



ECOSYSTEM BASELINE AND TROPHIC ROLE ASSESSMENT

1. Introduction

As part of the Fishery Improvement Project (FIP) under the MarinTrust Standard Version 3.0, an assessment of **ecosystem interactions and trophic structure** was conducted to address Action Plan requirements under **Clause E3.1 – Impact on the Ecosystem**.

The objective of this task was to:

- Review the **marine ecosystem structure** of the Karnataka coast.
- Compile the **trophic roles of key species targeted by purse seine fisheries**.
- Evaluate potential impacts of fishing activities on **food web dynamics**.

The analysis utilized existing scientific studies and recent fishery monitoring conducted by the **ICAR-Central Marine Fisheries Research Institute (CMFRI)** under the consultancy project on **Fishery and Stock Assessment of Small Pelagics along the Karnataka Coast**.

2. Overview of the Marine Ecosystem (Karnataka Coast)

The marine ecosystem along the Karnataka coast forms part of the **Eastern Arabian Sea ecosystem**, characterized by:

- Highly productive **upwelling-driven pelagic systems**
- Seasonal **monsoon-driven nutrient enrichment**
- Diverse pelagic and demersal fish communities

Key ecosystem components include:

- Pelagic forage fish populations
- Mid-level pelagic predators
- Large pelagic predators
- Plankton communities forming the base of the food web

Important habitats present in the region include:

- Estuaries
- Mangrove ecosystems



- Coral patches
- Coastal spawning and nursery grounds

These ecosystem elements have been documented through long-term monitoring programs by CMFRI and national fisheries research institutions.

3. Species Composition of Purse Seine Fisheries

Fish landing analysis conducted during **2025** shows that the purse seine fishery is dominated by **small pelagic species**.

Major species composition includes:

Species	Percentage of Catch
Indian mackerel (<i>Rastrelliger kanagurta</i>)	33%
Oil sardine (<i>Sardinella longiceps</i>)	17%
Tunas (<i>Euthynnus affinis</i> , <i>Auxis</i> spp.)	~18%
Seerfish (<i>Scomberomorus commerson</i>)	10%
Ribbonfish (<i>Trichiurus lepturus</i>)	4%
Scads (<i>Decapterus</i> spp., <i>Selar</i> spp.)	4–6%

The catch composition confirms that the fishery primarily targets **mid-trophic pelagic forage species**, which play an important ecological role in marine food webs.

4. Trophic Structure of the Ecosystem

The Karnataka pelagic ecosystem can be broadly classified into **four trophic levels**.

Level 1 – Primary Producers

- Phytoplankton
- Marine algae

These organisms convert solar energy into organic matter and form the **foundation of the marine food web**.



Level 2 – Primary Consumers

- Zooplankton
- Small crustaceans

They feed on phytoplankton and serve as food for small pelagic fish.

Level 3 – Forage Fish (Target Fishery Species)

Major species targeted by purse seine fisheries include:

Species	Ecological Role
Oil sardine	Major plankton feeder
Indian mackerel	Zooplankton and small fish predator
Scads	Mid-level pelagic predator
Lesser sardines	Small plankton feeders

These species play a **critical energy transfer role**, converting plankton biomass into fish biomass that supports higher predators.

Level 4 – Higher Predators

Predators depending on small pelagic fish include:

- Tuna species
- Seerfish
- Barracuda
- Marine mammals
- Seabirds

These predators rely on sardines, mackerel, and scads as a **major prey resource**, making small pelagics a key ecological link.



5. Ecosystem Interactions

The purse seine fishery primarily targets **schooling pelagic fish**, which typically results in:

- High species selectivity
- Low discards
- Limited habitat interaction

Unlike bottom trawling, purse seine operations occur in the **water column**, minimizing disturbance to benthic habitats.

The primary ecological interaction of concern relates to:

Forage fish exploitation, which may influence predator populations if harvest levels exceed ecosystem productivity.

However, the Karnataka ecosystem benefits from:

- High seasonal productivity
- Rapid turnover rates of small pelagic species
- Strong recruitment variability linked to monsoon cycles

6. Monitoring and Scientific Data Collection

Ecosystem monitoring and fishery data collection are conducted by **ICAR-CMFRI** through structured national programs.

Marine fish landing data are collected using a **Stratified Random Sampling (SRS) system**, which records:

- Species-wise catch composition
- Fishing effort
- Craft and gear types
- Length-frequency distribution

Enumerators collect this information from landing centers such as **Mangalore and Malpe**, and the data are transmitted electronically to the national database.



Biological sampling also records:

- Fish length and weight
- Sex ratio
- Maturity stages

These biological indicators support ecosystem and stock-assessment modelling.

7. Potential Impacts on Food Web Dynamics

Scientific ecosystem modelling studies conducted in the Arabian Sea indicate that:

- Small pelagic fish function as **key trophic intermediates**.
- Excessive exploitation could potentially influence predator populations.

However, current fisheries management measures reduce the risk of ecosystem disruption.

Key safeguards include:

- **Seasonal fishing ban during monsoon (June–July)**
- **Mesh size regulations to reduce juvenile catch**
- **Spatial restrictions near coastal habitats**
- **Effort controls through licensing**

These measures contribute to maintaining ecosystem balance.

8. Conclusion

The ecosystem baseline assessment confirms that:

1. The main elements of the marine ecosystem along the Karnataka coast are well documented.
2. The trophic role of small pelagic species targeted by purse seine fisheries is scientifically understood.



3. Existing research and monitoring programs provide sufficient information to evaluate ecosystem interactions.

References

ICAR-CMFRI. 2025. Fishery and Stock Assessment of Small Pelagics along the Karnataka Coast – Consultancy Project Report.

ICAR-CMFRI. 2026. Annual Report: Fishery and Stock Assessment of Small Pelagics along the Karnataka Coast.

Vivekanandan, E. et al. 2005. Fishing the Marine Food Web along the Indian Coast. Fisheries Research.

Mohamed, K. & Zacharia, P.U. 2009. Ecosystem modelling of the Arabian Sea fisheries.

