## SDG 14- LIFE BELOW WATER

**Target 14.2: Protect and Restore Ecosystems**

**Target 14.4: Sustainable Fishing**

## OVERVIEW AND SDG 14 RELEVANCE

The Applied Research Center for Environment and Marine Studies (ARCEMS) at King Fahd University of Petroleum and Minerals (KFUPM) actively contributes to Saudi Arabia's commitment to sustainable development and marine resource conservation through applied fisheries research. These research initiatives directly support Sustainable Development Goal 14 (Life Below Water) by promoting the conservation, restoration, and sustainable management of fisheries resources.

During 2025–2026, ARCEMS has been implementing a comprehensive fisheries research project focused on assessing the environmental impacts of different fishing gears and methods across Saudi Arabia's Arabian Gulf and Red Sea coasts. Conducted with the support of the Ministry of Environment, Water and Agriculture (MEWA), the project aims to generate scientific evidence to improve fishing practices, strengthen fisheries management measures, reduce adverse impacts on marine ecosystems, and promote the long-term sustainability of the Kingdom's fisheries resources.

## INSTITUTIONAL AND NATIONAL CONTRIBUTION

The Applied Research Center for Environment and Marine Studies (ARCEMS) at King Fahd University of Petroleum and Minerals (KFUPM) supports Saudi Arabia's commitment to sustainable fisheries management, marine biodiversity conservation, and SDG 14 (Life Below Water), in alignment with Saudi Vision 2030. During 2025–2026, ARCEMS, with the support of the Ministry of Environment, Water and Agriculture (MEWA), has been conducting fisheries research across the Arabian Gulf and Red Sea to assess the impacts of different fishing gears and methods on marine resources.

At the national level, the research provides scientific evidence to support fisheries regulations, sustainable fishing practices, marine resource conservation, and progress toward SDG Target 14.4 on sustainable fishing.

At the institutional level, the project strengthens KFUPM's contribution to applied marine research, government collaboration, and science-based policy development, reinforcing its role in advancing Saudi Arabia's environmental sustainability objectives.

## CONTRIBUTION OF FISHING GROUND MAPPING TO SDG 14.4: SUSTAINABLE FISHING

**Summary**

The research conducted by ARCEMS focused on mapping shrimp trawling grounds in Jizan, Saudi Arabia, using GPS tracking, GIS, and environmental and biodiversity datasets. GPS observations from six fishing vessels collected between January and April 2025 were analyzed to assess fishing intensity, seasonal variations, and spatial interactions with sensitive marine habitats. Key findings revealed seasonal shifts in fishing activity, with maximum spatial coverage in March, and fishing operations occurring near and partially overlapping coral reefs and mangrove habitats. A major achievement was the development and publication of an integrated GPS–GIS framework for identifying fishing grounds, assessing habitat interactions, and estimating fishing-related emissions. The research directly supports SDG 14, particularly Targets 14.2 and 14.4, by providing scientific evidence

for regulating fishing effort, protecting critical habitats, strengthening fisheries monitoring, and promoting ecosystem-based sustainable fisheries management.

**Article**

Mapping fishing grounds plays a significant role in achieving Sustainable Development Goal (SDG) Target 14.4, which aims to effectively regulate harvesting, end overfishing, eliminate illegal, unreported and unregulated (IUU) fishing, and implement science-based fisheries management to restore fish stocks to biologically sustainable levels. The systematic mapping of fishing grounds using Geographic Information Systems (GIS), satellite technology, and spatial fisheries data provides essential information on the geographical distribution of fishing activities, fishing intensity, seasonal fishing patterns, and the spatial distribution of commercially important fish stocks.

Identification and mapping of productive fishing grounds, spawning areas, nursery habitats, and ecologically sensitive zones enable fisheries management authorities to develop spatially explicit management measures, including seasonal fishing closures, fishing effort restrictions, habitat protection, and appropriate allocation of fishing activities. Such information also supports the prevention of excessive fishing pressure in vulnerable areas, reduces habitat degradation, and facilitates the monitoring of fishing activities to improve regulatory compliance. Furthermore, integrating fishing ground maps with catch data, fishing effort, vessel characteristics, and stock assessments allows authorities to identify areas of potential overexploitation and formulate science-based management strategies.

In the Kingdom of Saudi Arabia, mapping fishing grounds along the Arabian Gulf and Red Sea coasts can provide a scientific foundation for improving fisheries resource management, optimizing the spatial allocation of fishing effort, protecting critical marine habitats, and strengthening monitoring and enforcement. By supporting evidence-based fisheries regulations and the sustainable utilization of marine resources, fishing ground mapping can make a direct contribution to achieving SDG Target 14.4 and ensuring the long-term ecological and economic sustainability of Saudi Arabia's fisheries.

ARCEMS developed and published an integrated GPS–GIS analytical framework ( Figure 1) combining vessel movements, environmental conditions, biodiversity, bathymetry and operational emissions. The study demonstrated its application in a data-limited coastal trawl fishery. In the present study the mapped fishing grounds and examined their spatial overlap with coral reefs, mangroves and marine protected areas (Figure 2). Identified recurrent nearshore fishing activity occurring near, and partly overlapping, ecologically important habitats and conservation areas. This survey Provides spatial evidence to inform ecosystem-based fisheries management, habitat protection and marine spatial planning.

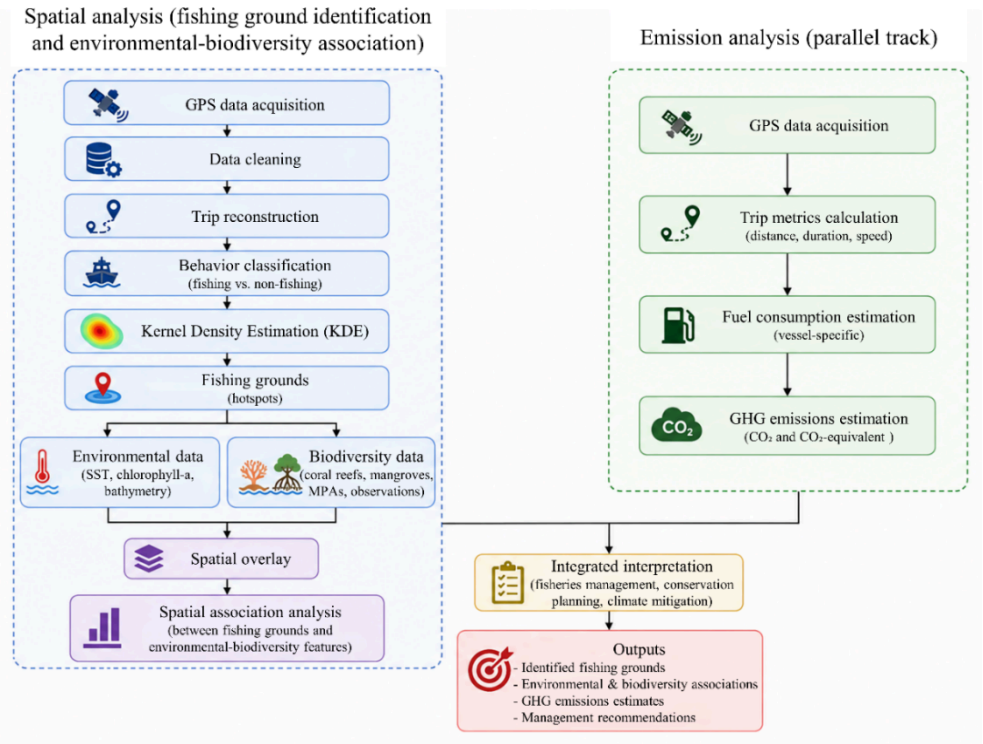



Figure 1. Schematic representation of data integration of GPS tracking, GIS, environmental and biodiversity datasets, and emissions estimation.

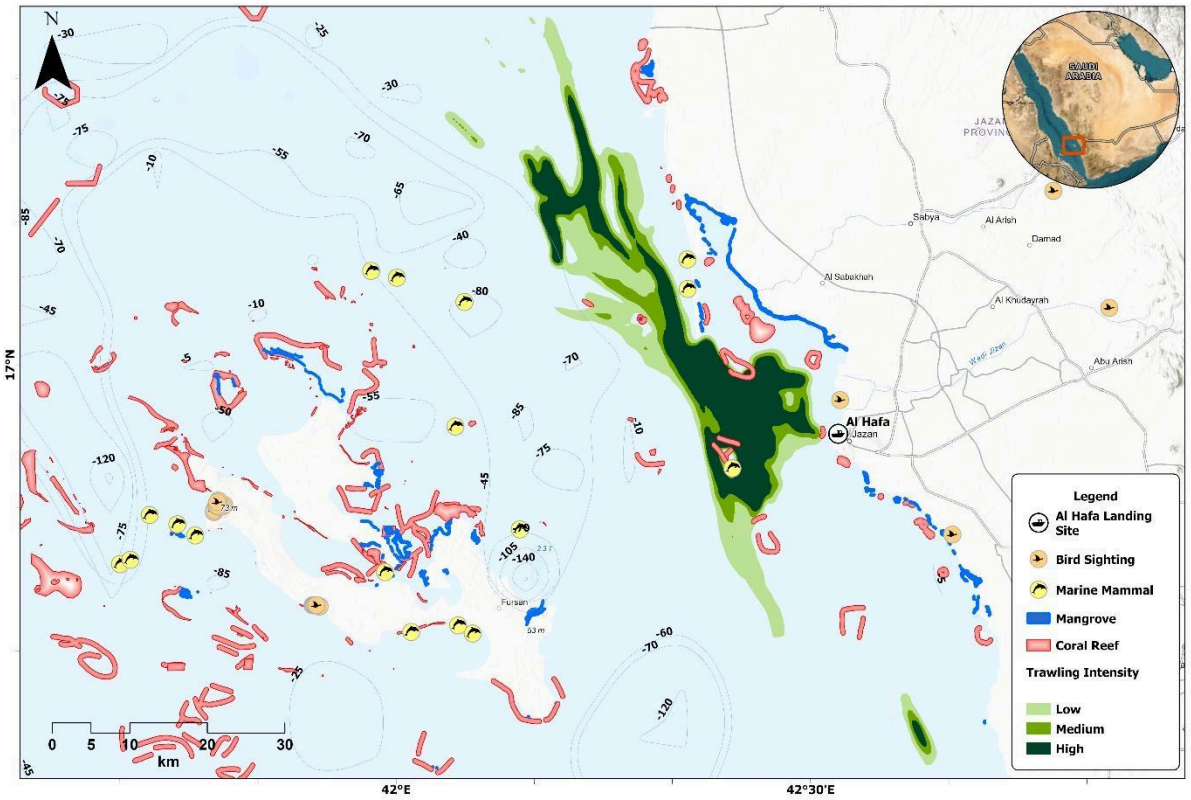



Figure 2. Fishing grounds of shrimp trawl fishery in overlapping with mangroves and coral reef areas in Al Haffa (Jizan area).

The spatial distribution of trawling intensity in the Jazan fishing grounds exhibited considerable temporal variation from January to April (Figure 3). During January, fishing activities were concentrated in a few localized areas, particularly offshore of Jazan. In February, fishing grounds expanded spatially, with moderate to high trawling intensity occurring across a wider area. March recorded the most extensive fishing activity, characterized by larger, interconnected zones of high trawling intensity extending along the coastal waters. In contrast, April showed a marked reduction in the spatial extent of trawling, with fishing activities becoming more fragmented and localized. These temporal variations highlight seasonal shifts in fishing effort and provide valuable information for spatial fisheries management and sustainable exploitation of marine resources.

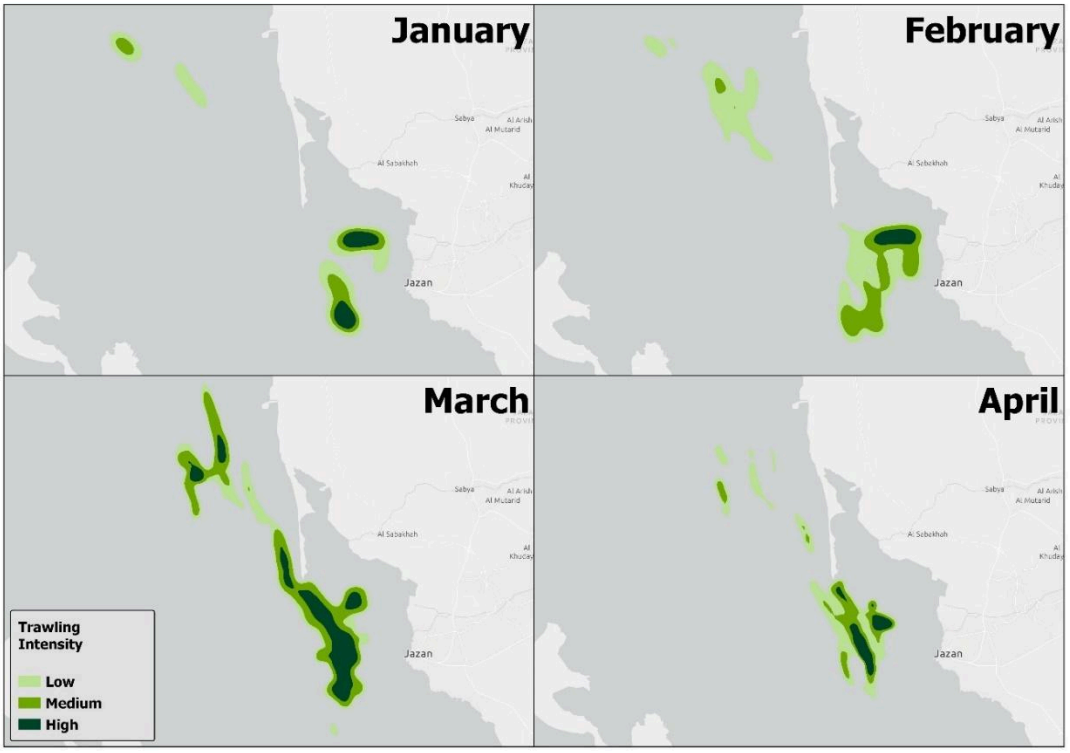



Figure 3. Temporal variation of fishing intensity of shrimp trawl fishery in Al Haffa (Jizan area).

## CONCLUSION

Fishing ground mapping therefore represents an important management tool for advancing sustainable fishing practices. However, its contribution to SDG Indicator 14.4.1, which measures the proportion of fish stocks within biologically sustainable levels, must ultimately be evaluated through biological stock assessments and changes in fishing pressure, rather than mapping alone.

### Evidence of the output

The results are published in "*GPS-Based Identification of Fishing Grounds in a Coastal Trawl Fishery: An Integrated Pilot Study From Jizan*" (https://doi.org/10.1111/fme.70115) integrates GPS observations from six fishing vessels during January 2025 – April 2025 with GIS, environmental, biodiversity, bathymetric and estimated greenhouse gas emission analyses.