Habitats and Ecosystem Impacts Evaluation Report for Red Swimming Crab Fishery in Dongshan, Fujian Province

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Objective

This report was completed as part of the work plan for the China Fujian Zhangzhou red swimming crab - bottom trawl & pot/trap FIP. Specifically, it describes progress being made on Action 5 (Ecosystem impacts) and Action 7 (Habitats impacts).

Fishery Characteristics

The red swimming crab fisheries take place in the Minnan-Taiwan Bank fishing ground, off the southern area in Fujian Province. The fishing grounds and areas remained unchanged during the surveys from August 2018 to April 2025. Based on the captain and crew interviews, and logbooks of trawl and trap vessels surveyed from Dongshan County, the vessels mainly operated in Minnan Fishing Ground, Taiwan Bank Fishing Ground, Yuedong Fishing Ground, Dongshan Fishing Ground and Southern Taiwan Fishing Ground (Fig. 1; see also Lin et al., 2021).

Based on the GPS locations on board collected from logbook data of trawl vessels (Phase VI), logbook data of trap vessels (Phase VII), and logbook data of trap and trawl vessels (Phase VIII), the fishing grounds were further specified; trawl vessels mainly operated in Minnan Fishing Ground, and trap vessels mainly operated in Taiwan Bank Fishing Ground (Fig. 2).

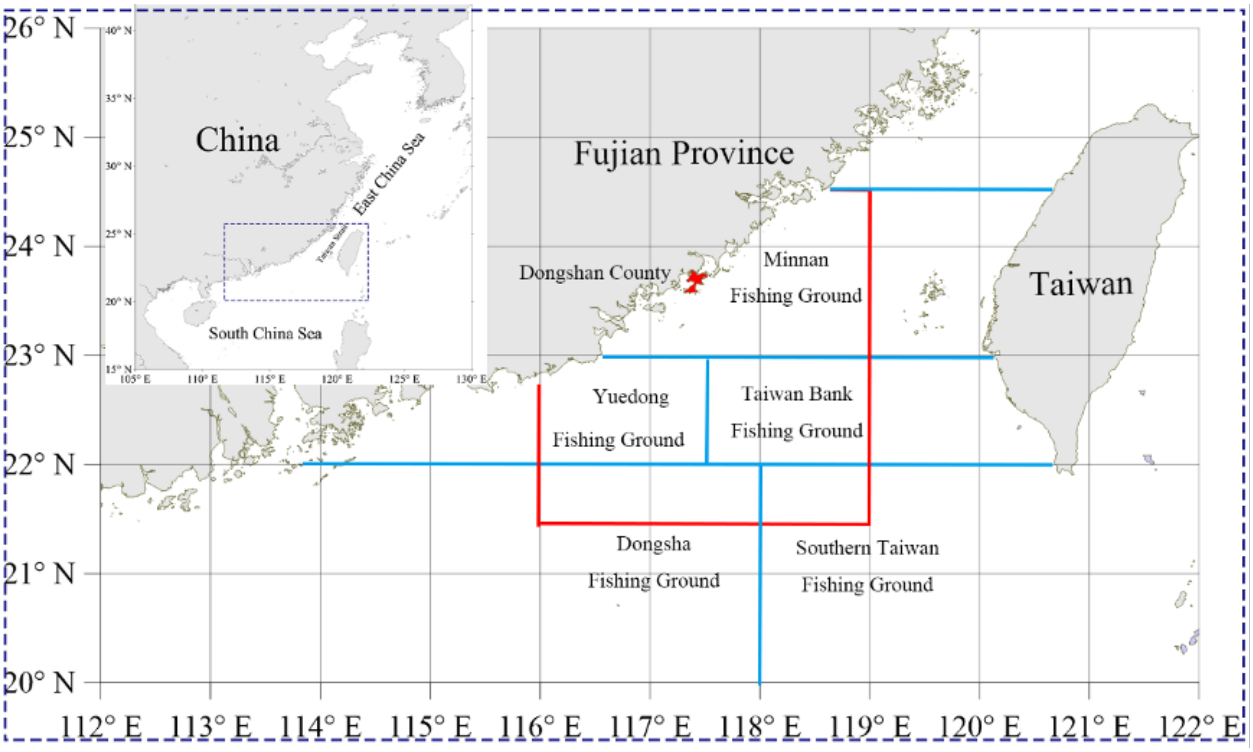


Figure 1. Fishing areas (within red line) of trawl vessels from Dongshan County (red area), covering five fishing grounds of southern Taiwan Strait.

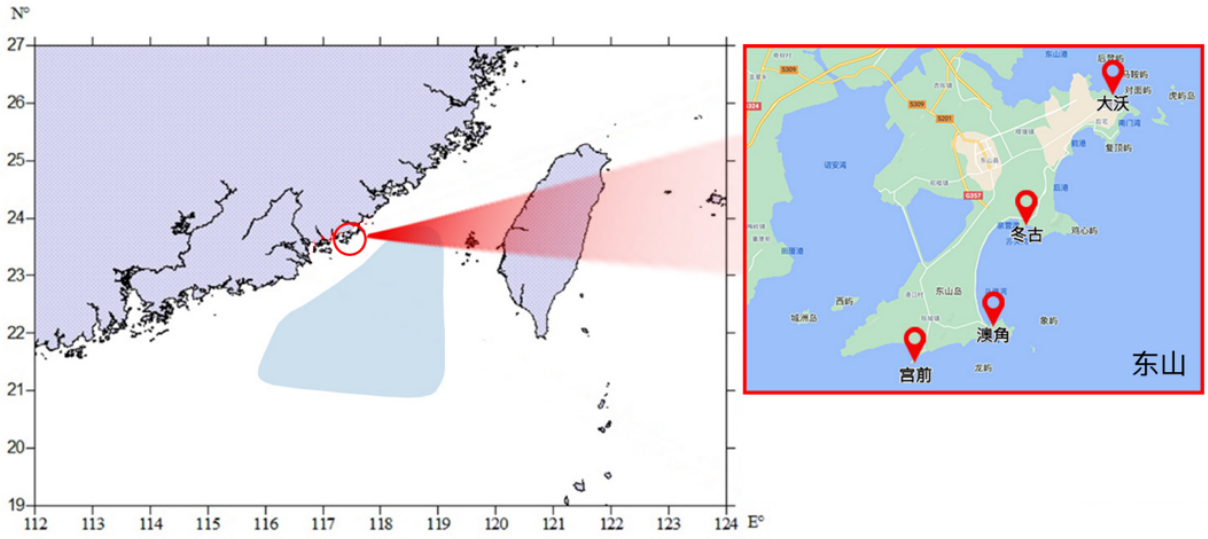


Figure. 2 Main fishing grounds (in light blue) of the red swimming crab fisheries.

The primary gear types targeting crab in this area are single vessel bottom trawls (Fig. 3) and crab pots/traps (Fig. 4). Trawls are dragged along the ocean bottom with two otter boards holding the wings of the trawl open. The ground rope has rubber discs and spacers intended to hold the bottom margin of the net above off the substrate, and the cod end has a minimum mesh size of 54 mm. Crab traps are small, cylindrical pots with iron frames and enclosed by nets with mesh size of 30 mm. Each fishing vessel carries 3,000-4,000 pots and lays them in

60--80 m of water. The pots are baited commonly with frozen *Scomber japonicus* and *Sardinalla* species. The pots typically soak for 5-6 hours in the daytime and 10 hours in the night time, and each can catch about 2.5 to 10 kg of crabs.

Figure. 3 Trawl vessel and ground rope of the red swimming crab fishery

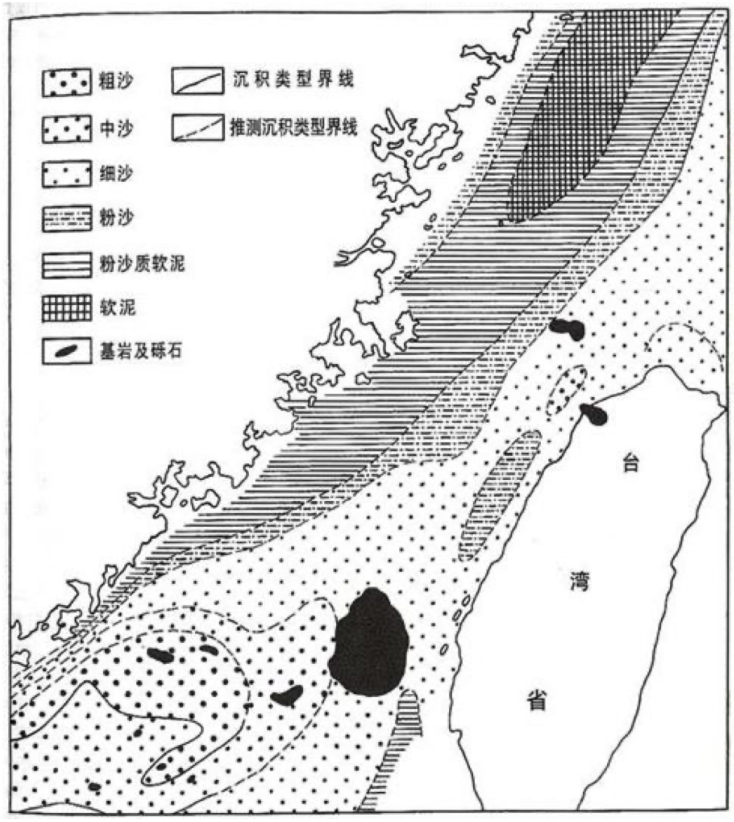
Figure. 4 Trap vessel and pots of the red swimming crab fishery

Both trap and trawl fisheries primarily operate on the same distribution of red swimming crab around Minnan--Taiwan Bank. The fisheries operate year round except for the summer fishing moratorium from May to mid August. The peak fishing seasons are from August to October for trawlers, and from October to November for traps. However, strong northeast monsoons significantly dampen fishing activity from November to Spring Festival, resulting in less fishing trips.

Habitats impacts

Fishing gear impacts

The commonly-encountered habitats are mainly fine to coarse sand associated with the Taiwan sandbank.



[large dots = sand, black = rock)

Fig. 4 Map of seabed sediment of Minnan-Taiwan Bank fishing ground. Dotted areas represent sand (coarse, medium and fine). Black solid areas represent rock. Dotted lines represent mealy sand. Solid lines represent mixed sand with mud. Grids represent mud.

VMEs identified in the area are the coral distribution areas. The Dongshan Coral Nature Reserve（福建东山珊瑚礁海洋自然保护区）, established in 1997, protects the corals with fishing activities prohibited in the Reserve. The corals are mainly distributed around the small islands off the eastern corner of the Dongshan Island, where the fishing activities are unlikely to occur.

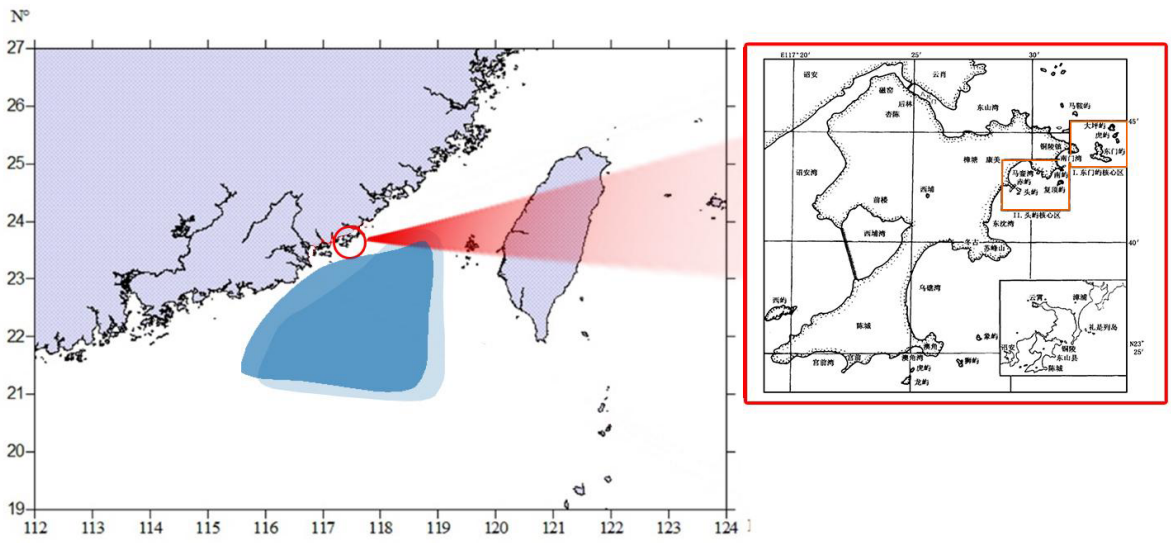


Fig. 5 The distribution of the Dongshan Coral Nature Reserve (I and II are the core areas of the Reserve)[1] and the fishing area of trawl (deep blue) the trap (light blue) vessels

Xiamen University conducted interviews with 10 bottom trawl and 10 trap vessels in 2019. Based on the interviews with fishermen, fishery operating areas do not overlap with the coral reserve. In addition, fishers try to avoid coral reefs because they cannot trawl near reefs at adequately high speeds for fishing purposes. Both the trap and trawl fisheries tend to operate on sandy bottom habitats, which are expected to recover quickly from fishing disturbances. Some trap vessels choose to operate in areas with rocky bottoms in order to avoid the conflict with the bottom trawl vessels.

Gear Loss

The 2019 interviews included questions about gear loss. For trawl vessels, fishers reported that they essentially do not lose nets. Per vessel per year, 0-5 nets may be damaged by reefs, pots, or garbage (e.g. wood, oil barrels). The crew makes small repairs onboard or transports nets back to port for more extensive manual repair. If trawlers pick up crab traps during fishing activities, they usually discard them back into the water in areas where fishing vessels don't operate. This is because transporting the lost traps increases fuel costs, and there is no financial incentive to bring them back to shore.

There are 200 registered trap vessels in Tongling town, Dongshan County, each of which carries 3,000 to 4,000 crab cages for each trip. The buoys and cages are not marked to identify owners. The traps are typically operated in areas where bottom trawlers, other fishing vessels,

[1] HUANG Zong-Guo, ZHENG Cheng-Xing, LI Chuan-Yan, WANG Jian-Jun, ZOU Ren-Lin. The diversity of scleractinian coral associated species in Dongshan, Fujian Province[J]. Biodiv Sci, 1999, 07(3): 181-188.

and cargo ships operate as well. The ropes connected to the cages can be easily damaged by the other ships, including bottom trawlers that operate in the same area. Some of the trap vessels may lay the traps in rocky seabed to avoid the conflict with trawlers, resulting in trap loss frequently as well. The reasons for loss in these areas will be investigated, and could be because the ropes can be damaged more easily by rocks when withdrawing the traps. Therefore the loss of traps is considered significant in the crab trap fishery.

Based on the interviews of the fishers at the landing ports, an estimation of 7,000-10,000 traps/vessel/year were lost or damaged in Dongshan County. However the actual number may be lower, as the number of active trap vessels is likely smaller than the number of vessels officially registered. Traps can be brought back for recycling, but because only 0.5-1.0 yuan/ cage is provided, many fishers do not bother to do so. Thus the ghost fishing impacts are expected to be significant for the trap fishery, and minimizing gear loss is important for managing the impacts.

The fishers suggested the following measures to help reduce loss of crab cages and increase the cage recycling rate.
1. Establish an effective communication mechanism between bottom trawl vessels and trap vessels to reduce the conflicts in fishing areas;
2. Increase the price of cage recycling and sign recycling agreements with fishermen;
3. The government should actively encourage recycling.

The FIP is not yet at the stage of starting dialogues with fishers and the government about these potential measures.

Habitats management

In addition to the above-mentioned establishment of a coral reserve to protect the vulnerable marine ecosystem, China has designated no trawling zones off the coast of the Bohai Sea, the Yellow Sea and the East China Sea since 1955. This is essential to reduce the damage of bottom trawlers to the seabed of nearshore waters and effectively protect some key habitats including the spawning grounds of fishery species and vulnerable ecosystems such as coral reefs and seagrass beds, which are mainly distributed in the nearshore waters.

Since 1995, China has implemented a summer fishing moratorium in the Bohai Sea, the Yellow Sea, the East China Sea and the South China Sea. The crab trawl and trap fisheries follow the summer fishing moratorium from May to mid August, mitigating the fisheries impacts on the habitats during the breeding season.

In the "14th Five-Year" National Fisheries Development Plan (2021-2025), the habitat restoration has been strengthened to effectively protect important aquatic germplasm resources.

As an effort to mitigate the fisheries' impacts on habitat, the FIP has been researching the overlap between the fisheries and key fish habitats, especially those of the species with high

conservation value, such as sea horses. Based on the research findings, the FIP is helping identify the key habitats of the sea horses and will propose to establish non-trawling zones to avoid the interruptions on the key habitats.

Ecosystem Impacts

Description of the larger ecosystem

The East China Sea Large Marine Ecosystem (LME) is a vast, semi-enclosed LME bordered by China, South Korea, and Japan. It extends to the Taiwan Strait and is bounded to the North by the Yellow Sea LME. The East China Sea LME is a monsoonal system influenced by the warm Tsushima Current, which originates in this LME, and by the Kuroshio Current, of higher temperature and salinity, in the south. It is a productive LME with shallow coastal waters that provide spawning and nursery grounds for many species of pelagic fish.

Impacts on key ecosystem elements

The Minnan-Taiwan Bank fishing ground is highly productive with abundant fishery resources. According to the catch analysis conducted in 2021 and 2022, there were 253 species found in the crab bottom trawl fishery catch, including 180 fishes (71.15%), 55 crustaceans (21.74%) and 18 cephalopods (7.11%). Besides the red swimming crab *Monomia haanii*, the blue swimming crab *Portunus pelagicus*, Threadfin porgy *Evynnis cardinalis*, Japanese scad *Decapterus maruadsi*, lizardfish, whiparm octopus, webfoot octopus, loligonid squids, are the dominant species in the catch.

The heavy fishing mortality of the trawl fishery on high--value demersal stocks, especially the small and juvenile individuals of fish, crustaceans and cephalopods has led to a shift in the ecosystem and harvest toward faster--growing, smaller species. According to the survey conducted by Xiamen University team during 2021-2022, feed fishes (mainly juvenile fish and low economic valuable species) contributed about 25%-50% of the total capture volumes in the crab bottom trawl fishery. Researches showed that the otter board trawl had substantial change in fishery resource structure, as the catch was mainly composed of species with short lifecycle, and biomass of low-trophic level species such as crustaceans and cephalopods have increased obviously .

For the crab trap fishery, it mainly causes effects to ecosystems through using the fishery resources for bait.

For the trap fishery, the average fishing days per trip were 21 days. Each vessel carries about 3,000-4,000 traps; about 1,000 traps were connected by a line and operated as a unit. During

day time, traps were collected every 5-6 hours. At night time, traps were collected after about 10 hour sets. The *Scomber japonicus* and sardines (*Sardinella spp.*) are the most commonly used as bait, and pacific saury (*Cololabis saira*) is also used as bait. The baits are sourced from both distant water fishery and domestic fishery. Based on the information on the weight of bait per trap (200 g), the number of traps per vessel (3000 traps) and the number of collection per day (3 collections) in Dongshan trap fishery, the amount of bait weight was estimated, i.e. 1,800 kg bait weight/vessel/day (= 200*3000*3/1000). A block of frozen bait is about 10 kg, and about 600 blocks (i.e., 6 t) were used per vessel per month.

Ecosystem management

The potential impact of these fisheries on the ecosystem structure and function is managed at a national scale under PRC fisheries regulations. Even though the ecosystem-based management has not appeared in China, some of the management measures can contribute to the mitigation of the fisheries' impacts on the ecosystem.

In Fujian province, 35 economic valuable species are listed in the Regulation on Minimum Allowable Catch Size and the Proportion of Juvenile Fish of 35 Economically Valuable Species in Fujian (enacted in 2018), most of the important fishery species in the local fishery are subject to this Regulation. The Regulation also stipulates that in 2018, 2019 and 2020, the weight of juvenile fish of the above-mentioned species shall not exceed 50%, 30% and 20% of the total weight of the species, respectively, in a single trip. After 2020, it shall not exceed 20%. In the "14th Five-Year" National Fisheries Development Plan (2021-2025), the domestic fisheries management will apply both input and output control scheme adhering to the strict implementation of minimum catch size for important fishery species and the stipulation of the proportion of juvenile fish in the catch. In 2021, Fujian Province released The Implementation Plan of the Marine Fishery Resources Conservation Subsidies, leveraging the fishery subsidy to reform the fishery management in Fujian. The Plan stipulates that responsible fishing performance of fishing vessels, including the catch proportion of juvenile fish, bycatch and protection of marine mammals, are included in the subsidy calculation and issuance system. These above measures can greatly improve the catch of the juvenile fish in the crab bottom trawl fishery, reduce the impacts to the recruitment process of the fishery stocks.

References

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