

SPECIAL REPORT

Reviving the Seas: confiscated fishing vessels as artificial reefs in Malaysia

Muhammad Amirullah Al Amin Ayob, Hamizah Nadia Alias@Yusof, Mazalina Ali, and Abd Haris Hilmi Ahmad Arshad
SEAFDEC/MFRDMD

Since 2006, the Department of Fisheries Malaysia (DoFM) has been successful in producing various innovations of artificial reefs (ARs) using concrete and steel (Ahmad *et al.*, 2018). Building on this expertise, the DoFM, SEAFDEC Marine Fishery Resources Development and Management Department (MFRDMD), and Malaysian Maritime Enforcement Agency (MMEA) conducted a study in 2019 on the resilience of confiscated foreign fishing vessels as artificial reefs (ARs) and their impacts on the fish species diversity and biomass. A total of 18 vessels were sunk in the waters of Kuala Kemasin, Kelantan in July–November 2019 while five vessels were deployed in Pulau Kapas, Terengganu in March 2019. The water depth, distance from the coastline, traffic of domestic vessels, water visibility, and substrate of the sites in Kelantan and Terengganu were found to be suitable for ARs.

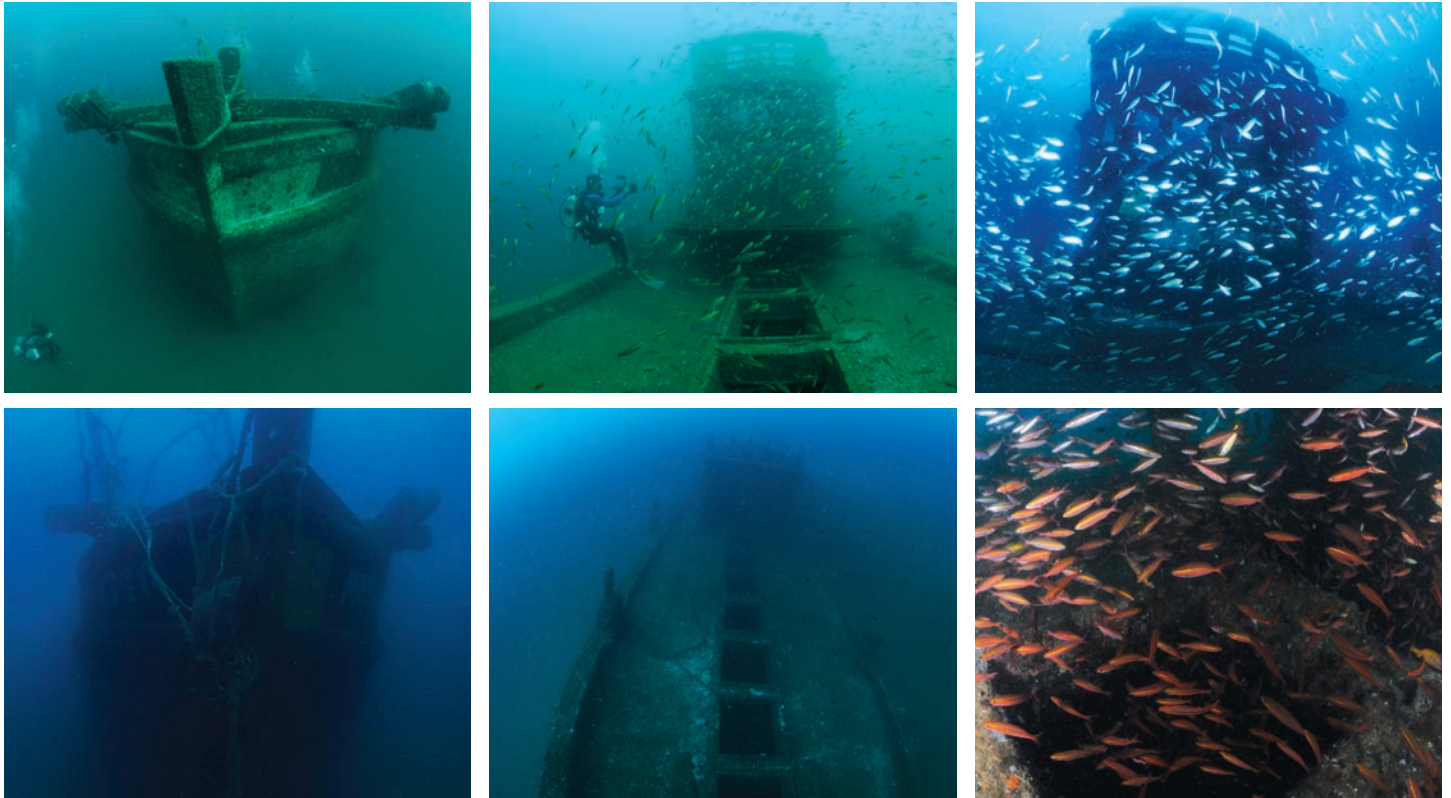
All preparation before and during the sinking of these vessels were monitored by MFRDMD researchers complying with the standard operating procedures approved by DoFM. The vessels used were made of wood and coated with approximately 5 cm of fiberglass. Before sinking, all the vessels were cleaned of pollutants, particularly hydrocarbon fuel. Then, the fish storage boxes of each vessel were filled with gravel weighing between 80 t and 120 t to act as ballast to ensure that the vessels would sink and not be carried away by strong currents. Moreover, two holes were drilled, one in the bow and one in the stern, to allow water to enter and sink the vessels to the target location and settle properly on the seafloor. The sinking time of each vessel ranged from 15 min to 20 min depending on the size and weight of the vessel. After the deployment process, an echosounder was used to

check whether each vessel sunk properly on the seafloor *i.e.* settled in an upright position or rested on its left/right side. On the other hand, the vessels that did not sink properly were marked and additional efforts were done to sink them properly on the seafloor. After a few days, a group of divers inspected the vessel structure for any breakage or damage. Sinking the vessels properly was critical to their success as ARs as it determines their structural stability and suitability for marine life to inhabit and thrive.

Subsequently, the researchers from MFRDMD conducted an underwater video census to assess fish biodiversity and biomass in eight randomly selected vessels deployed in Kuala Kemasin on 21–22 September 2019. A total of 22 families consisted of 32 species of commercial fish and 14 species of coral fish. The total biomass of commercial fish was estimated to be 5,005 kg. The most common commercial fish species include the goldband fusilier (*Pterocaesio chrysozona*) with around 36,000 individuals, yellowtail scad (*Selaroides leptolepis*) with 18,000 individuals, yellow snapper (*Lutjanus lutjanus*) with 14,400 individuals, and Madras snapper (*Lutjanus madras*) with 7,200 individuals. For coral fish species, the most common were the barred cardinalfish (*Archamia fucata*) with around 19,980 individuals, golden cardinalfish (*Apogon aureus*) with 13,320 individuals, and bluespotted damselfish (*Neopomacentrus cyanomos*) with 12,600 individuals (Muhammad Amirullah *et al.*, 2020).

In Pulau Kapas, MFRDMD carried out an underwater video census at all vessels on 3–4 November 2019. A total of nine families composed of 13 species of commercial fish and four species of coral fish were recorded. The total biomass of

	Kuala Kemasin, Kelantan	Pulau Kapas, Terengganu
Period of AR installation	July–November 2019	March 2019
Site coverage area (m ²)	1,836	336
Distance from coastline (nm)	8.9	4.1
Water depth (m)	24	25
Substrate	Muddy sand	Sandy
Vessels (ARs) deployed (number)	18	5
Vessel weight (GRT)	> 70	< 60
Average size (m) of vessels (L × W × H)	25.5 × 4.0 × 8.0	19.2 × 3.5 × 5.0
Date of fish surveys	21–22 September 2019	3–4 November 2019
Fish diversity (number of species)	46	17
Commercial fish biomass (kg)	5,005	129



MFRDMD conducting fish visual surveys in artificial reefs made of confiscated foreign fishing vessels installed in Kuala Kemasin, Kelantan (top row) and Pulau Kapas, Terengganu (bottom row) in Malaysia

commercial fish was estimated at 129 kg. The most common commercial fish species include mangrove red snapper (*Lutjanus lutjanus*) with an estimated 1,000 individuals, Madras snapper (*Lutjanus madras*) with 800 individuals, yellowstripe snapper (*Lutjanus vitta*) with 700 individuals, and goldband fusilier (*Pterocaesio chrysozona*) with 500 individuals. The most abundant coral fish was yellowtail damselfish (*Neopomacentrus cyanomos*) with about 500 individuals, followed by damselfish (*Neopomacentrus* sp.) with 250 individuals (Muhammad Amirullah *et al.*, 2020).

It can be inferred that using fiberglass-coated wooden vessels as ARs could also attract both commercial and coral fish species when compared to other reefing materials such as concrete. It was found that the size and number of vessels deployed directly correlated with the fish species diversity and biomass. Specifically, the use of a larger and greater number of vessels seemed to attract more diverse fish species resulting in higher fish biomass. This finding is supported by the study conducted by Saharudin *et al.* (2012) who suggested a positive correlation between the coverage area of ARs towards fish species diversity and biomass in Peninsular Malaysia.

MFRDMD and DoFM will continue to regularly monitor the fish species diversity and biomass in ARs in both sites. Also, the stability and durability of the deployed ARs would be monitored to prevent the structures from turning into marine debris and causing pollution in the sea. Through regular

monitoring, MFRDMD would take appropriate measures to ensure the longevity of the deployed ARs, thus preserving the marine ecosystem. Although official guidelines have not yet been developed, DoFM approved the guidelines for reefing of confiscated fishing vessels for research purposes by MFRDMD under this pilot study. The outputs of this study will be used as a reference for the official guidelines that will be developed in the future.

References

- Ahmad, A., Rafezi, H., Nur Iskandar, T., Nor Azman, Z., Muhammad Amirullah Al Amin, A., & Mohd Saki, N. (2018). Penyelidikan dan Pembangunan Reka Bentuk dan Pembinaan Tukun Tiruan Di Malaysia (1975–2017). SEAFDEC/SP/37.
- Muhammad Amirullah Al Amin, A., Ahmad, A., Hamizah, N., A., Mohd Saki, N., Nor Azman, Z., Mohd Sukri, M., & Wahab, D. (2020). Study on biomass, value and biodiversity of fishes by underwater videography at selected artificial reefs in Peninsular Malaysia. Kuala Terengganu, Terengganu, Malaysia. SEAFDEC/MFRDMD
- Saharudin, A.H., Ahmad, A., Lokman, M.H., & Wan Salihin, W.A. (2012). Historical development and management of Malaysian Artificial Reefs (ARs). Proceedings of MTS-IEEE Oceans, 2012, Yeosu, Korea. 28 pp. 