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 Carangidaewere the most dominants families, represented by 34.21, 22.62, 19.28 and 11.14% in mass respectively. A total of 46210kg of fish were caught by 41 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 1,127.07kg/haul/boat.In conclusion,the use of beach seines for fishing can help to sustainably manage fisheries by targeting specific populations of fish and reducing bycatch. It can also provide food and income for local communities.

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 Omanto 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, threelocations 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].

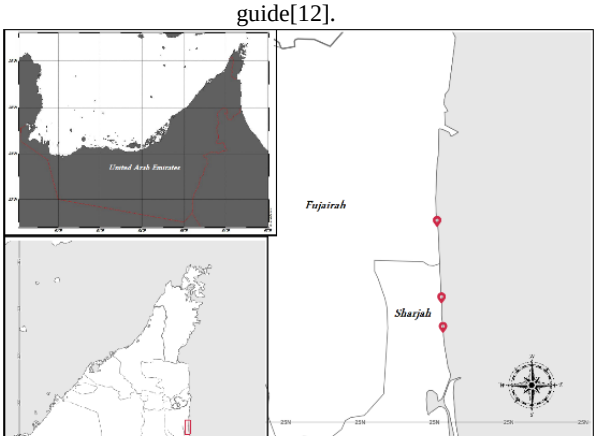

Figure 1. Map showing beach seine sites on the East Coast of the United Arab Emirates

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 tell 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 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)	%
Commercial species			**16.95**
Carangidae	*Scombroidescommersonnianus*	15.0	0.03
	Atule mate	869.0	1.88
	Seriolinanigrofasciata	65.0	0.14
	Caranxheberi	12.0	0.03
	Carangoidesbajad	125	0.27
	Carangoideschrysophyres	163.0	0.35
	Trachinotusblochii	2.0	0.01
	Decapterusrusselli	3605	7.80
	Gnathanodonspeciosus	290.0	0.63
Lethrnidae	*Lethrinusnebulosus*	114.0	0.24
	Lethrinuslentjan	118.0	0.26
	Lethrinusmicrodon	34.0	0.07
	Lethrinusborbonicus	92.0	0.20
Haemulidae	*Diagrammapictum*	6.0	0.01
	Plectrhincussordidus	15.0	0.03
Scombridae	*Thunnustonggol*	40.0	0.09
	Rastrelligerkanagurta	165.0	0.36
	Scomberomoruscommerson	279.0	0.60
Sparidae	*Acanthopagrusbifasciatus*	4.0	0.01
	Rhabdosargussarba	38.0	0.08
	Argyropsspinifer	245.0	0.53
Lutjanidae	*Lutjanus sp.*	22.0	0.05
Gerridae	*Gerres sp.*	43.0	0.09
Rachycentridae	*Rachycentroncanadum*	12.0	0.03
Mugilidae	*Valamugilseheli*	185	0.40
Sphyranidae	*Sphyraena sp.*	42.0	0.09
Mullidae	*Parupeneus sp.*	340.0	0.74
Siganidae	*Siganuscanaliculatus*	658.0	1.42
Crabs	*Portunusspp*	18.0	0.04
Cephalopods		217.0	0.47
Low value species			**29.56**
Nemipteridae	*Nemipterusbipunctatus*	8.0	0.02
	Scolopsis sp.	102.0	0.22
Trichiuridae	*Trichiuruslepturus*	595.0	1.29

Leiognathidae	*Leiognathus sp.*	10455.0	22.62
Ariidae	*Arius thalassinus*	22.0	0.05
Belonidae	*Tylosuruscrocodilus*	65.0	0.14
Batoid Fishes		515.0	1.11
Others		1895.0	4.11
Pelagic target species			**53.49**
Clupeidae	*Sardinella sp.*	8910	19.28
Engraulidae	*Stolephorusindicus*	15810	34.21

3.3 Species composition

Thirty-seven species (except Batoides and Cephalopods) were obtained from beach seine with dominant of *Stolephorusindicus*(34.21%),*Leiognathussp*(22.62%), *Sardinellsp* (19.28%),*Decapterusruselli*(7.80%), *Atule mate* (1.88%) and *Siganuscanaliculatus* (1.42%) whereas the remaining species are <1.0% of the total catch.

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

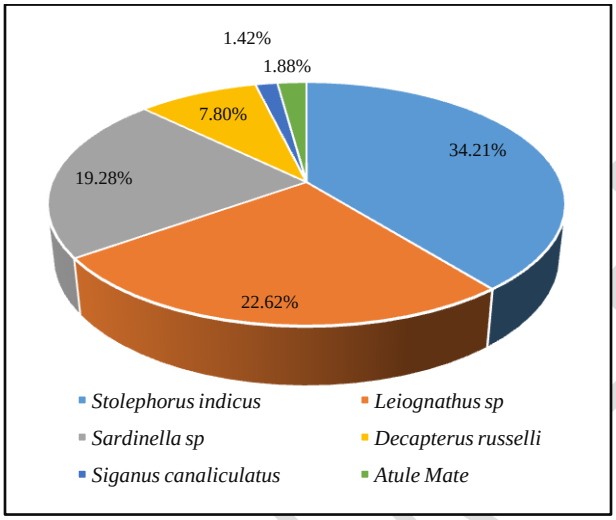

Figure 2.Dominant fish species caught by beach seine from East Coast of United Arab Emirates

A total of 46210kg of fish were caught by 41 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.

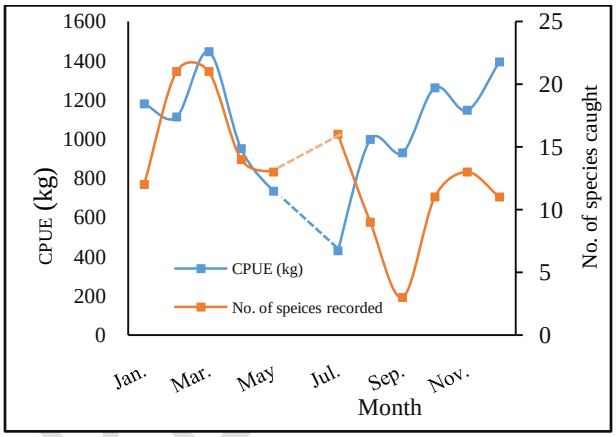

Fig. 3. Monthly catch per unit effort CPUE and number of species caught by beach seine from the East Coast of the UAE.dot lines (no beach seine).

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
Decapterusrusselli	4.95	16.45	24.07	4.66
Stolephorusindicus	53.08	19.81		17.64
Sardinella sp.	15.46	33.25		22.67
Leiognathus sp.	9.98	11.57	36.87	46.03
Atule mate	1.94	2.89	3.72	
Batoides	1.63	1.45		
Trichiuruslepturus		1.45	2.05	1.9
Siganuscanaliculatus		3.18	1.98	1.6
Carangoidesbajad			2.15	
Gnathonodonspeciosus			1.54	
Lethrinuslentjan			1.06	

Scomberomoruscommerson			4.34	
Argyropsspinifer			1.26	
Nemipterus sp.			2.39	
Sphyraena sp.			1.09	
Parupeneus sp.			11.61	

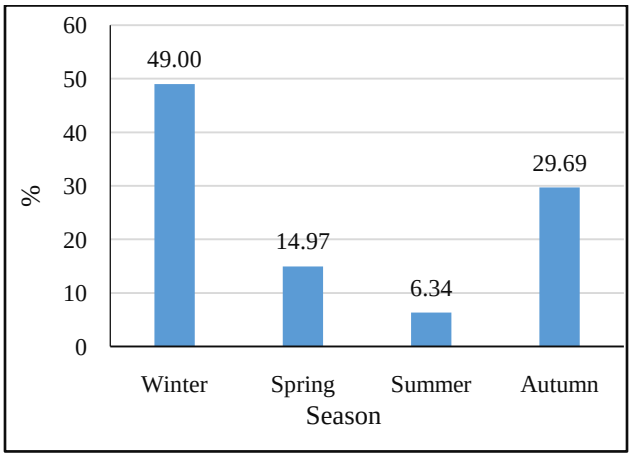

Figure 4.Percentage abundance of catch caught by beach seine in the East Coast of UAE.

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 and conclusion

"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)
Decapterusrusselli	10.0 – 15.0	12.0	15.0
Stolephorusindicus	6.0 – 10.0	8.0	5.0
Sardinella sp.	7.0 – 14.0	10.0	4.0
Leiognathus sp.	5.0 – 9.0	7.0	3.0
Atule mate	14.0- 18.0	16.0	44.0
Siganuscanaliculatus	14.0 – 18.0	15.0	54.0
Carangoidesbajad	15.0 – 30.0	23.0	189.0
Gnathonodonspeciosus	20.0 – 25.0	23.0	159.0
Lethrinuslentjan	18.0 – 26.0	24.0	230.0
Scomberomoruscommerson	60.0 – 68.0	63.0	1560.0
Argyropsspinifer	20.0 – 35.0	26.0	315.0
Nemipterus sp.	22.0- 28.0	24.0	220.0
Sphyraena sp.	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 andsignificantly 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 *Stolephorusindicus*,

*Leiognathussp*and*Sardinellasp*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 *Acanthopagrusaustralis*, *Rhabdosargussarba*and *Gerressubfasciatus*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 *Sardinellaaurita*,*Sardinellamadeirensis*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 whitings, lizardfish and shrimp" [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" [25].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, *Decapterusrusselli* were dominant species for nine months and size composition varied between 10.0 and 15.0 cm. The juveniles of *Gnathonodonspeciosus*, *Argyropsspinifer* and *Siganuscanaliculatus* were dominant for eight months. On the other hand, the pelagic target species *Sardinellasp* and *Stolephorusindicus*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, beachseine 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'smortality are high".Clark *et al.,* [35]in South Africa,concluded the mortality attributable to this fishery is less than 0.5%. Accordingto these authors, beach seine fishing is therefore unlikelyto inflict significant mortality on overall stocksfor the majority of the species.

Beach seines can have both positive and negative impacts on fisheries. The use of beach seines for fishing can help to sustainably manage fisheries by targeting specific populations of fish and reducing bycatch. It can also provide food and income for local communities.

However, beach seines can also have negative impacts on fisheries, particularly if they are not managed properly. Overfishing and the use of illegal or unregulated gear can lead to the depletion of fish stocks and the destruction of habitats. This can have serious ecological and economic consequences for both marine ecosystems and the people who depend on them.

In conclusion, beach seines can be an effective tool for sustainable fisheries management, but they need to be used responsibly and in a way that preserves the health of marine ecosystems. Proper regulation and management can help to maximize the benefits of beach seines while minimizing their environmental impacts.

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