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Acetes as a Keystone Species in the Fishery and Trophic Ecosystem Along Northeastern Arabian Sea

Vinaya Kumar Vase[1] · Mohammed K. Koya[1] · Gyanaranjan Dash[1] · Swatipriyankasen Dash[1] · K. R. Sreenath[1] · D. Divu[1] · Rajan Kumar[1] · Shikha Rahangdale[1] · Rajesh K. Pradhan[1] · Abdul Azeez[1] · Kapil S. Sukhdhane[1] · K. G. Jayshree[1]

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Abstract

Diet composition of nine commercially exploited fishery resources which contributes 55–60% of the total fish landings in the northwest coast of India were analyzed in this study. Gut content analysis of the selected fish groups has shown significant variations in the prey composition and predator preference on a prey item. The diet matrix revealed *Acetes* sp. (32.74%) as a key and common shared prey item, followed by mesopelagic fishes (30.51%), other shrimps (11.00%), digested material (7.42%), crabs (4.03%) and cephalopods (2.77%), etc. In this study, *Acetes* sp was considered as a proxy for the non-penaeid prawns due to its significant contribution (92%) to the total non-penaeid landings. Targeted exploitation of *Acetes* sp. has intensified recently (from 0.44 lakh t in 2004 to 1.40 lakh t in 2018) with an average annual growth rate of 11.2% due to the demand from fish meal plants. By considering its ecological and fishery importance, *Acetes* sp. should be considered as keystone species in the ecosystem. The Schaefer surplus production model was used to calculate the Biological Reference Points (BRPs) and model parameters MSY, FMSY, r, EMSY, and K. The model fit was fair ($R^2 = 0.630$) and significantly positive correlation was observed between $CPUE_{observed}$ and $CPUE_{model}$. The estimated optimum exploitation limits ($p < 0.05$) for the fishery were Maximum Sustainable Yield (MSY) as 1.20 lakh t and fishing effort required to harvest MSY (EMSY) as 51.30 lakh fishing hours. However, the recent exploitation yield and fishing effort are beyond the optimum exploitation limits. Further increase in exploitation of the resources may hamper the sustainability of the stocks and may lead to detrimental impact on the trophic interactions of the fishery resources. Technical interventions are needed in the field of post-harvest and value addition for attaining fair economic returns from the harvest which at present forms a low-value high-volume fishery. Sustainable exploitation and management measures need to be introduced and implemented for the *Acetes* sp. in order to sustain the stocks and to maintain the integrity of the fishery ecosystem.

Keywords Diet matrix · Surplus production model · *Acetes* sp. · Multivariate analysis · Arabian Sea

Introduction

The northern Arabian Sea with semi-enclosed landmasses from three sides has the uniqueness of seasonal reversal of atmospheric and oceanic surface circulations (Kidwai and Amjad 2000). The Arabian Sea is one of the major productive oceanic regions in the world (De Sousa et al. 1996). Additionally, the monsoon cycles play a major role in the productivity of the Arabian Sea along Indian waters. Due to the land lock nature, the southwest monsoon plays an important role in the occurrence of the upwelling in the coastal areas of the northern Arabian Sea. Further, the winter convective mixing during the northeast monsoon ensures the perennial productivity of the region (Morrison et al. 1997; Solanki et al. 1998; Madhupratap et al. 2001). The total length of the northwest coast is around 2,320 km which is around 29% of the total coastline of India; the region consists of around 714 marine fishing villages and 278 landing centres (Jayasankar et al. 2012). The contribution of marine fish catch from the Gujarat state is the highest among the maritime states of India with landings of 7.80 lakh t in 2018 (22.0% share of the total). The commercially important fish landings along the northern Arabian Sea were non-penaeid prawns, ribbonfish, bombayduck, croakers, catfishes, lizard fishes, flatfishes, pomfrets, cephalopods, and penaeid prawns (Sathianandan et al. 2014).

✉ Vinaya Kumar Vase
v.vinayakumarvs@gmail.com

[1] Veraval RC of ICAR-CMFRI, Matsyabhavan, Bhidia, 362 269 Veraval, India