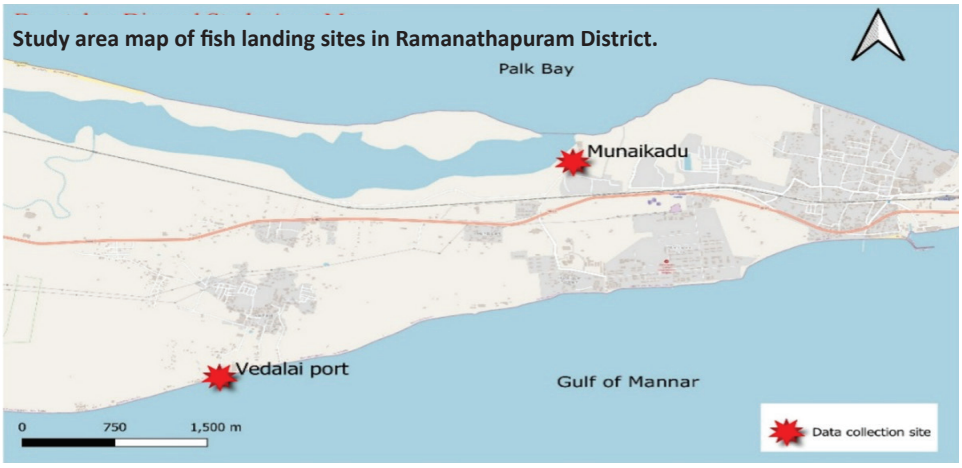
Assessment of discarded bycatch composition in artisanal fisheries from Palk Bay and Gulf of Mannar, India

Bycatch, the incidental capture of non-target species during fishing, has long posed economic, ecological, and operational challenges for fishers. While selective methods like harpoons and handlines have historically minimized bycatch, unintended catches still occur, often with low survival rates upon release.

Globally, marine fisheries bycatch was estimated at 28.7 million tons in 1994, with annual discards reaching 27.0 million tons of which shrimp trawling alone contributed 35% (Alverson et al. 1994) and 7.3 million tons later (Davies et al. 2009). This discarded fauna comprises diverse taxa, including mollusks, crustaceans, cnidarians, fish, and echinoderms many of which play vital roles in benthic and pelagic food webs.

Bottom trawling, a major contributor to unintentional mortality, is recognised as a significant threat to marine ecosystems due to its destructive impact on seabed structures, biodiversity, and sediment suspension, as well as habitat degradation (Belz et al. 2018). Bycatch threatens numerous species, including chondrichthyans (sharks, rays, and chimaeras), marine turtles, sea snakes, marine mammals, seabirds, and teleosts, many of which are categorised as threatened or endangered (Pacoureau et al. 2021). Discards also disrupt food webs, redistribute biomass, and can cause localized hypoxia, altering benthic community composition and ecosystem functions (Gilman et al. 2012). India, one of the top global seafood exporters, reported 1.78 million metric tons of exports in 2023–24, generating ₹60,523.89 crore (equivalent to US$7.38 billion) (PIB 2024). However, the rise in commercial fish production over the past five decades has been accompanied by increased bycatch landings and discards, exacerbating ecological pressures on marine ecosystems. Trawl nets, particularly demersal fisheries using otter and beam trawls, are amongst the most destructive fishing gear, severely impacting benthic invertebrate communities (Silveria et al. 2020).

The present study documents discarded bycatch by traditional fishers at landing sites along the ecologically significant coasts of Palk Bay and the Gulf of Mannar, highlighting the need for sustainable fishing practices to mitigate ecological and economic losses.



Methods

This study investigated discarded bycatch at two traditional fish landing sites: Munaikadu (9.170° N, 79.074° E), in Palk Bay and Vedalai Port (9.277° N, 79.109° E), in the Gulf of Mannar during September–October 2024. Direct observations and mobile camera recordings were conducted daily during peak landing hours to document discarded bycatch species. Identification was conducted using marine resources like online databases, reference materials from the marine museum, and expert consultations at the CMFRI, Mandapam Regional Centre. An open-type questionnaire survey with local fishers (n = 63) provided insights into bycatch composition and its implications for sustainable fisheries. Vernacular names of species were recorded through fisher interviews.

***Squillidae* sp. (Mantis shrimp) commonly found bycatch at Munaikadu. © Bhavanesh.**

Results and Discussion

The study recorded 58 discarded bycatch species predominantly comprising benthic species critical to maintaining ecological balance. In Munaikadu, common observed species included *Squillidae* spp., *Placuna placenta, Plotosus canius, Aurelia aurita,* and *Terapon puta* while less frequently observed species like *Sorsogona tuberculata, Echeneis naucrates* were also recorded. Molluscan species such as *Cerithidea singulata*, and *Cerithium ruppellii* were observed. Notably, *Squillidae* spp., a burrow-dwelling mantis shrimp, were heavily impacted, posing a threat to their population if unsustainable practices persist. An approximately 1,000 individuals discarded in a single day's discard from 20–30 boats were recorded during the study.

At Vedalai Port, small-scale fishers employ fish, shrimp, and crab nets. Among these, the crab mesh nets contribute the most of the bycatch due to their weighted design, which settles on the seafloor, unintentionally capturing various benthic organisms. Despite relatively low bycatch levels compared to bottom trawling, a noticeable increase in bycatch was observed when bottom trawlers operated nearby, disrupting seabed habitats and marine diversity.

This disturbance threatens species like the endangered Dugong *Dugong dugon*, which inhabits these coastal habitats (Anand et al. 2015). The area supports diverse species, including *Luidia hardwicki, Pentaceaster* spp., *Protoreaster lincki, Goniodiscaster scaber, Carpilius maculatus, Malleus malleus, Pinctada fucata,* and *Pugilina cochlidium*. Seagrass discards were notably high, reflecting the impact on habitat stability. Bycatch species

***Squillidae* spp., accumlated in a small mound at the Munaikadu. © Bhavanesh.**

such as *Terapon puta* and *Squillidae spp.,* though of low commercial value, are repurposed for poultry and aquaculture feed, while *Turbinella pyrum* is collected for decorative purposes. This unintended exploitation contributes to resource depletion and ecosystem destabilization. Traditional fishers reported a significant decline in fish stocks, with daily earnings dropping from Rs 1,500–2,000 to Rs 200–500 over the past decade, forcing many to migrate for alternative livelihoods, eroding traditional fishing knowledge.

The findings emphasize the urgent need for sustainable fisheries management. The implementation of selective fishing gear and bycatch reduction technologies (BRT) can mitigate ecological impacts and support fish stock recovery. Community-based resource management and alternative livelihood opportunities are essential to enhance socio-economic resilience. Addressing these challenges requires collaborative efforts to balance ecological sustainability with the socio-economic needs of coastal communities.

Bycatch discarded on the shore of Vedalai landing site. © Bhavanesh.

Discarded bycatch species at Munaikadu and Vedalai landing centers in Palk Bay and the Gulf of Mannar.

	Scientific name	Common name	Local name	IUCN Red List	Location	
1	*Sorsogona tuberculata*	Tuberculated Flathead	Nilanthatti	LC	MK	VP
2	*Echeneis naucrates*	Live Shark Sucker	Pilal Otti	LC	MK	-
3	*Plotosus canius*	Grey Eel Catfish	Aak Keluthi	LC	MK	-
4	*Caranx* sp.	Trevally	Parai	NE	MK	-
5	*Aurigegula fasciata*	Stripped Pony fish	--	NE	MK	-
6	*Netuma thalassina*	Gaint Sea Catfish	Keluthi	LC	MK	-
7	*Terapon puta*	Small Scale Terapon	Kichan	LC	MK	VP
8	*Luidia hardwicki*	NA	Star	NE	-	VP
9	*Pentaceaster* sp.	NA	Star	NE	-	VP
10	*Protoreaster linck*i	Red-knobbed Starfish	Star	NE	-	VP
11	*Goniodiscaster scaber*	Biscut Sea Star	star	NE	-	VP
12	*Pentaceraster regulus*	NA	Star	NE	-	VP
13	*Temnopleurus toreumaticus*	NA	Morai	NE	-	VP
14	*Salmacis virgulata*	NA	Morai	NE	-	VP
15	*Echinodiscus auritus*	NA	NA	NE	-	VP
16	*Portunus pelagicus*	Blue Swimming crab	NA	NE	-	VP
17	*Alpheus* sp.	NA	Era	NE	MK	-
18	Squillidae spp.	Mantis Shrimp	Era puchii	NE	MK	-
19	*Philyra adamsii*	NA	NA	NE	MK	-
20	*Carpilius maculatus*	Seven-eleven Crab	NA	NE	-	VP
21	Decapoda spp.	Spider Crab	NA	NE	MK	-
22	*Neoliomera pubescens*	Strawberry Crab	NA	NE	-	VP
23	*Rhinolambrus* sp.	NA	NA	NE	-	VP
24	*Charybdis natator*	NA	Paru Nandu	NE	-	VP
25	Portunidae spp.	NA	NA	NE	-	VP
26	*Portunus spp.*	NA	NA	NE	-	VP
27	Decapoda spp.	NA	NA	NE	MK	VP
28	*Pitar erycina*	NA	NA	NE	-	VP
29	*Placuna placenta*	Windowpane Oyster	NA	NE	MK	-
30	*Malleus malleus*	Hammer Oyster	Kodari Chipi	NE	-	VP
31	*Mimachlamys sanguinea*	NA	Shiva vari chipi	NE	MK	VP
32	*Siliqua radiata*	NA	NA	NE	MK	-
33	*Anadara inaequivalvis*	NA	NA	NE	MK	-
34	*Laevicardium attenuatum*	NA	Manja Chipi	NE	-	VP
35	*Acrosterigma maculosum*	NA	NA	NE	-	VP
36	*Pinna muricata*	Thorny Fan Mussel	Aaku	NE	-	VP
37	*Pinctada fucata*	Indian Pearl Oyster	NA	NE	-	VP
38	*Paphia textile*	Textile Venus	NA	NE	MK	-
39	*Pteria chinensis*	NA	NA	NE	-	VP
40	*Pteria avicularia*	Swift Wing Oyster	NA	NE	-	VP
41	*Pugilina cochlidium*	Melon Conch	Pancimuli	NE	MK	VP
42	*Lambis lambis*	Spider Conch	NA	NE	MK	VP
43	*Cerithium* sp.	NA	NA	NE	MK	-
44	*Siliquaria* sp.	NA	Thundampar	NE	-	VP

	Scientific name	Common name	Local name	IUCN Red List	Location	
45	*Bufonaria rana*	Common Frog Shell	NA	NE	MK	-
46	*Chicoreus ramosus*	Branched Murex	Yanaimuli	NE	-	VP
47	*Notocochlis gualteriana*	Comma Necklace Shell	Amiyankaas	NE	-	VP
48	*Tonna dolium*	Spotted Tun	Sirataisangu	NE	MK	VP
49	*Turbinella pyrum*	Sacred Chank	Kulisangu	NE	-	VP
50	*Architectonica perspectiva*	Perspective sundial	NA	NE	MK	-
51	*Natica tigrina*	Tiger Moon Snail	NA	NE	MK	-
52	*Conus tessulatus*	Tessellate Cone	NA	NE	MK	-
53	*Rapana rapiformis*	Turnip Shell	NA	NE	-	VP
54	*Harpulina lapponica*	Brown-Lined Volute	NA	NE	-	VP
55	*Unedogemmula indica*	Indian Turrid	NA	NE	-	VP
56	*Turritella attenuata*	Screw Shell	Koburasangu	NE	-	VP
57	*Angaria plicata*	NA	NA	NE	MK	-
58	*Umbonium moniliferum*	NA	NA	NE	MK	-

NA—Not available | NE—Not Evaluated | LC—Least Concern | MK—Munaikadu | VP—Vedalai Port.

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