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Ecological indicators used in China

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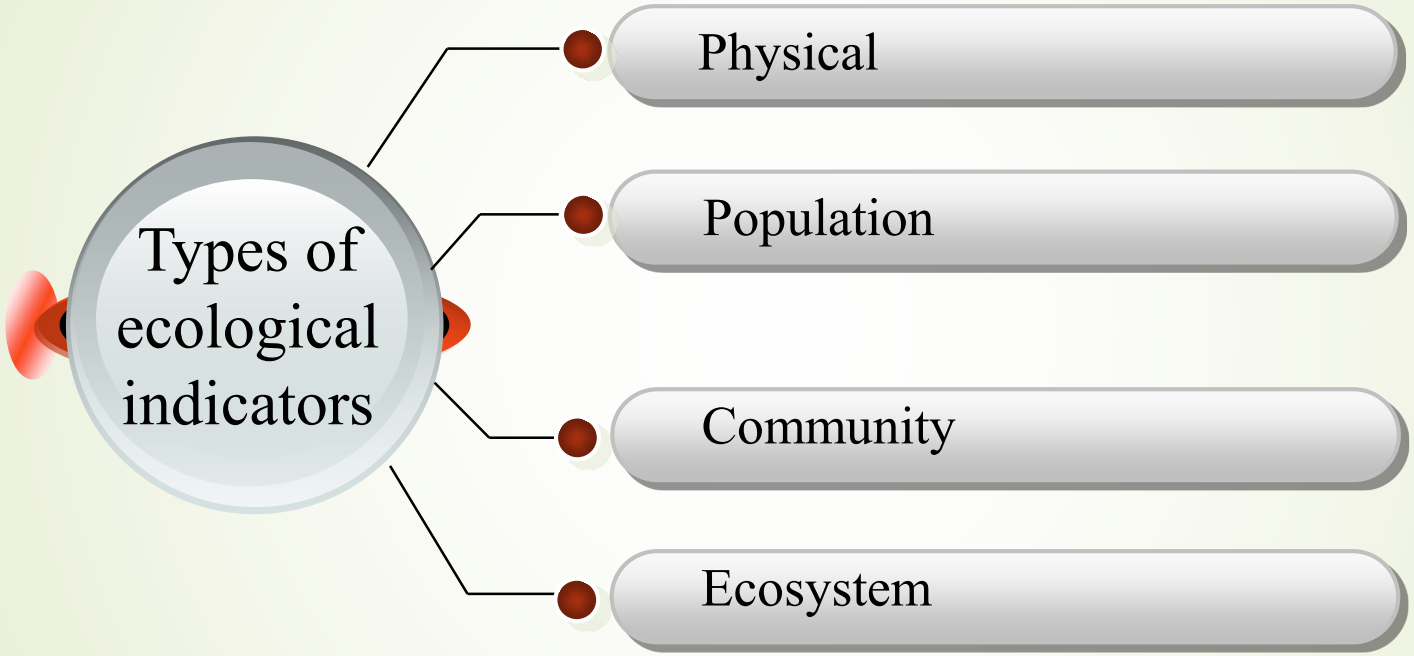

Types of ecological indicators
Physical
Population
Community
Ecosystem

Physical indicators often used in China

- Chlorophyll a
- Dissolved inorganic nitrogen and phosphorate
- Rate of denitrification and nitrification
- pH
- Dissolved oxygen
- …

Generally used ecological indicators at population level in China

- Growth rate
- Age or size at maturity
- Natural mortality (M)
- Average age or size
- Diet composition
- Survey-based relative abundance index
- Recruitment per spawner
- …

Long-term variations in these indicators to evaluate population status in annual stock assessment reports and understand population responses to multiple stressors like fishing and climate change (e.g., Li *et al*., 2011; Shan *et al*., 2017).

Typical ecological indicators at community level in China

- Relative abundance index of surveyed community
- Mean fish length in the surveyed community
- Mean maximum life span of surveyed community
- Biodiversity, e.g., species richness
- Mean trophic level of surveyed community
- Mean trophic level of the landings of targeted community

- Evaluating variations in community structure, productivity, stability and resilience
- Understanding the effects of natural and anthropogenic forcing, especially overfishing, on targeted community
- Evaluating the effects of fisheries enhancement projects

Ecosystem indicators used in China

- Survey-based total biomass
- Survey-based biodiversity, e.g., species richness
- Mean trophic level of surveyed communities accounting for variability in species' trophic level
- Mean trophic level of total landings accounting for variability in species' trophic level
- Primary production required and efficiency
- System omnivory index
- Estimated capacity

} from model-dependent knowledge of an ecosystem

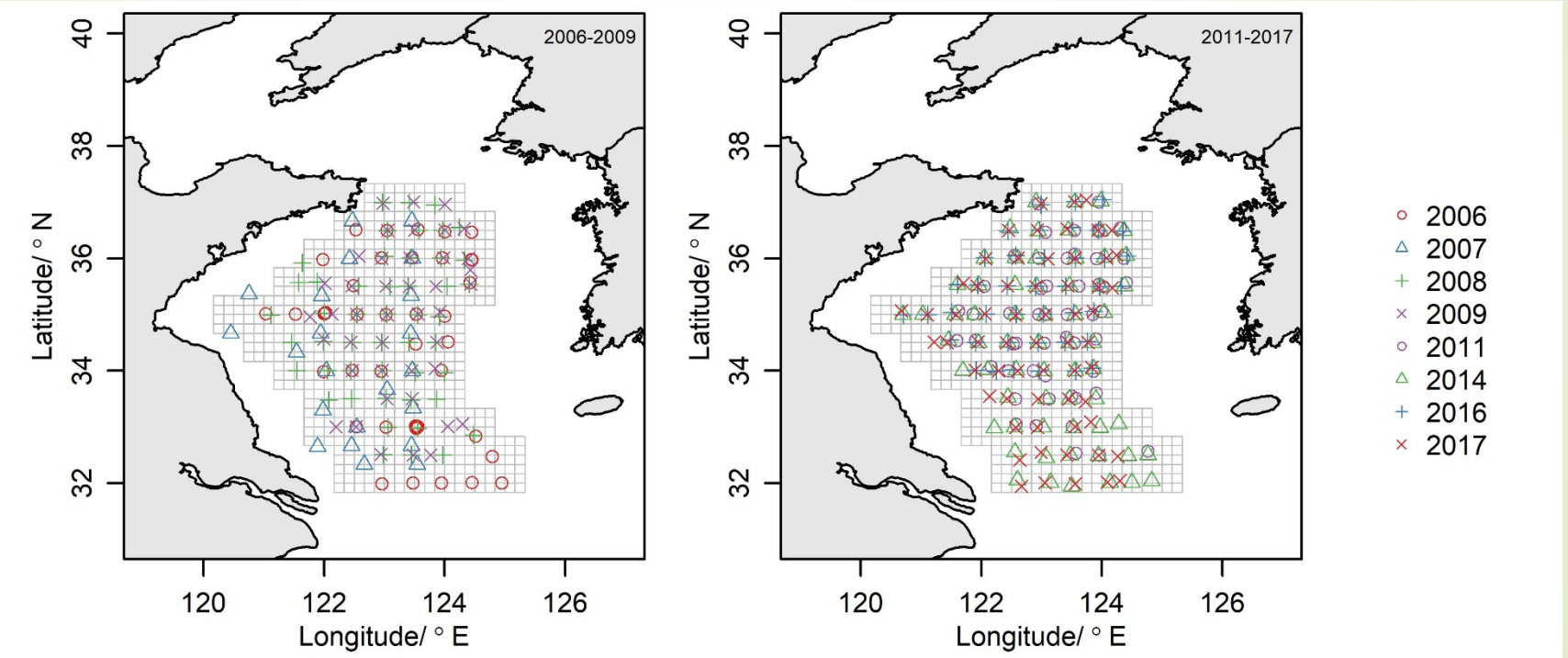
- Evaluating variations in ecosystem
- Assessing ecosystem productivity, stability and resilience
- Understanding the effects of natural and anthropogenic forcing, especially overfishing, on a given ecosystem
- Evaluating the effects of fisheries conservation or enhancement plans

Lacking indicators of species interactions?

Whether we could identify a simple indicator for the intensity of between-species interactions at coarse scale (100 – 1000 km^2), thereby helping to **differentiate fish community assemblies** and **understand community structure and potential differences in population dynamics**?

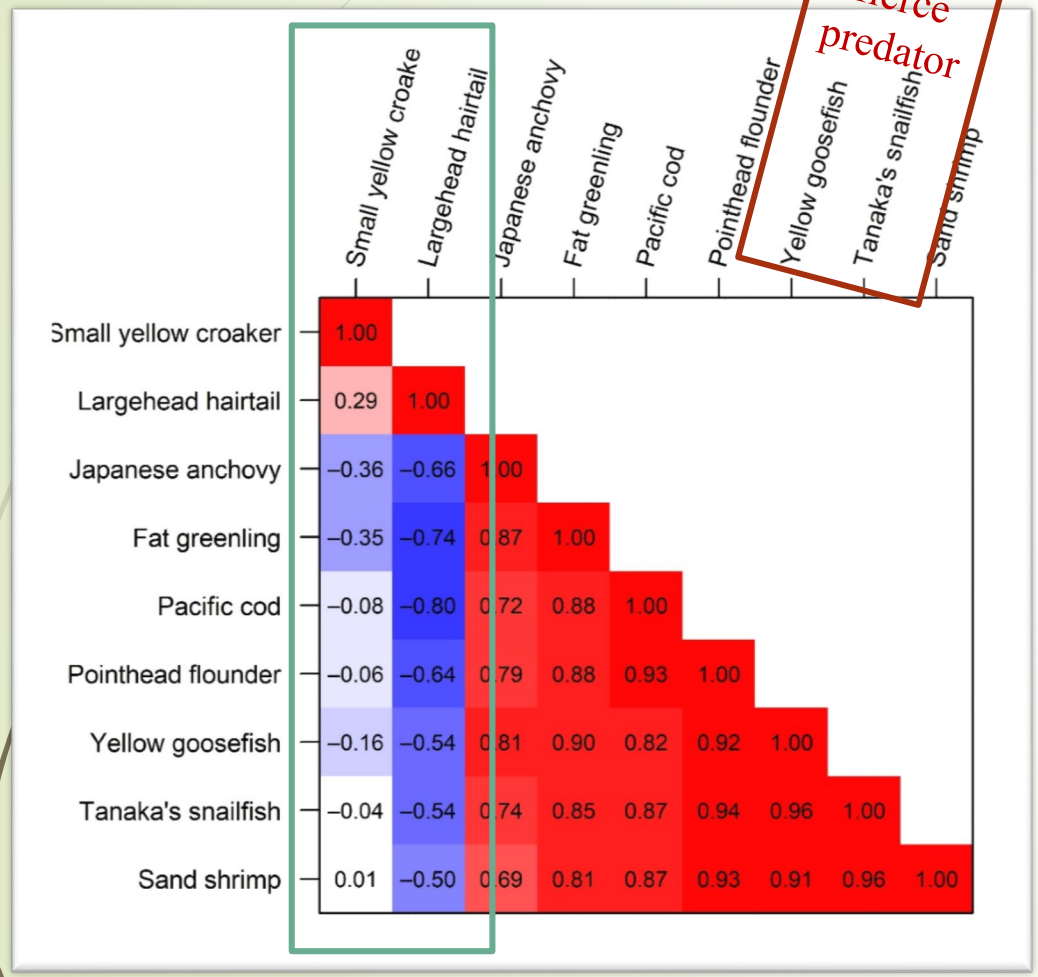
Coarse-scale spatial correlation in species distribution may be a good choice.

Case study of nine dominant fish and shrimp species in the Yellow Sea for studying the spatial correlation patterns of marine fish species

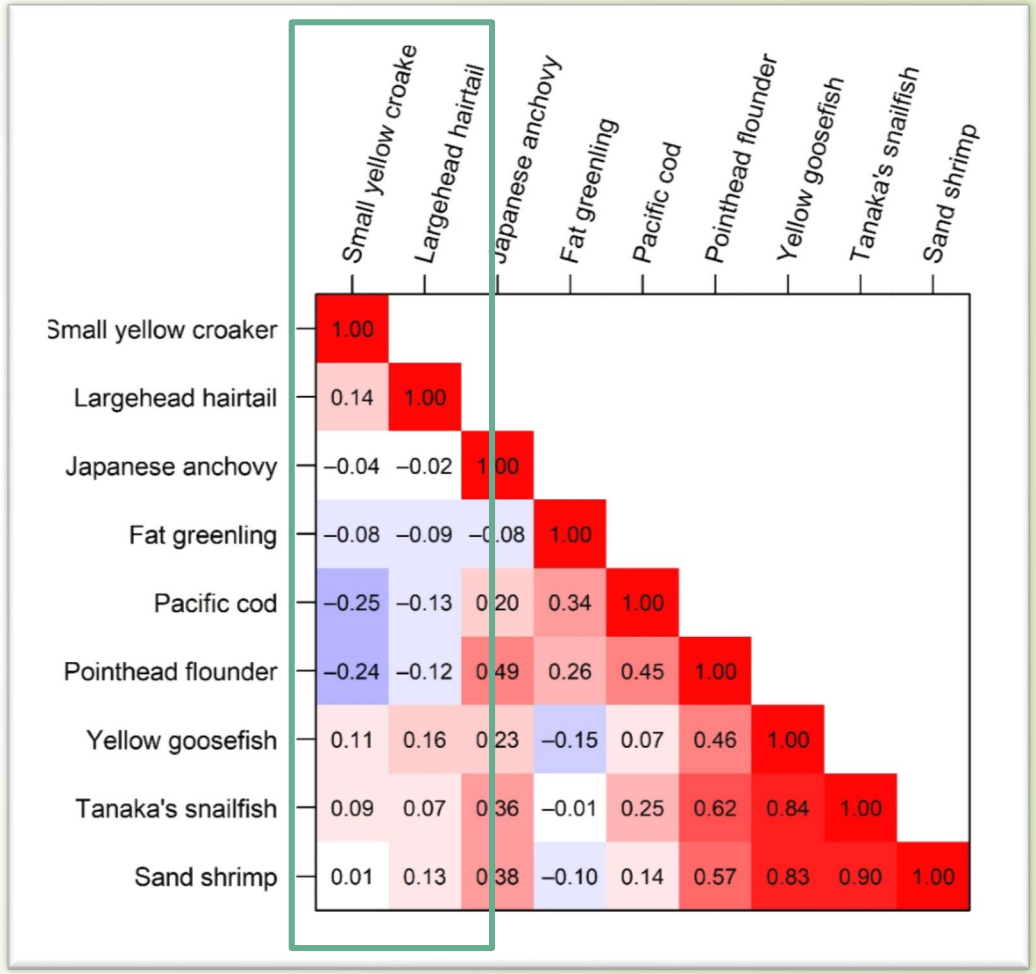


Distribution of relative abundance indices of the YSFRI bottom trawl survey data within the study area (gridded) in the Yellow Sea during the falls of 2006 – 2009, 2011, 2014, 2016 and 2017

Case study of nine dominant fish and shrimp species in the Yellow Sea

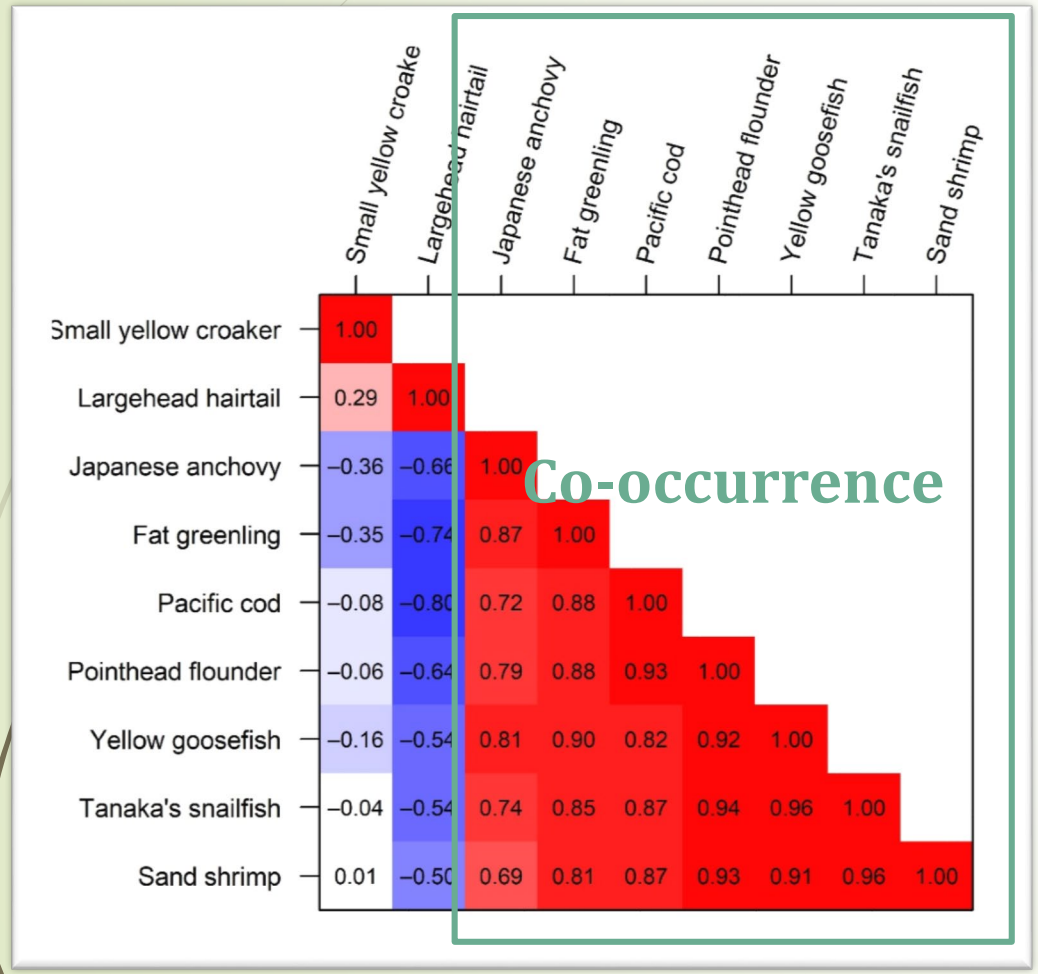


spatial correlation coefficients between encounter probabilities

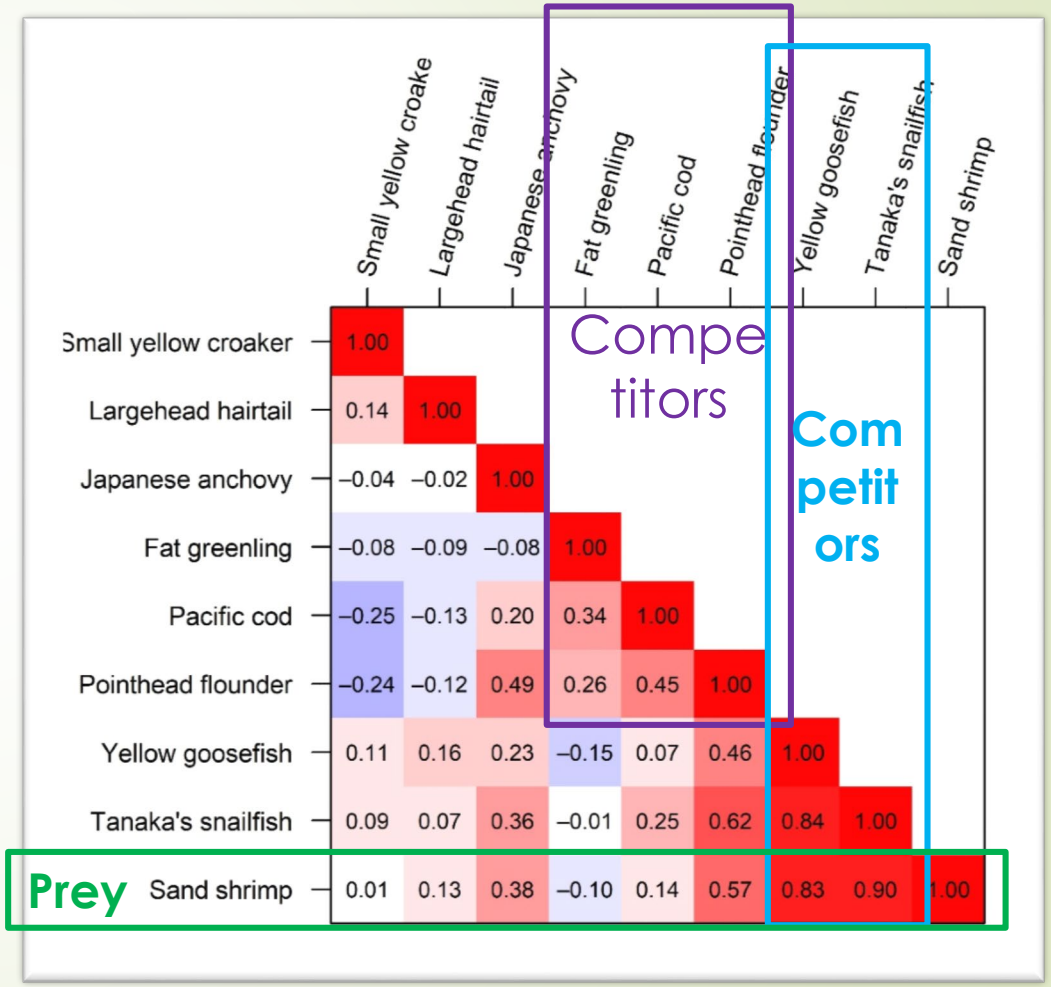


spatial correlation coefficients between positive catch rates

Case study of nine dominant fish and shrimp species in the Yellow Sea



spatial correlation coefficients between encounter probabilities



spatial correlation coefficients between positive catch rates

Thanks!