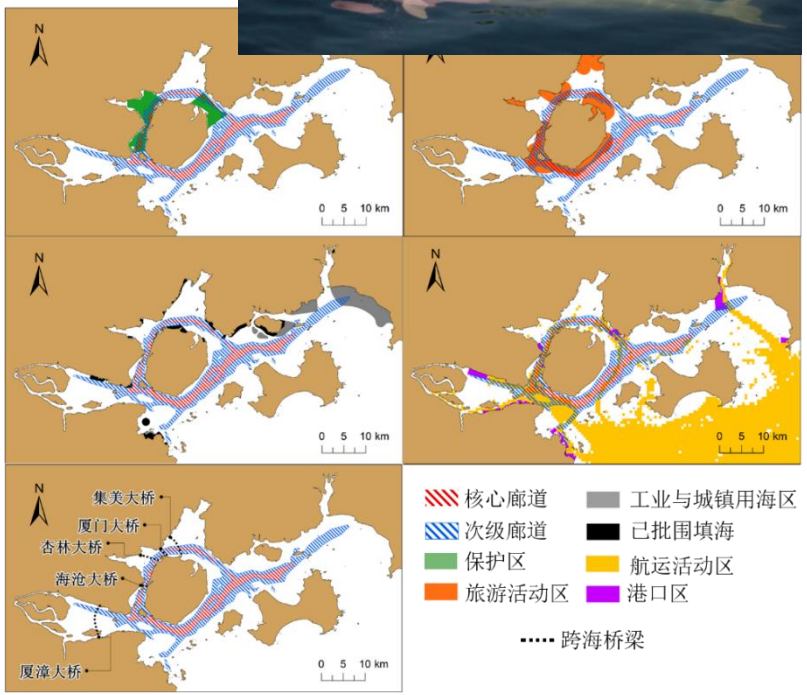
Identification of Marine Ecological Corridors in China

- Based on the research foundation of ecological connectivity and the demand of the national strategy for ecological civilization construction, guidelines for identifying and conserving marine ecological corridors are proposed.
- Five marine areas were selected from north to south for pilot research on the identification of marine ecological corridors.
- Based on the collection of historical data and field supplementary investigations in the pilot areas, the ecological corridors of each pilot area were preliminarily identified using the workflow and technical methods proposed in the guidelines.

Identification of Marine Ecological Corridors in China

- Identifying marine ecological corridors for Indo-Pacific humpback dolphins (Sousa chinensis) based on species distribution modeling and least-cost path analysis.
- The route along Tiulong River Estuary-south of Culangyu lslet-Huangcuo-Dadeng lsland and Xiaodeng Island may be the main migratior route of Indo-Pacific humpback dolphins in Xiamen Bay.
- The assessment results indicate that tourism and shipping activities are likely to be the main sources of impacts on the Indo-Pacific humpback dolphin ecological corridor.

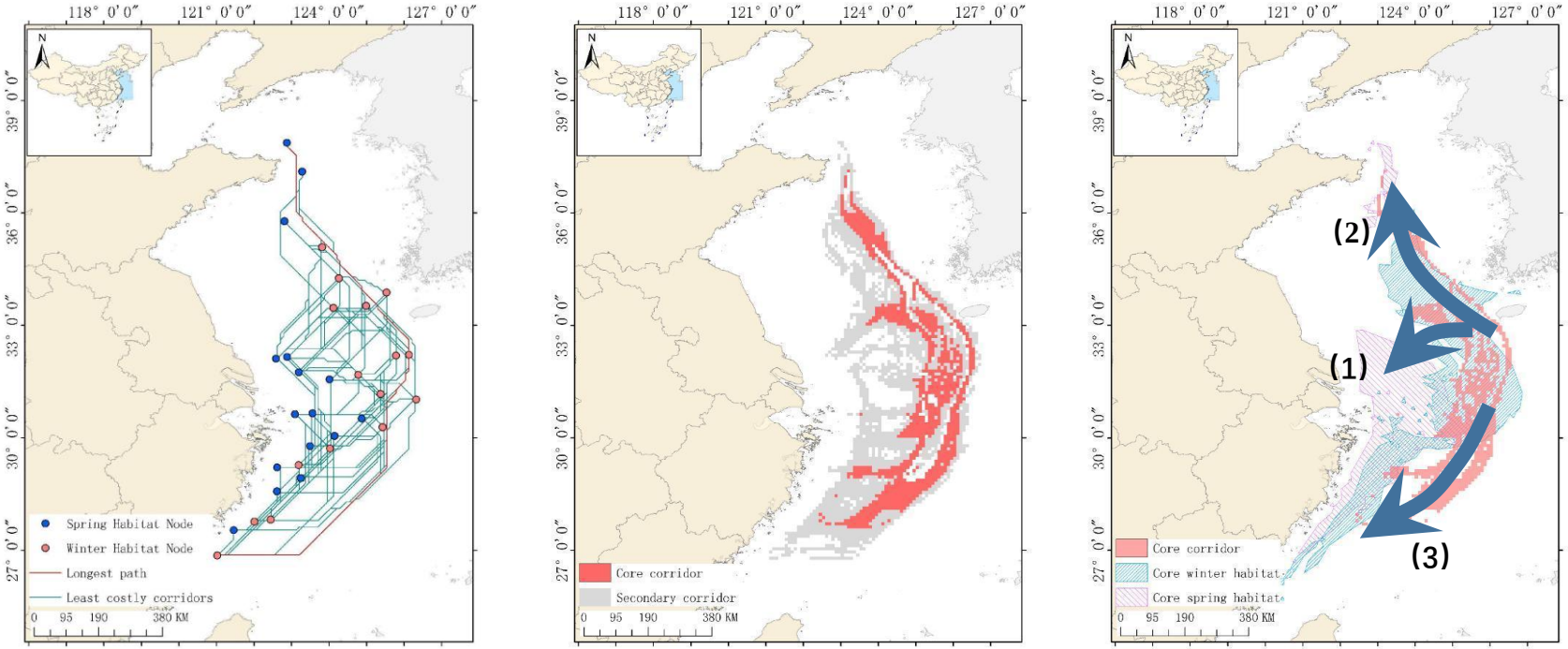




(He, Hu, **Du**, Chen, Acta Ecologica Sinica, 2022)

Identification of Marine Ecological Corridors in Yellow Sea

- For the small yellow croaker (*Larimichthys polyactis*) in the East China Sea and Yellow Sea as the research subject, explor the spatial distribution and corridors of small yellow croaker in different seasons.
- It attempts to establish a method for identifying ecological corridors for small yellow croaker based on random forest models, least-cost path analysis.

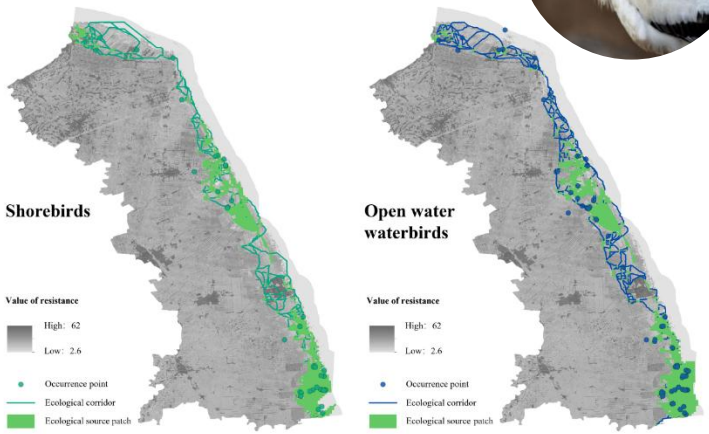


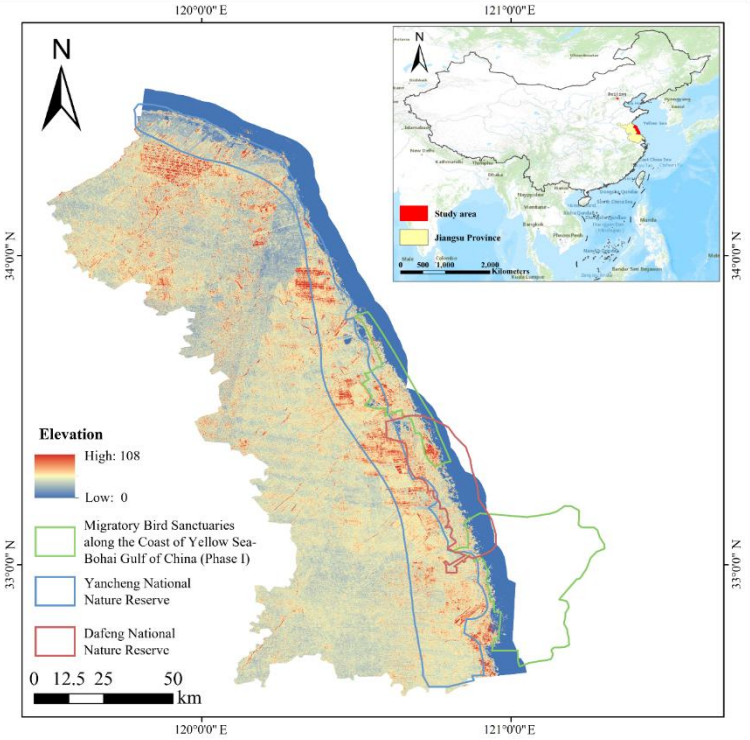
(a) Shortest Path Diagram; (b) Core Corridor and Secondary Corridor; (c) Simulation of Directional Corridor Pathway

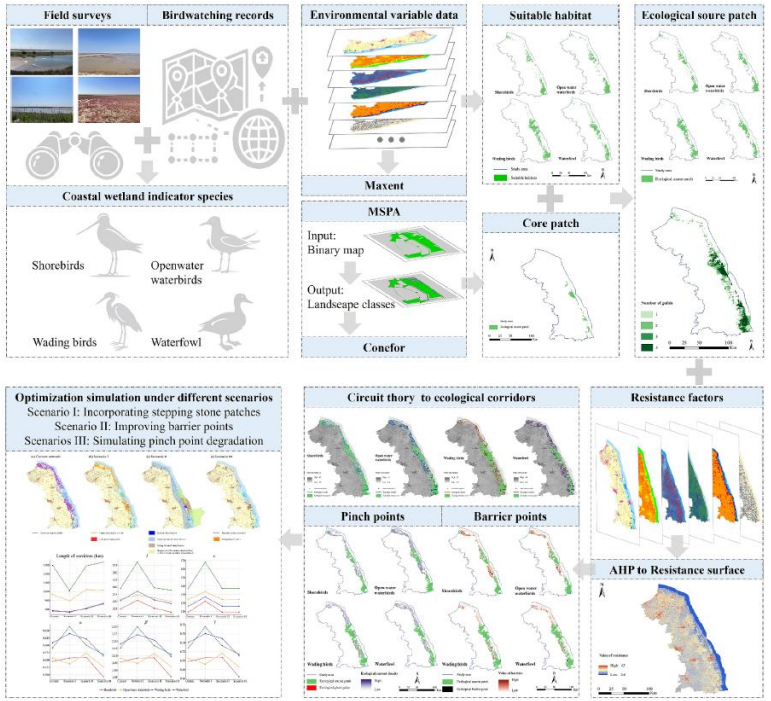
(Chen, **Du***, et al., in preparation)

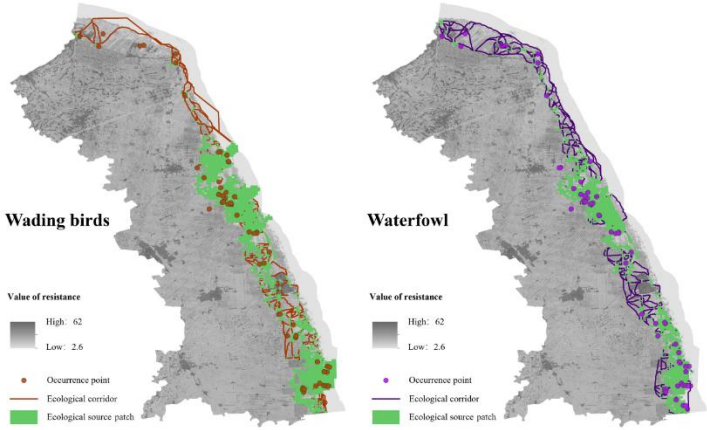
Identification of Marine Ecological Corridors in Yellow Sea

- A method for identifying ecological corridors for migratory waterbirds is presented using coastal wetlands in Yancheng in Yellow Sea as an example.
- Using distribution data of 40 coastal waterbird species to identify ecological source patches by combining MaxEnt and MSPA methods, and identified key ecological bottlenecks and facilitators using circuit theory.







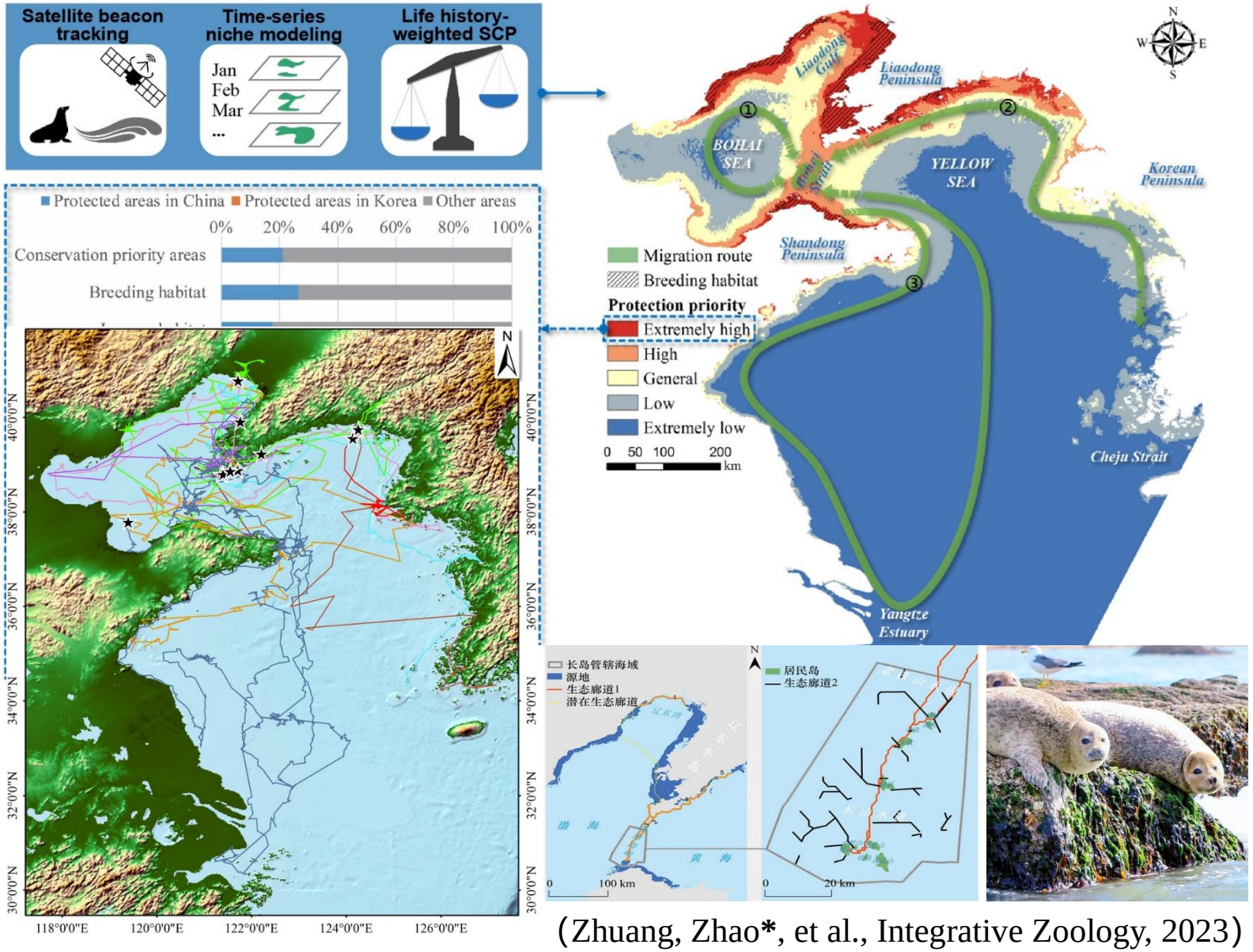


Identification of ecological corridors and validation of occurrence points

(Huang, Hu, **Du**, Wang*, et al., Ecological Indicators, 2025)

Identification of Marine Ecological Corridors in Yellow Sea

- A time-series niche model and life-history weighted systematic conservation planning were designed on the basis of a satellite beacon tracking survey (2010–2020) of the YSE Spotted seal population.
- The closed-loop migration route formed in the Yellow Sea indicated that this population might be geographically isolated from populations in other breeding areas around the world.

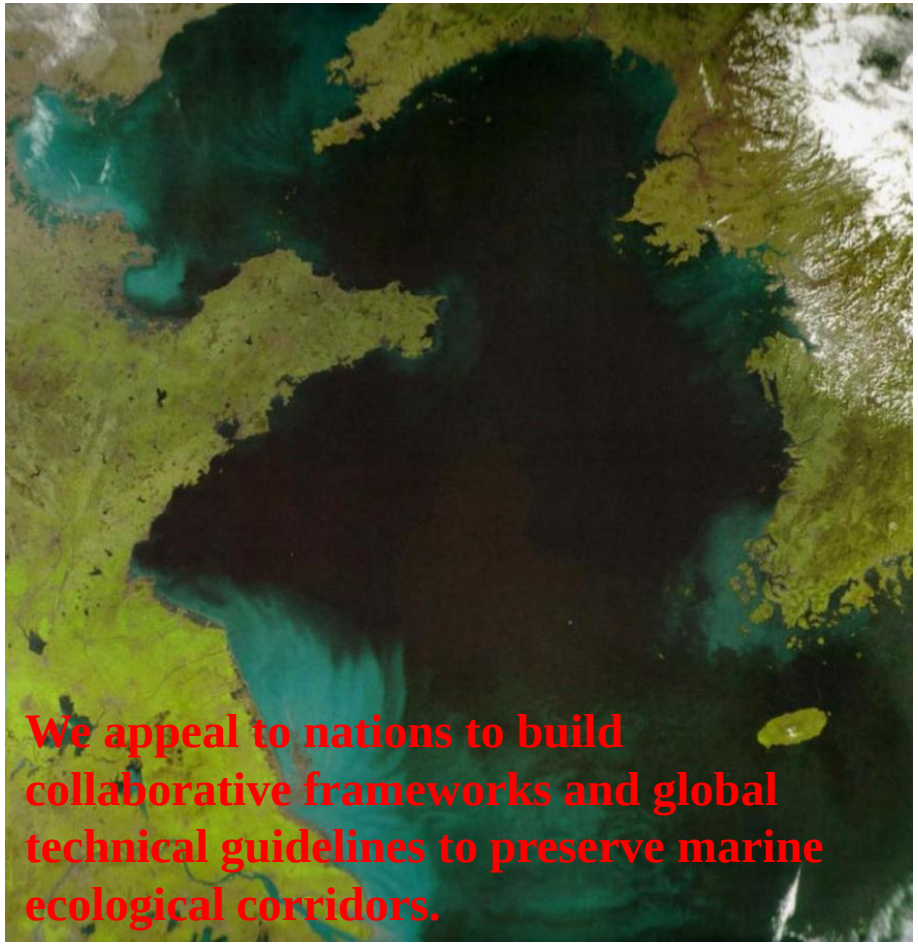


(Zhuang, Zhao*, et al., Integrative Zoology, 2023)

Prospect

- **Global Technical Guidelines for identification of Marine Ecological Corridors**
- **Identification of Marine Ecological Corridors: Case Studies**

- Spotted seal
- Chinese white dolphin
- Coastal waterbirds
- Small yellow croaker
- Anchovy
- Sharks
- Scleractinian coral
- ….



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CORRESPONDENCE | 13 February 2024

Build global collaborations to protect marine migration routes

By Jianguo Du, Bin Chen, Feng Cai & Wenjia Hu

Migrations of marine species such as whales, eels and sea turtles are some of the largest in the world. Identifying, monitoring and maintaining ecological corridors is one focus of the Kunming–Montreal Global Biodiversity Framework, which was adopted in 2022 at the United Nations COP15 biodiversity summit, chaired by China.

China sees protection of these habitats as a priority. In 2020, maintenance of coastal corridors was integrated into the national master plan for ecological protection and restoration. In January, the revised Marine Environmental Protection Law was implemented, legislating for the conservation and restoration of crucial marine ecological corridors. The Ministry of Natural Resources is developing technical guidelines to identify ecological corridors for fishes, mammals, reptiles, water birds and corals.

Global cooperation beyond the efforts of individual countries is also crucial. The COP14 Convention on the Conservation of Migratory Species of Wild Animals, which meets in Samarkand, Uzbekistan, this week, has adopted “Nature knows no borders” as its slogan. We appeal to nations to build these collaborative frameworks and global technical guidelines to preserve marine ecological corridors.

Thank you!