

# CHAPTER 26

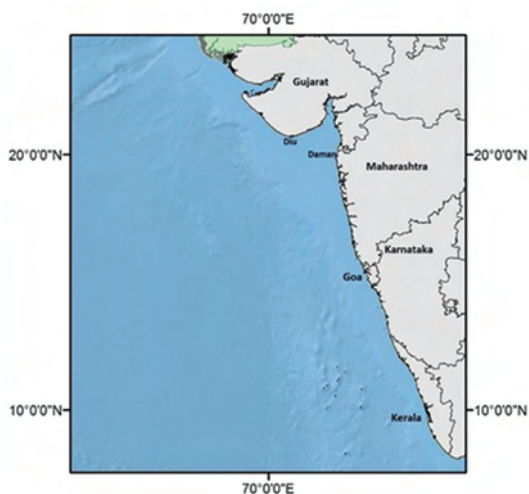
## FISHERIES OCEANOGRAPHY- ESTABLISHED LINKS IN EASTERN ARABIAN SEA

Grinson George, Jayasankar J., Phiros Shah, Tarun Joseph, Muhammad Shafeeque, Monolsiha S., Platt T. and Sathyendranath S.

Fishery Resources Assessment Division  
ICAR-Central Marine Fisheries Research Institute

### Introduction

Fish distribution along the western Indian coastal waters indicates a bias for pelagic-planktivores to the southern coast and carnivores to the northern coast. Southwest coast of India is an upwelling zone rich in phytoplankton dominated by diatoms during summer monsoon. The landing centre observation data since 1985 clearly indicate a dominance of Indian oil sardine (*Sardinella longiceps*) in this upwelling zone. The physiological activity of the fish is also tuned to the arrival of summer monsoon. A resting season is expected with the retrieval of monsoon in this area. Further north of our coastal waters, we see that the dominant group of fishes includes the Sciaenids popularly known by the name 'Ghol' (*Protonibea diacanthus*), 'Koth' (*Otolithoides biauritus*) and 'Dhoma' (*Johnius dussumieri*). These fishes seem to flourish on the winter productivity in the northern coastal waters. The winter primary productivity in southern waters is not good enough to support carnivores with physiological active season during the winter. The productivity differences in the coastal waters in time and space and the oceanographic features supporting these could be studied from a synoptic scale with the help of satellite remote sensing and geographical information system. In this study, we have utilized the various open sources remote sensing data to identify the oceanographic responses and the physical forcing that govern the distributional preferences of some dominant marine fish species.



### Variability in fish biodiversity – north and south of eastern Arabian Sea

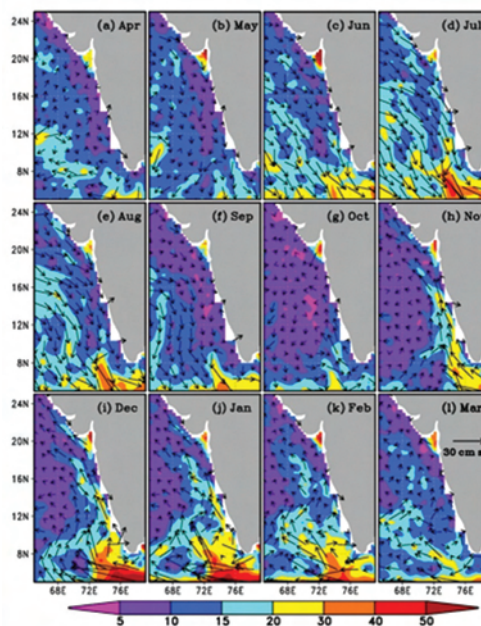
The tropical waters are often characterized by high species diversity. Along the west coast of India, the number of species that contribute to the commercial fisheries is found to be higher in tropical waters than temperate regions. India, being one of the most prominent tropical fishing nations contribute about 3.5 million tons of fish annually. With a coastline



of formidable (8129 km approximately) length, regional differences in catch composition have been observed consistently. Such differences may arise due to influence of multiple forcing factors of physical, chemical, geological and biological origin.

There exists a strong difference in catch composition along the west coast across the 15° N latitude with the planktivorous species dominating the South Eastern region and carnivorous species thriving in the North Eastern Arabian Sea (NEAS). However, the study was unable to explain this difference in catch composition and also highlights the due importance of the role played by feeding and breeding behaviour of fishes in order to adequately understand their response to oceanographic forcing. The relationship between oceanographic forcing (physical and chemical) upon fish response (spatial distribution) has remained largely elusive owing to the lack of synoptic-level datasets on the oceanographic variables which differentiates multiple ocean sites from each other.

Satellite remote sensing have played a pivotal role in addressing this data gap by offering the opportunity to systematically measure and monitor multiple oceanographic variables at desired resolutions. With the advent of remote sensing capabilities, optical responses of coastal waters can easily be monitored which makes ecological classification based on remote sensing reflectance possible. The South Eastern Arabian Sea (SEAS) exhibits a strong seasonality in remote sensing reflectance comparison to its north eastern counterpart. However, the general notion is that seasonal extremes in weather are more dominant in the temperate latitudes than in the tropics. Seasonal changes in the biological behaviour (breeding/ feeding) of fish have strong links with weather conditions. In order to ensure improved chances for survival of fish larvae, the physiological activity of adult fish should coincide with the onset of better food conditions in close proximity both temporally and spatially. Fish also exhibit a natural tendency to avoid predators and provide its larvae with best possible resources to ensure their survival to adulthood. In general, the most dominant commercial tropical fishes can be classified based on their feeding behaviour as planktivorous and carnivorous and their breeding responses exhibit a strong seasonality with the onset of summer and winter monsoon respectively.

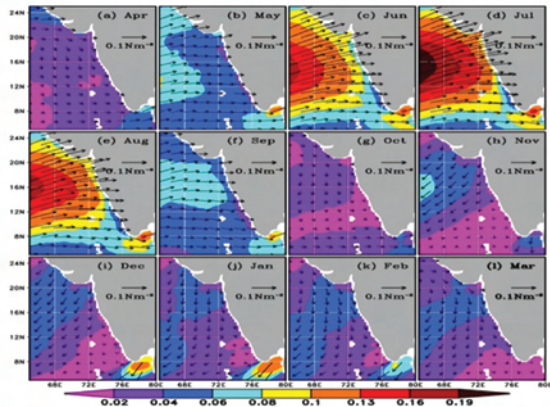




There is a major role played by physical (winds, temperature, salinity, tidal amplitude and sea surface height), biological (surface chlorophyll, catch ratio, feeding and spawning behaviour of fishes) and geological (nature of shelf region) forcing in explaining the difference in catch composition.

### Wind over the eastern Arabian Sea

Characteristic feature of the north Indian Ocean is the seasonal reversal of wind pattern and associated reversal of oceanic circulation. Being the part of north Indian Ocean eastern Arabian Sea also exhibits seasonal reversal of wind. During the summer monsoon season from May to September winds are south westerly (blowing from south-west) over the eastern Arabian sea. During the winter monsoon winds are north easterly (Blowing from north east). Principal eastern boundary of the Arabian Sea (west coast of India) is characterised by wind driven upwelling during summer monsoon. Compared to the winter monsoon, winds are stronger during summer monsoon.



### Currents over the eastern Arabian sea

In tune with the seasonal reversal of prevailing atmospheric circulation, current pattern over the Eastern Arabian Sea also exhibits a seasonal reversal. Principal eastern boundary current in the Arabian Sea is the west India coastal current and it reverses twice in a year. During the summer monsoon from May to September currents are equatorward along the west coast of India and during the winter monsoon from November to February it is poleward. Divergence of surface currents feeds the upwelling zones along the west coast of India during summer monsoon.

### Chlorophyll - a concentration during Upwelling

Upwelling and downwelling are the two predominant mechanisms that determine the biological productivity over the eastern Arabian Sea. Productivity over the South eastern Arabian Sea mainly dependent on the upwelling during summer monsoon. Convective mixing and downwelling induced by coastally trapped waves during winter monsoon are the causative mechanism for the biological productivity over the north east Arabian Sea.

Chlorophyll concentration along the north-west coast of India maintains a threshold throughout the year, while south west coast of India is characterised by high biological



productivity and Chlorophyll concentration during the period of upwelling from May to September. Cold coastal upwelling and subsequent phytoplankton growth are most evident along the eastern coasts of Seas.

