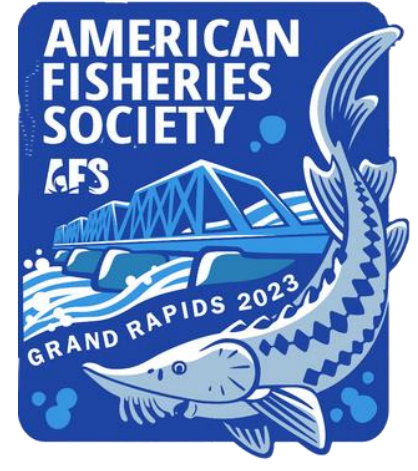


Potential impacts of offshore wind farm on Taiwan's coastal gillnet fishery



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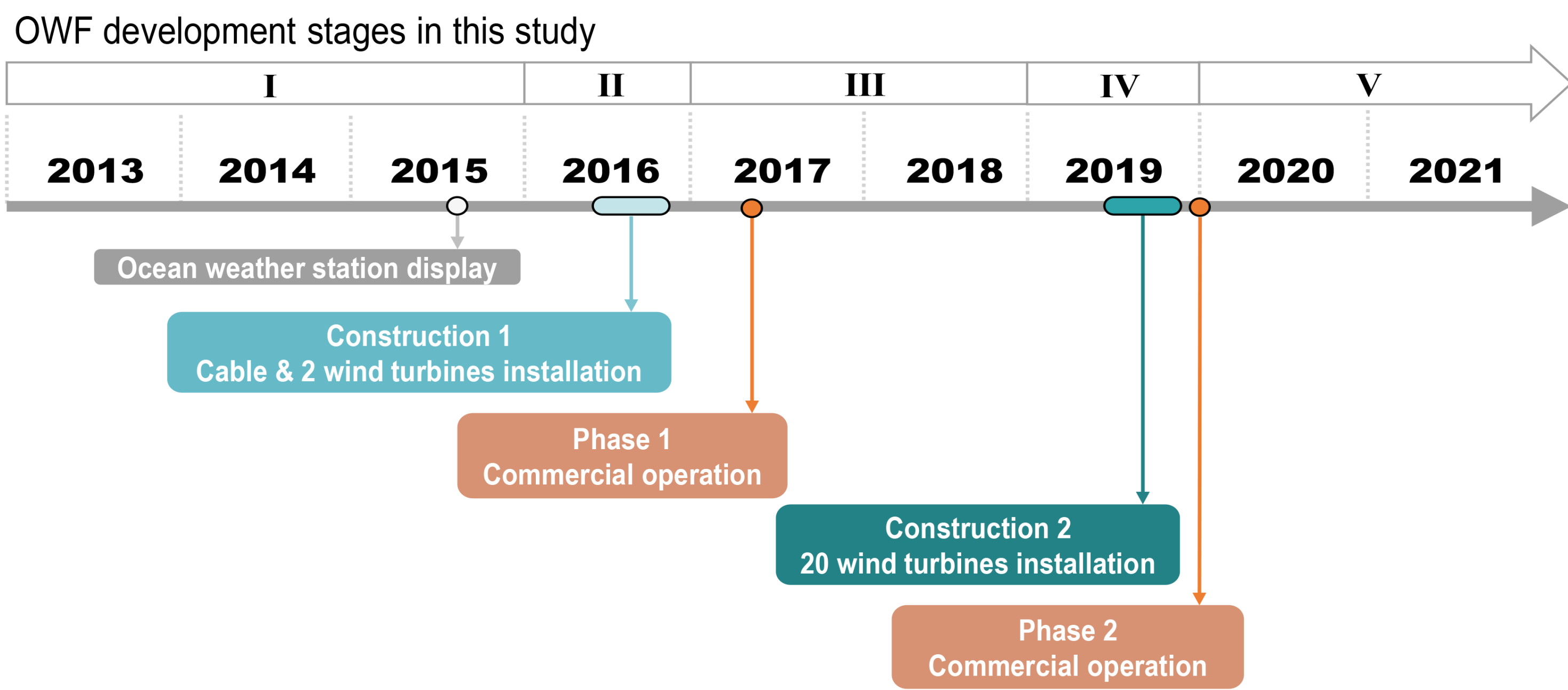
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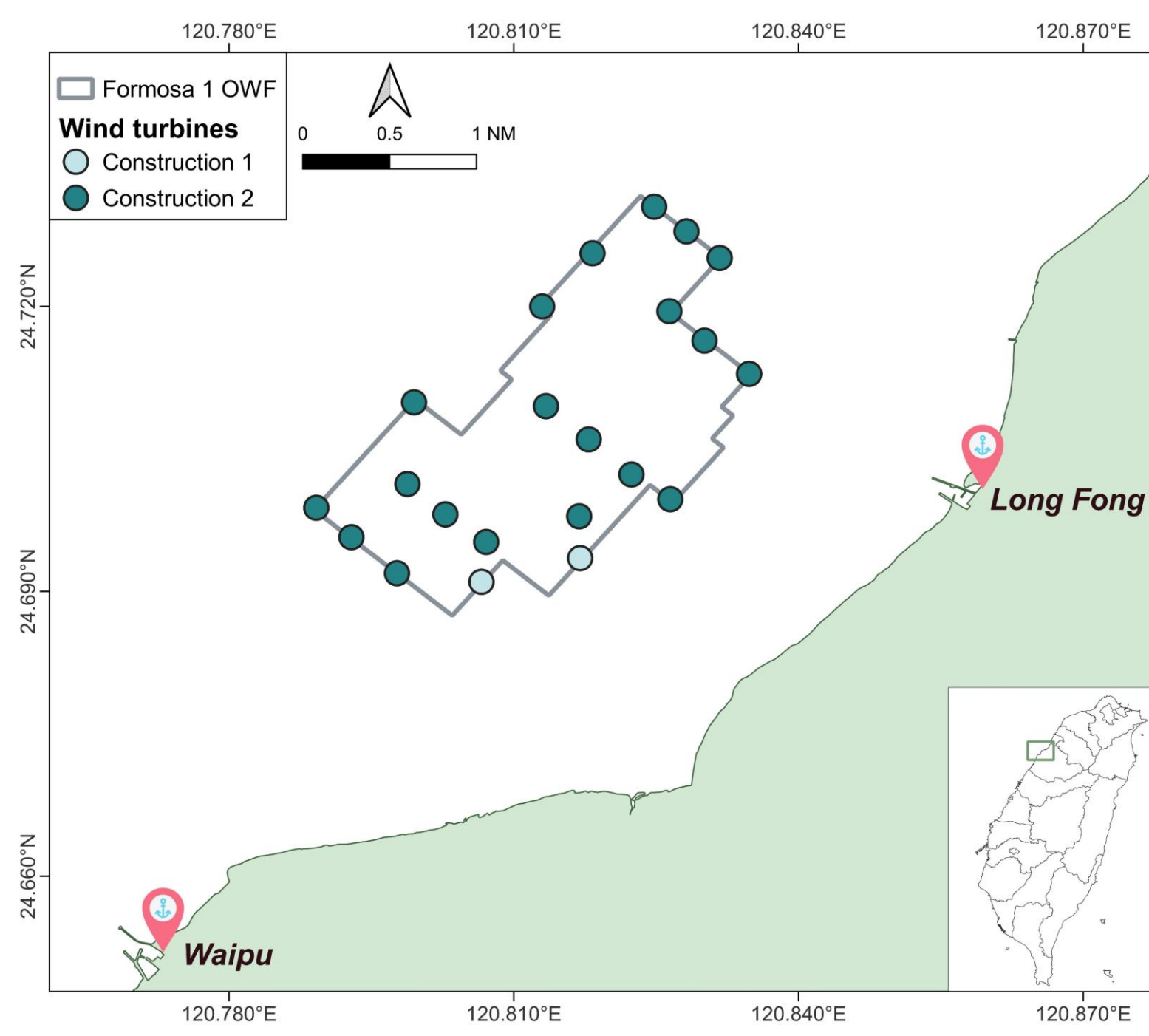
Objectives

Formosa 1, the first demonstration offshore wind farm (OWF), is located off the coast of Miaoli County in northwestern Taiwan and with a total installed capacity of 128 MW. However, its development may have potential impacts on the fishing grounds and behaviors of the gillnet, the major fishery sector in the area. In this study, we analyze the dynamics of gillnet fishing activities and their primary target species over five stages of OWF development from 2013 to 2021 based on commercial fishery data, including landings and vessel position information. Ultimately, the study aims to provide insights to balance OWFs development and coastal fisheries management.

Formosa 1 offshore wind farm timeline



Study area & fishery data



Gillnet fishing activities data was collected from 78 vessels sampled mainly in Long Fong and Waipu ports from 2013-2021, including:

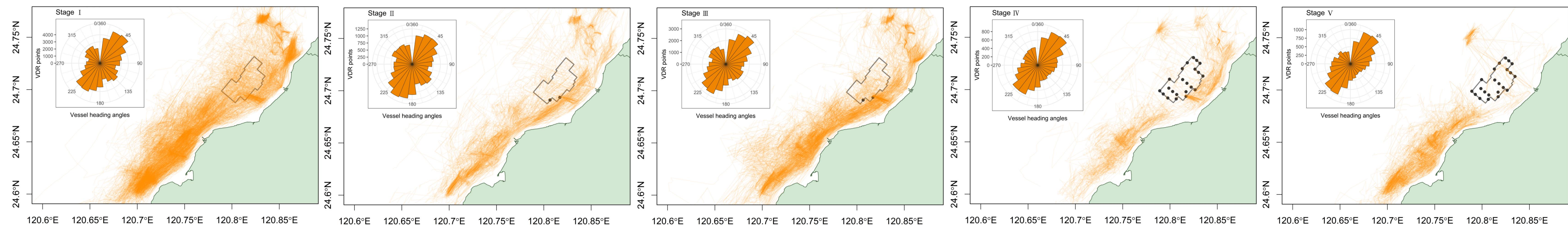
Landings

Vessel ID, Trip date, gear type, species, weight, etc.

Voyage Data Recorder (VDR)

Speed, heading, and location were recorded at 3-minute intervals for tracking vessel positions.

Fishing operation of gillnet



- The vessel's heading information based on VDR across the five development stages reveals the direction of fishing operations, including setting and hauling the nets. The primary direction is from Northeast to Southwest (NE-SW), while the secondary direction is from Northwest to Southeast (NW-SE).

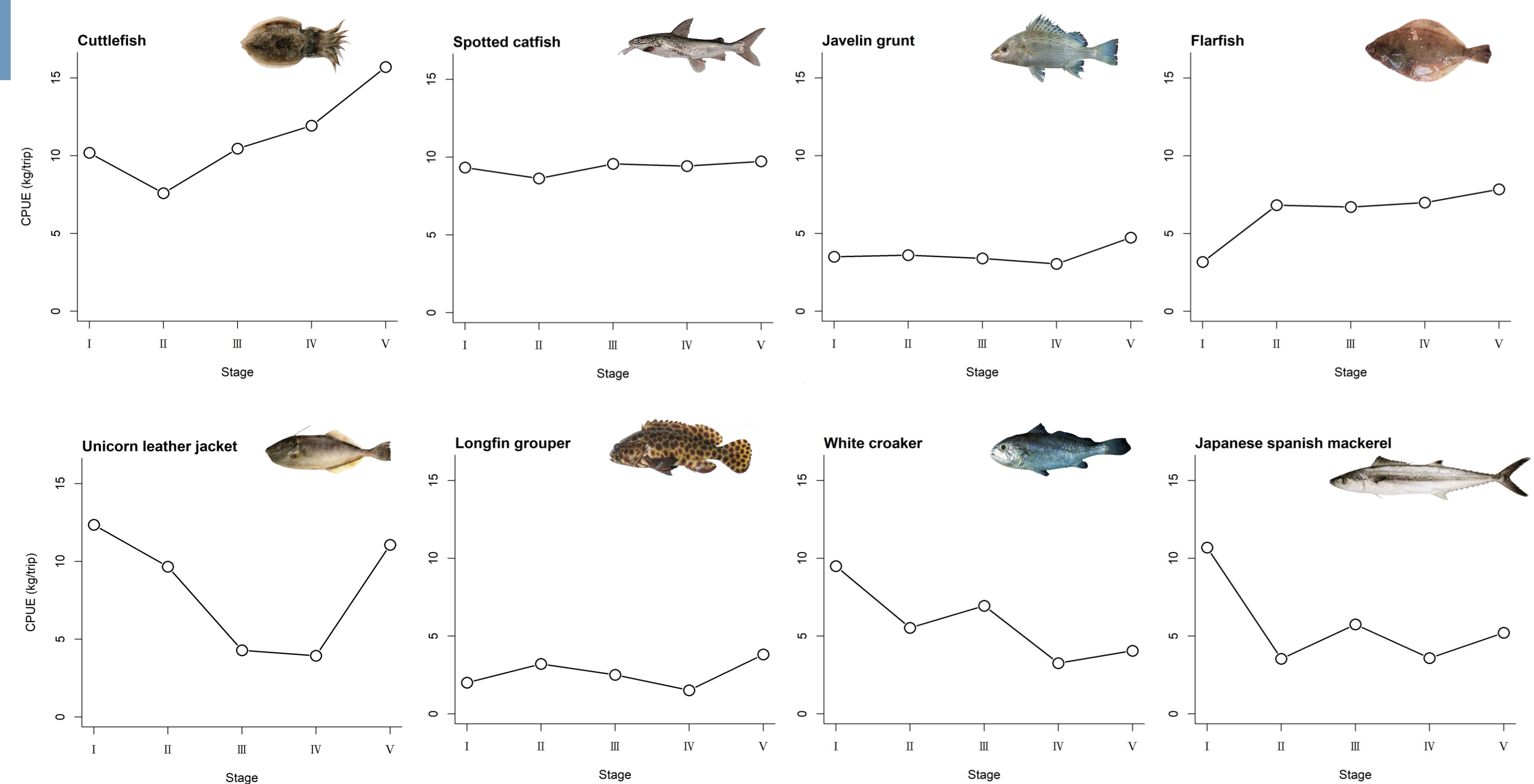
Impact of fish resources

- Use the Relative Importance index of Fishing (RIF) to identify target species and assist in evaluating the importance of each species to gillnet fishing. The study area has 16 bony fish, 2 cartilaginous fish, and 2 cephalopods as important for gillnet.

RIF = C% × F%
C% = Percentage of catch
F% = Percentage of fishing trips

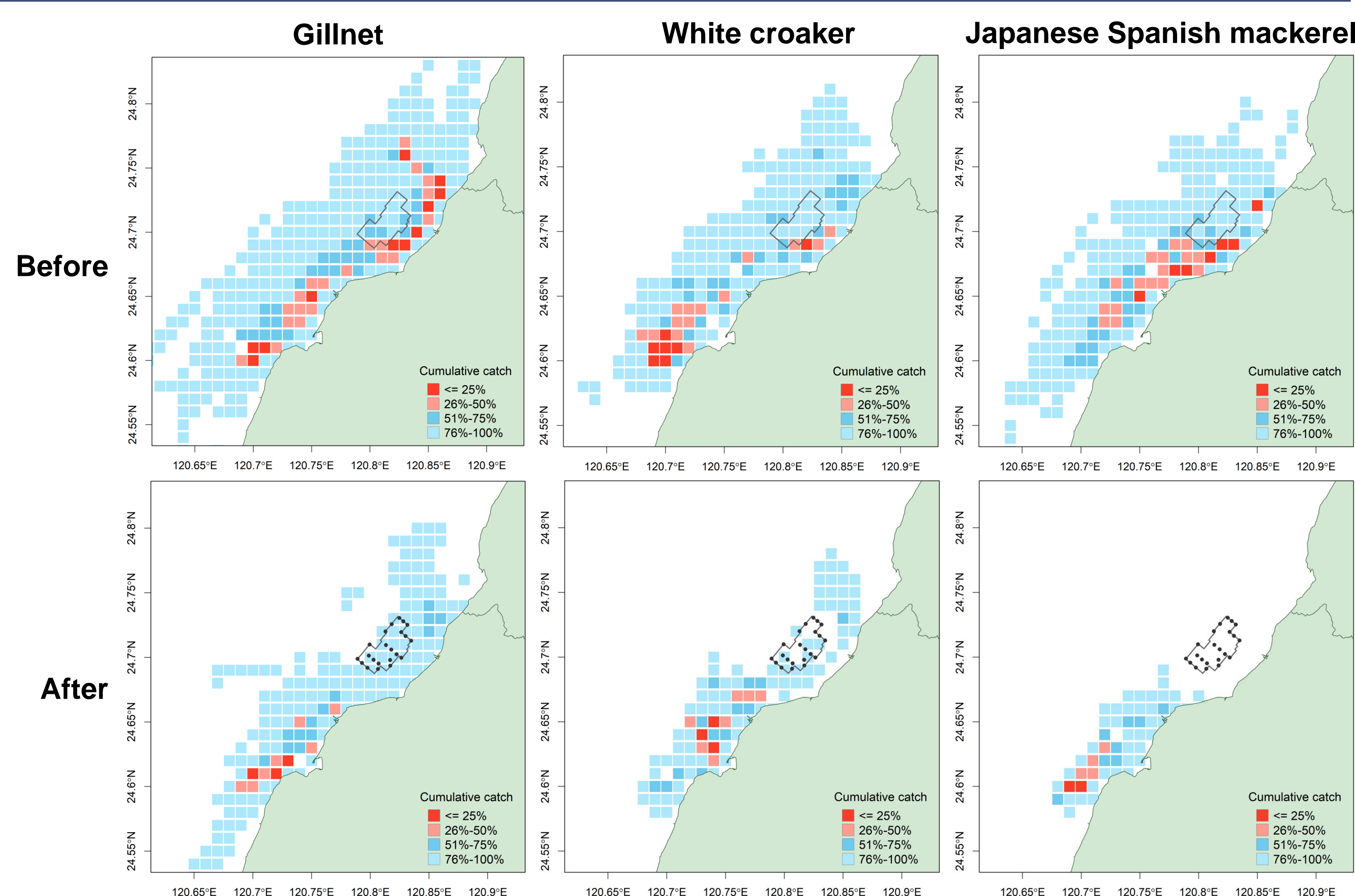
- The Wilcoxon signed-rank test indicates that 6 species have a significant difference in importance for gillnets fishing before and after the OWF development, as detailed in the table below.

Species	Vessels	Wilcoxon signed-rank test	Trend in RIF ranks before and after OWF	
Common name	Scientific name			
Cuttlefish	Sepiidae spp.	25	0.0283*	→
Spotted catfish	<i>Arius maculatus</i>	22	0.0118*	→
Javelin grunt	<i>Pomadasys kaakan</i>	28	0.0020*	→
Flatfish	Pleuronectiformes	28	0.0262*	→
Unicorn leather jacket	<i>Aluterus monoceros</i>	24	1.809e-05*	→
Longfin grouper	<i>Epinephelus quoyanus</i>	23	4.017e-05*	→
White croaker	<i>Pennahia argentata</i>	29	0.0008*	←
Japanese Spanish mackerel	<i>Scomberomorus niphonius</i>	22	0.0211*	←



- Nominal catch per unit effort (CPUE, kg/trip) of species demonstrates the relative abundance across the five stages of OWF development.

Shifting of fishing hotspot distributions



- The cumulative catch distribution, arranged from highest to lowest, is used to illustrate the displacement of fishing hotspots before and after the OWF development.

Conclusion

1. Fishery structure

The structure of gillnet fishery has not changed during the OWF development process, such as vessel scale, catch rate, and target species.

2. Gillnet setup

The primary direction of fishing operations (NE-SW) remains unchanged, but the secondary direction (NW-SE) has seen a decrease after the development.

3. Target specie

There were no significant differences for most species, except for White croaker and Japanese Spanish Mackerel, which have seen a decrease in CPUE and importance for gillnet fishing.

4. Fishing hotspots

The hotspot distribution has decreased, but no redistribution of fishing grounds.

5. Trade-offs

Due to the advent of this development, many elderly fishermen have chosen to retire, which has led to a reduction in overall fishing efforts. Meanwhile, the implementation of OWF has increased ocean spaces for conservation measures such as marine protected areas. As a result, the remaining fishermen continued to operate on the same fishing grounds without a significant impact on their catch rate.

Acknowledgements

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