

## Original Research Article

# Beach Seine Fisheries in the United Arab Emirates on Sea of Oman

### Abstract

The catch of beach-seine operating in East Coast of the United Arab Emirates during the period from January to December 2022 was investigated. The catch composition was represented by 37 species belong to 22 families. Engraulidae, Leiognathidae, Clupeidae and Carangidae were the most dominants families, represented by 34.21, 22.62, 19.28 and 11.14% respectively. A total of 46210kg of fish were caught by Fourty-one beach seines in the study areas. Monthly CPUE ranged from 430 to 1446kg per operation. The highest CPUE was recorded in March, while the lowest CPUE was in July. In the present study, the average catch of beach seine was 1127.07kg/haul/boat.

**Keywords:** Beach-Seine, East Coast, Sea of Oman, catch composition, United Arab Emirates

### 1. Introduction

Fisheries management includes different management measures, including technical adjustments and regulation of the fishing gears that are important to achieve fisheries sustainability e.g. on height and mesh size to improve the selective properties of fishing gear so that bycatches of non-targeted fish are reduced [1]. According to [2] seine net is a very long net with or without a bag in the center, which is set either from the shore or from a boat for surrounding a certain area to operate with two long ropes fixed to its ends for hauling and herding the fish. Seine nets are classified into two categories, beach seine/shore seine and boat seine with and without cod-end [3]. Normally beach seines were operated in shallow water bodies targeting the coastal pelagic shoals [4]. The minimum depth of operation for the beach seine was reported about 2m [5, 6], while the maximum depth is 18m [7]. Various studies have been reported on the design, operation, and economics with the fishery of beach seines in Indian ocean [4,5,6,8,9,10, and 11]. In the United Arab Emirates, traditional beach seine locally called *dhaghwa* operated by using motorized fiber glass boat in the coastal area on Sea of Oman. Beach seine fisheries are managed by input controls, including spatial and temporal closure and gear restrictions including length of nets and mesh sizes, i.e., nets with mesh size less than 8.0cm is prohibited for finfish and mesh size less than 0.63cm (mesh bar) is prohibited for sardine and anchovy. The beach seine is widely used along the East Coast of the United Arab Emirates for many commercially valuable fish species especially those that have immigrated from the Sea of Oman. Although the important of beach seine fisheries, no information about size and species composition of the beach seine catch available. The aim of the present work is to study the size and species composition of the inshore species collected by beach seine from the East Coast of the United Arab Emirates on Sea of Oman to enable us to manage the beach seine operation in the mentioned area.

### 2. Materials and Methods

Prior to the study, a survey was conducted to determine the number of beach seine units operated in the eastern area of the UAE on the Sea of Oman. The survey was based on field trip to the different sites and personal interviews of beach seine operators. The study was conducted in East Coast of the United Arab Emirates on Sea of Oman during the period from January to December 2022 (Figure 1).

To collect data, three locations were chosen to monitored fish caught by beach seine. The reason to select those locations due to beach seines were most numerous in these areas. Catch data for beach seines were monitored from the study areas and information such as date, place, amount of catch per operation and type of fish caught were collected. Monthly and total catch per unit effort was calculated as total catch of beach seine divided by the number of fishing operations. The catch species were identified to the most possible taxa. Identification procedure was based on morphological characters using finfish identification guide [12].

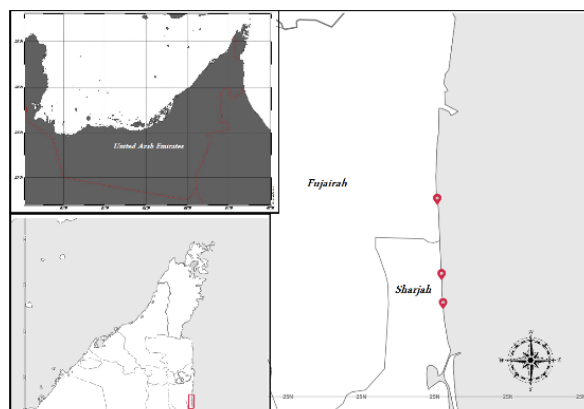


Figure 1. Map showing beach seine sites on the East Coast of the United Arab Emirates

### 3. Results

#### 3.1. Beach seine fisheries

In the East Coast of the United Arab Emirates, the beach seine locally called *dhaghwa* is surrounding net (1000m long) operated with two long ropes (each about 200m long) which is used for towing the net to the beach. Normally beach seines are non-selective fishing gears with small mesh sizes for pelagic fish (Sardine and Anchovy) and big mesh size for others fish. The fishing activity start from October till the end of June every year. A total of 58 beach seine unit were operated in the eastern area of the Emirates, most of which were located in Kalbaa and Fujairah beaches.

#### 3.2 Catch Composition

Table 1 shows the types of fish species obtained during the study period. In terms of numbers, the highest number of species (21) was obtained during February and March, whereas the lowest number of species (3) was recorded during the September. Of the 22 fish families recorded, the dominant families in mass were Engraulidae (34.21%), Leiognathidae (22.62%), Clupeidae (19.28%) and Carangidae (11.14%). The majority of the other species were caught irregularly and presented a low abundance.

Table 1 Composition of species caught by beach seine from East Coast of the UAE

Family	Species	Weight (kg)	%
<b>Commercial species</b>			<b>16.95</b>
Carangidae	<i>Scombroides commersonianus</i>	15.0	0.03
	<i>Atule mate</i>	869.0	1.88
	<i>Seriolina nigrofasciata</i>	65.0	0.14
	<i>Caranx heberi</i>	12.0	0.03
	<i>Carangoides bajad</i>	125	0.27
	<i>Carangoides chrysophyres</i>	163.0	0.35
	<i>Trachinotus blochii</i>	2.0	0.01
	<i>Decapterus russelli</i>	3605	7.80
	<i>Gnathanodon speciosus</i>	290.0	0.63
	Lethrinidae	<i>Lethrinus nebulosus</i>	114.0
<i>Lethrinus lentjan</i>		118.0	0.26
<i>Lethrinus microdon</i>		34.0	0.07
<i>Lethrinus borbonicus</i>		92.0	0.20
Haemulidae	<i>Diagramma pictum</i>	6.0	0.01
	<i>Plectrhincus sordidus</i>	15.0	0.03
Scombridae	<i>Thunnus tonggol</i>	40.0	0.09
	<i>Rastrelliger kanagurta</i>	165.0	0.36
	<i>Scomberomorus commerson</i>	279.0	0.60
Sparidae	<i>Acanthopagrus bifasciatus</i>	4.0	0.01
	<i>Rhabdosargus sarba</i>	38.0	0.08
	<i>Argyrops spinifer</i>	245.0	0.53
Lutjanidae	<i>Lutjanus sp</i>	22.0	0.05
Gerridae	<i>Gerres sp</i>	43.0	0.09
Rachycentridae	<i>Rachycentron canadum</i>	12.0	0.03

Mugilidae	<i>Valamugil seheli</i>	185	0.40
Sphyranidae	<i>Sphyraena sp</i>	42.0	0.09
Mullidae	<i>Parupeneus sp</i>	340.0	0.74
Siganidae	<i>Siganus canaliculatus</i>	658.0	1.42
Crabs	<i>Portunus spp</i>	18.0	0.04
Cephalopods		217.0	0.47
<b>Low value species</b>			<b>29.56</b>
Nemipteridae	<i>Nemipterus bipunctatus</i>	8.0	0.02
	<i>Scolopsis sp</i>	102.0	0.22
Trichiuridae	<i>Trichiurus lepturus</i>	595.0	1.29
Leiognathidae	<i>Leiognathus sp</i>	10455.0	22.62
Ariidae	<i>Arius thalassinus</i>	22.0	0.05
Belonidae	<i>Tylosurus crocodilus</i>	65.0	0.14
Batoid Fishes		515.0	1.11
Others		1895.0	4.11
<b>Pelagic target species</b>			<b>53.49</b>
Clupeidae	<i>Sardinella sp</i>	8910	19.28
Engraulidae	<i>Stolephorus indicus</i>	15810	34.21

### 3.3 Species composition

Thirty-seven species (except Batoides and Cephalopods) were obtained from beach seine with dominant of *Stolephorus indicus* (34.21%), *Leiognathus sp* (22.62%), *Sardinella sp* (19.28%), *Decapterus russelli* (7.80%), *Atule mate* (1.88%) and *Siganus canaliculatus* (1.42%) whereas the remaining species are <1.0% of the total catch.

Figure 2 shows the relative abundance of dominant species caught by beach sein from the East Coast of the United Arab Emirates.

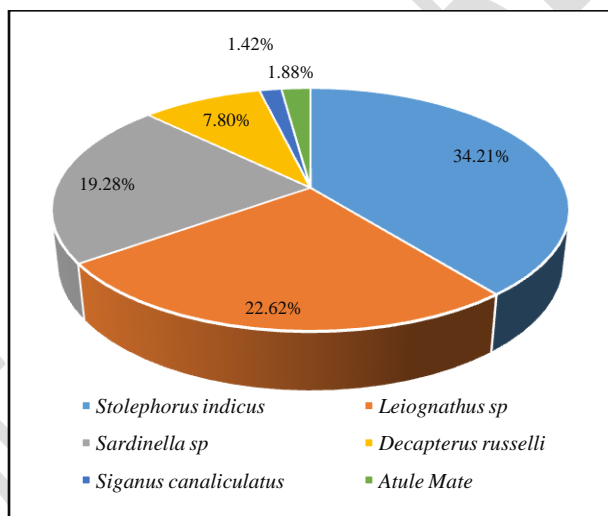


Figure 2. Dominant fish species caught by beach seine from East Coast of United Arab Emirates

A total of 46210kg of fish were caught by Forty-one beach seines in the study areas. Monthly CPUE ranged from 430 to 1446kg per operation. The highest CPUE was recorded in March, while the lowest CPUE was in July (Figure 3). In the present study, the average catch of beach seine was 1127.07kg/haul.

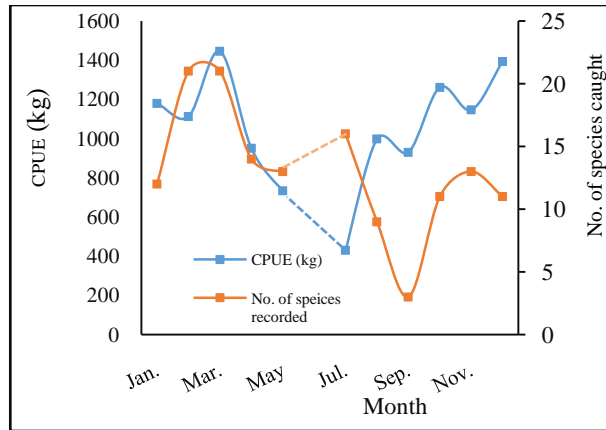


Fig. 3. Monthly catch per unit effort CPUE and number of species caught by beach seine from the East Coast of the UAE. dot lines (no beach seine)

### 3.4 Seasonal variations

Table 2 shows seasonal variation of the species composition and revealed that, during Winter: it is evident that Engraulidae attained the highest percentage (53.08%) followed by Clupeidae (15.46%) and Leiognathidae (9.98%) whereas in Spring: family Clupeidae obtained the highest value of the total catch (33.25%) followed by Engraulidae (19.81%) and Carangidae (19.34%). On the other hand, family Leiognathidae acquired the highest percentage during Summer season (36.87%) followed by Carangidae (31.48%) while during Autumn family Leiognathidae attained the highest value (46.03%); Clupeidae (22.67%) and Engraulidae (17.64%). In general, Winter showed the highest percentage of the total catch (49.0%) followed by Autumn (29.69%); Spring (14.97%) and Summer (6.34%) Figure 4.

Table 2. Seasonal fluctuation (%) of the dominant species caught by beach seine

Species	Winter	Spring	Summer	Autumn
<i>Decapterus russelli</i>	4.95	16.45	24.07	4.66
<i>Stolephorus indicus</i>	53.08	19.81		17.64
<i>Sardinella sp.</i>	15.46	33.25		22.67
<i>Leiognathus sp.</i>	9.98	11.57	36.87	46.03
<i>Atule mate</i>	1.94	2.89	3.72	
<i>Batoides</i>	1.63	1.45		
<i>Trichiurus lepturus</i>		1.45	2.05	1.9
<i>Siganus canaliculatus</i>		3.18	1.98	1.6
<i>Carangoides bajad</i>			2.15	
<i>Gnathonodon speciosus</i>			1.54	
<i>Lethrinus lentjan</i>			1.06	
<i>Scomberomorus commerson</i>			4.34	
<i>Argyrops spinifer</i>			1.26	
<i>Nemipterus sp.</i>			2.39	
<i>Sphyraena sp.</i>			1.09	
<i>Parupeneus sp.</i>			11.61	

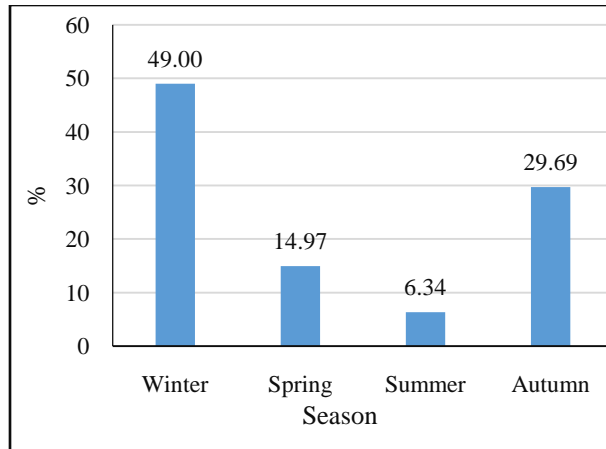


Figure 4. Percentage abundance of catch caught by beach seine in the East Coast of UAE.

Table 3, shows the size composition, average weight, length range and average length of the most common species caught by the beach seine in East Coast of the United Arab Emirates on Oman Sea. It is clear the majority of species were of small sizes.

#### 4. Discussion

Fishing can directly and indirectly affect the biomass and harvested yields of stocks, ecological interactions among species and the productivity and functioning of ecosystems [13].

Table 3. Size composition of the dominant species caught by beach seine

Species	Length range (cm)	Av. Length	Av. Wt (g)
<i>Decapterus russelli</i>	10.0 – 15.0	12.0	15.0
<i>Stolephorus indicus</i>	6.0 – 10.0	8.0	5.0
<i>Sardinella sp</i>	7.0 – 14.0	10.0	4.0
<i>Leiognathus sp</i>	5.0 – 9.0	7.0	3.0
<i>Atule mate</i>	14.0– 18.0	16.0	44.0
<i>Siganus canaliculatus</i>	14.0 – 18.0	15.0	54.0
<i>Carangoides bajad</i>	15.0 – 30.0	23.0	189.0
<i>Gnathonodon speciosus</i>	20.0 – 25.0	23.0	159.0
<i>Lethrinus lentjan</i>	18.0 – 26.0	24.0	230.0
<i>Scomberomorus commerson</i>	60.0 – 68.0	63.0	1560.0
<i>Argyrops spinifer</i>	20.0 – 35.0	26.0	315.0
<i>Nemipterus sp</i>	22.0– 28.0	24.0	220.0
<i>Sphyræna sp</i>	30.0 - 42.0	38.0	346.0

Beach seines, known locally as *dhaghwa*, can be up to 1000m or more in length. One end of the seine is moved rapidly from the shore in a wide arc in an effort to surround fishes; both ends of the seine are then pulled to shore. Speedboats with outboard motors and even four-wheel drive vehicles are used to pull these seine nets to the shore, but traditionally this was done by a large group of men. Its targets the small size species such as sardines and anchovy, incidentally juveniles of commercial species.

The abundant families in mass were Engraulidae (34.21%), Leiognathidae (22.62%), Clupeidae (19.28%) and Carangidae (11.14%). Catches displayed seasonal fluctuation and were dominant by few species, four species providing more than 80% of the total catch. The total catch caught by beach-seine operated in the East Coast of the United Arab Emirates consisted of 46210kg. In South Africa, beach seining captures mostly juvenile slip-mouths, anchovies and sardines [14]. Beach seines in Madagascar catch very small fish that included mostly clupeid species [15], while seining in Thailand yielded mostly juvenile and small sized fish belonging to families Gobiidae, Engraulidae, Leiognathidae and Ambassidae [16].

In the present study, 37 species were identified and significantly lower than that in Mediterania [17] with 60 species; Australia [13] with 70 species in Lake Macquarie and 37 species in St Georges Basin and Australia [18] with total 70 species or even South Africa [14, 19]. On the other hand, the total number of fish species obtained by [20] from Abu-Qir Bay, Egypt close to the present study and less than that recorded by [21] from Port-Said fishing area, Egypt. The catch of beach seine operated in the East Coast of the United Arab Emirates can be classified into different group, the first group represent the targeted fish species in the area and constitute of (53.49%), the second group has commercial species (adult and juveniles) and constitute (16.95%) the last group has non-edible or retained to the sea (29.56%). In the present study three species *Stolephorus indicus*, *Leiognathus sp* and *Sardinella sp* were dominant in mass and providing 76.11% of the total catch. Al-Sayes *et al.*, [22] stated Sardine comprised a considerable portion for the beach catch of the eastern harbor of Alexandria, Egypt. Gray and Kennelly [13] found *Acanthopagrus australis*, *Rhabdosargus sarba* and *Gerres subfasciatus* were most numerically abundant species caught in Australia. The juveniles of commercial species constitute 15-17% of the total catch and intensification of the activity may contribute to collapse of fish stock in Eastern Mediterranean [21].

Beach seines are mainly targeted for the coastal pelagic shoals. The current study revealed that the small pelagic fish represent 53.49% of the total catch caught by beach seine. The study conducted by [22] in Egypt noted that the catches were mainly composed of the commercially important species *Sardinella aurita*, *Sardinella madeirensis* and *S. pilchardus*. Garcia *et al.*, [23] reported the species most frequently found in the catches of the beach seine fishery at Bay of Malaga were *S. pilchardus* and *E. encrasicolus*, mainly as juveniles. In northeastern Mediterranean, [24] reported that *S. pilchardus* accounted for 51% of the catches of the beach seine fishery. The species most frequently found in the catches of the beach seine fishery at Bay of Malaga were *S. pilchardus* and *E. encrasicolus*, mainly as juveniles. The dominant species landed by in Kerala beach, India includes mackerel, sardines, lesser sardines, anchovies, silver bellies, halfbeaks, full beaks, trevallies, herrings, silver whittings, lizardfish and shrimps [9, 11]. Australia and Indonesia are considered as two countries with the most diverse fishery species [25]. The most reason for less variety species being caught was the fact that it being operated from the shore line, with fixed fishing ground from time to time, and much smaller size of Beach Seine. Species diversity in the catch would have theoretically been much higher if it operated in more variety and wider area of fishing grounds. Motlagh *et al.*, [1] concluded that the height and mesh size of beach seine may have an important influence on catch properties.

The corner stone to any assessment of the ecological effects of a fishery is the need to identify and quantify the composition (species, quantities, length/age distributions) of the retained catch (26, 27 and 28). In the present study the Indian scad, *Decapterus russelli* were dominant species for nine months and size composition varied between 10.0 and 15.0 cm. The juveniles of *Gnathodon speciosus*, *Argyrops spinifer* and *Siganus canaliculatus* were dominant for eight months. On the other hand, the pelagic target species *Sardinella sp* and *Stolephorus indicus* were dominant for eight months and the size composition varied between 7.0 and 14.0cm and from 6.0 to 10.0cm respectively. Edwin *et al.*, [4] stated that, to reduce the incidence of juveniles the existing cod-end mesh size of below 10 mm has to be increased to 22 mm and square mesh is recommended at the cod-end region, because of the time hauling the diamond mesh tends to close up preventing the escapement of juvenile fish and beach seining has to be avoided in ecologically sensitive areas. Monteclaro & Abunal [29] reported the capture of undersized fish suggests that this fishing practice may be detrimental to fish stock biomass.

The tendency in seasonal retained catch rates varied between species-specific, for example the retained catch rate of *D. russelli* were greatest in summer while *S. indicus* in winter. On the other hand, the catch of Sardines was outnumbered during spring and the greatest rate of *Leiognathus sp*. occurred in autumn. The operation of beach seine may result in habitat degradation as it is dredged closely to bottom substrates [13]. Wiadnya *et al.*, [30] stated that, with very low catch contribution, and very limited and localized effect on bottom habitats, beach seine should not be treated as equal as their relatives, such as trawls and

other seine nets. The impact of fishing gear on benthic organisms has been emphasized [31, 32, and 33]. However, according to [34] in a study performed in South Africa, beach seine netting does not have a significant detrimental effect on the benthic flora and invertebrate species and the major problem that should be addressed is the impact of beach seine fishery on fish juvenile mortality. Although presumably the levels of juvenile's mortality are high. Clark *et al.*, [35], in South Africa, concluded the mortality attributable to this fishery is less than 0.5%. According to these authors, beach seine fishing is therefore unlikely to inflict significant mortality on overall stocks for the majority of the species.

## 5. References

- Al-Sayes, A.A.; Hashem, M.T.; Soliman, I.A. The beach seine fishery of the Eastern Harbour, Alexandria. *Bull. Inst. Oceanogr. Fish. Egypt.* 1981,7, 323–342.
- Alverson, D.L.; Freeberg, M.H.; Murawski, S.A.; Pope, J.G. A global assessment of fisheries bycatch and discards. *FAO Fish. Tech. Pap.* 1994, 339, 233p.
- Beckley, L.E.; Fennessy, S.T. The beach-seine fishery off Durban, KwaZulu-Natal. *S. Afr. J. Zool.* 1996, 31(4), 186-192.
- Broadhurst, M.K.; Wooden, M.E.L.; Millar, R.B. Isolating selection mechanisms in beach seines. *Fish. Res.* 2007, 88: 56-69.
- Cabral, H.; Duque J.; Costa, M.J. Discard of the beach seine fishery in the central coast of Portugal. *Fisheries Research*, 2003, 63, 63-71.
- Carpenter, K.E.; Krupp, F.; Jones, D.A.; Zajonz, U. *FAO species identification field guide for fishery purposes. The living marine resources of Kuwait, Eastern Saudi Arabia, Bahrain, Qatar and the United Arab Emirates.* Rome. 1997, 293p
- Clark, B.M.; Bennett, B.A.; Lamberth, S.J. Assessment of the impact of commercial beach-seine netting on juvenile teleost populations in the surf zone of False Bay, South Africa. *S. Afr. J. Mar. Sci.* 1994, 14, 255–262.
- Davies, T.E.; Beanjara, N.; Tregenza, T. A socio-economic perspective on gear-based management in an artisanal fishery in southwest Madagascar. *Fisheries Manage. Ecol.* 2009, 16(4), 279-289.
- De Groot, S.J. The impact of bottom trawling on the benthic fauna of the North Sea. *Ocean Mgmt.* 1984, 9, 177–190.
- Edwin L.; Manju Lekshmi, N.; Yasmi, V.S.; Paras Nath Jha. beach seine fishery of india – a review. *fishery technology 2020a*, 57, 225–233
- Edwin, L.; Manju Lekshmi, N.; Dhiju Das P.H. *Keralathile Parambaragatha kambavala sangethika marga nirdheshagal.* Allakal, Publication. 2020b, 5: 50, 4 (in Edwin et al., 2020a)
- El-Mor, M.; El-Etreby, S.; Sapota, M. Species composition and structure of beach seine by-catches in Port-Said fishing harbor, Egypt. *Oceanological Studies*, 2002. 31(3-4 ), 31-42
- Faltas, S.N. Analysis of beach seine catch from Abu Qir Bay (Egypt). *Bull. Natl. Inst. Oceanography. Fish. Egypt.* 1997, 23, 69–82.
- FAO. Fishing Gear types. Beach seines. Technology Fact Sheets. In: *FAO Fisheries and Aquaculture Department* [online]. Rome. Updated 13 September 2001. <http://www.fao.org/fishery/>
- Froese, R.; Pauly, D. *Fish Base: World wide web electronic publication.* www.fishbase.org, version 02/2016. Penang, Malaysia, World Fish Center.
- Garcia, A.; Crespo, J.; Rey, J.C. Contribution a l'etude du littoral sud-Mediterraneen de l'Espagne, avec description d'une pecherie a la seene de plage et de son exploitation. *FAO Stud. Rev.* 1981, 58, 131–147. (in Cabral *et al.*, 2003)
- Gray, C.A.; Kennelly, S.J. Catch characteristics of the commercial beach-seine fisheries in two Australian barrier estuaries. *Fisheries Research*. 2003, 63, 405–422
- Hall, S.J. *The Effects of Fishing on Marine Ecosystems and Communities.* Fish Biology and Aquatic Resources Series 1. Blackwell Scientific Publications, Oxford, 1999, 274p

- Kaiser, M.J.; Cheney, K.; Spence, F.E.; Edwards, D.B.; Radford, K. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. VII. The effects of trawling disturbance on the fauna associated with the tubeheads of serpulid worms. *Fish. Res.* 1999, 40, 195–205.
- Kennelly, S.J. The issue of bycatch in Australia's demersal trawl fisheries. *Rev. Fish Biol. Fish.* 1995, 5, 213–234.
- Lamberth, S.J.; Bennett, B.A.; Clark, B.M.; Janssens, P.M. The impact of beach-seine netting on the benthic flora and fauna of False Bay, South Africa. *S. Afr. J. Mar. Sci.* 1995b, 15, 115–122.
- Lefkaditou, E.; Adamiou, A. Beach-seine fishery at the Thracian Sea. Preliminary results. *Proc. Hell. Symp. Oceanogr. Fish.* 1997, 2, 21–24.
- Lekshmi, M.N.; Dhiju Das P.H.; Leela Edwin. Karamadi- A waning practice of shore seining operation along Kerala, Southwest coast of India. *Raffles B. Zool.* 2019, 61(2): 795-809.
- Monteclaro, H.M.; Abunal E.P. Catch Rates and Composition of the Beach Seine Fishery in Northern Panay Gulf, Philippines: Implications for Management. 2013. *Phil. J. of Nat. Sci.*, 18: 1-10
- Motlagh, S.A.T.; Gorgin, S.; Fazli, H.; Abdolmaleki, S. Effect of beach seine height and mesh size on catch characteristics in the southern part of the Caspian Sea. *International Journal of Fisheries and Aquaculture.* 2011, 3(9), 184-190
- Nunoo, F.K.E.; Azumah, D.Y.M. Selectivity studies on beach seine deployed in nearshore waters near Accra, Ghana. *International Journal of Fisheries and Aquaculture.* 2015, 7(1), 111-126.
- Prena, J.; Schwinghamer, P.; Rowell, T.W.; Gordon, D.C.; Gilkinson, K.D.; Vass, W.P.; McKeown, D.L. Experimental otter trawling on a sandy bottom ecosystem of the Grand Banks of Newfoundland: analysis of trawl bycatch and effects on epifauna. *Mar. Ecol. Prog. Ser.* 1999, 181, 107–124.
- Raj, D. K.; Monalisha, S.; Patterson, J.K. Impacts of Traditional Shore Seine Operation along the Tuticorin Coast, Gulf of Mannar, Southeast India. *Curr. Sci.* 2017, 112 (1), 40-45
- Saleela, K.N.; Dineshbabu, A.P.; Santhosh, B.; Anil, M.K.; Unnikrishnan, C. Shore seine fishery along Poovar in Thiruvananthapuram district, southwest coast of India. *J. Mar. Biol. Ass. India.* 2015, 57(2), 113-116
- Sichum, S.; Tantichodok, P.; Jutagate, T. Diversity and assemblage patterns of juvenile and small sized fishes in the nearshore habitats of the Gulf of Thailand. *Raffles. B. Zool.* 2013, 61(2), 795-809
- Sridhar, A.; Muralidharan, M. Marine fishing craft and gear of Odisha. *Dakshin Foundation, Bangalore.* 2013, 92p
- Surya, S.; Jhonson, B.; Jeena N.S.; Anikuttan, K.K.; Rajkumar, M.; Remya, L.; Shanmuganathan, K.; Abdul Nazar, A.K. An examination on the biological economics of shore seine fishery: A case study from Dhanushkodi Island, Tamil Nadu *Indian J. Mar. Sci.* 2018, 47(10), 2049-2055
- Swathi Lekshmi, P.S.; Chaniyappa, M.; Naik, A.R. Kairampani–The Traditional Shore Seine Fishing of Karnataka. *Asian Agri-History.* 2014, 18(4), 375-381
- Tietze, U.; Lee, R.; Siar, S.; Moth-Poulsen, T.; Båge, H.E. Fishing with beach seines. *FAO Fisheries and Aquaculture Technical Paper, Rome.* 2011, 562, 149p
- Wiadnya, D.G.R.; Wiryawan, B.; Marsoedi; Kusuma, W.E.; Darmawan, A. Characteristics of Beach Seine Fishery of East Java: Facing Ministerial Decree of Marine Affairs and Fisheries No. 2/2015. *Research Journal of Life Science.* 2017, 4(1), 67-75