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# Polychaetes associated with seagrass meadows, *Posidonia oceanica* at Salloum Marine Protected Area, Mediterranean Sea, Egypt

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## ABSTRACT

*Posidonia oceanic* meadows are one of the most important subtidal communities in the Mediterranean Sea and are very rich in micro and macrofauna. The present study investigated the associated polychaetes with *P. oceanica* from Salloum Marine Protected Area that extends along the northwestern coast of the Egyptian Mediterranean Sea from autumn 2018 to summer 2019. A total of 37 species of polychaete species were recorded, within 33 genera belonging to 18 families and 6 orders. Order Phylloida was the dominant, represented by 14 species (37.84 % of all species) within 11 genera and 6 families (33.33% of all families). It was followed by orders Eunicida and Terebellida; each was represented by 4 families and 7 species. The results showed that families Nereididae, Syllidae, Serpulidae, and Terebellidae were dominant; each comprised four species and were represented together by 16 species of 43.24 % of all recorded polychaetes. Out of the recorded species, 30 were recorded at sites S1 and S2, declined into 19 and 17 species at S3 and S8, respectively. The abundance of collected polychaetes showed spatial and seasonal fluctuations. A total of 879 individuals of recorded species were obtained. The highest number of individuals was 352 (40.05 %), collected at S1 and declined to 295 at S2 and reached the lowest (117 and 115 individuals) at S3 and S8, respectively. Seasonally, winter had the highest number of individuals (283) and declined sharply to 144 individuals in autumn. These results showed that sites S1 and S2 were characterized by the highest number of species and individuals than the eastern sites, S3 and S8. Thus, there are 31 infaunal species, living either in permanent burrows or temporarily buried in the soft bottom around seagrasses compared with only 6 sessile or sedentary species, living attached to or fixed on *P. oceanica* parts.

## INTRODUCTION

*Posidonia oceanica* (L.) Delile meadows are so important and are considered one of the focal points of the hypothetical underwater museum **(Mojetta, 1996)**. They are one of the most important ecosystems of the Mediterranean Sea **(Buia *et al*., 2001)**.

Those meadows are distributed as scattered oases in the Mediterranean desert; they only occupy 2 % of the bottom with a coverage of 2.5-5.5 million hectares **(Mojetta, 1996; Buia *et al.*, 2001)**. In spite of their exposure to pollution, they are of fundamental importance to the biota of the sea **(Mojetta, 1996)**.

*Posidonia* beds are characterized by a leafy canopy and a horizontal rhizome-root layer, which is appropriate for the associated faunal inhabitants. Moreover, dead *Posidonia* beds still have a rich macrofauna in terms of the number of species and diversity **(Borg *et al.*, 2006)**.

The complex structure of *Posidonia* meadows leads to formation of micro and macrohabitats, representing many biotic communities from both mobile and sedentary bottom dwellers, which explains how a hectare of meadowland produces almost 30 tons of organic material annually, serving as a home for an animal biomass of over 10 tons comprising 500 different specie belonging to all faunal groups from sponges to fish and not less than 400 species from algae **(Mojetta, 1996)**.

Among marine invertebrates, polychaetes, molluscs, isopods, amphipods and decapods are important populations, which transform energy from primary producers (algal epiphytes and detritus of seagrass leafs) into a biomass to the final consumers **(Buia *et al.*, 2000)**. However, the polychaetes are considered to be excellent descriptors of the structure of faunal assemblages, including those in association with seagrasses **(Gambi *et al.*, 1998; Brito *et al.*, 2005)**. Although *P. oceanica* associated fauna lacks particular polychaete species, the morphological structure of this submerged marine plant is favorable for many benthic invertebrates including polychaetes with high richness of less abundant species **(Gambi *et al.*, 1995)**.

From polychaetes, most of syllid species diversity and abundance in shallow water habitats, particularly seagrass *P. oceanica* are negatively correlated with depth. Seagrass meadows of *P. oceanica* have more diversity and richness than bare rocks and sandy habitats. Syllid species varies with substratum and depth, but overall, the most dominant and frequent species in such habitat comprised *Syllis gerlachi* (Hartmann-Schröder, 1960) and *Syllis garciai* (Campoy, 1982) and however, members of the subfamily Syllinae are dominant polychaete species in the *P. oceanica* meadows **(Somaschini & Gravina, 1994)**.

Meadows of *P. oceanica* represent a favorable substrate with different microhabitats for benthic organisms. The unique structure of seagrass is inhabited by different benthic organisms, mainly polychaetes, crustaceans and molluscs **(Çinar, 2003)**. Assemblages of polychaete species in seagrass habitat are characterized by high diversity and abundance **(Somaschini *et al.*, 1994; Ergen *et al.*, 2006)**. In the Mediterranean Sea, several investigations addressed polychaetes associated with *P. oceanica* beds in the western regions **(Giangrande, 1985; Gambi *et al.*, 1989, 1995)**, but the eastern regions of the Mediterranean, scarcely studied this topic, except for Çinar (2003) who investigated polychaetes associated with *P. oceanica* at the coasts of Turkey.

Hence, the present work aimed to asses the faunal composition, status and abundance of polychaetes associated with *P. oceanica* at the Salloum Marine Protected Area on the northwestern Egyptian coast along the Mediterranean Sea.

## MATERIALS AND METHODS

### Study areas

The study area of the present study was chosen at Salloum Marine Protected Area, Matrouh Governorate. This area is at the northern west coast of the Egyptian Mediterranean Sea (Fig. 1). It extends along the coastline from Salloum City (31° 32' 56.09" N and 25° 9' 65.46 "E) at the west to Ras El-Syada (31° 31' 2.71" N and 25° 27' 40.26" E) at the east. The exact position of each site, common name or local (vernacular) names are recorded and given in Table (1).

Along that area, 9 sites were surveyed during the period from autumn 2018 to summer 2019. Out of those sites, only four (S1,S2, S3, and S8) were occupied with variable stands of seagrass meadows of *Posidonia oceanica* at the seaward borders of the first 100 m from the shore line with water depth varying from 1- 6m (Table 1). Therefore, these sites were chosen for the intensive seasonal studies. The other five sites (S4, S5, S6, S7 and S9) were excluded due to increasing depth (> 7- 10 m) and the appearance of seagrass about 700m offshore, which needs more equipment and facilities that were difficult to be obtained.

**Table 1.** The exact position of the study sites at Salloum Marine Protected Area, Matrouh Governorate, Egypt during the study period

| No. | Sites | Latitudes (N) | Longitudes (E) | Seagrass % cover |
|---|---|---|---|---|
| **1** | Salloum Bay Site (S1) | 31° 32' 56.09" | 25° 9' 65.46" | 40.4 |
| **2** | Water Desalination Station (S2) | 31° 32' 73.39" | 25° 9' 11.57" | 3.2 |
| **3** | Salloum Military Hospital (S3) | 31° 32' 85.20" | 25° 10' 89.11" | 3.0 |
| **4** | Public beach (S4) * | 31° 31' 57.35" | 25° 10' 36.19" | 0 |
| **5** | El-Floka beach (S5) * | 31° 31' 39.10" | 25° 11' 12.52" | 0 |
| **6** | Salloum MPA west border (S6) * | 31° 31' 10.19" | 25° 12' 51.19" | 0 |
| **7** | Abu Zureibah west (S7) * | 31° 30' 14.36" | 25° 18' 54.43" | 0 |
| **8** | Ras El- Gara (S8) | 31° 30' 23.02" | 25° 21' 55.23" | 3.0 |
| **9** | Ras- El-Syada (S9) * | 31° 31' 2.71" | 25° 27' 40.26" | 0 |

* Denotes to only survey sites.

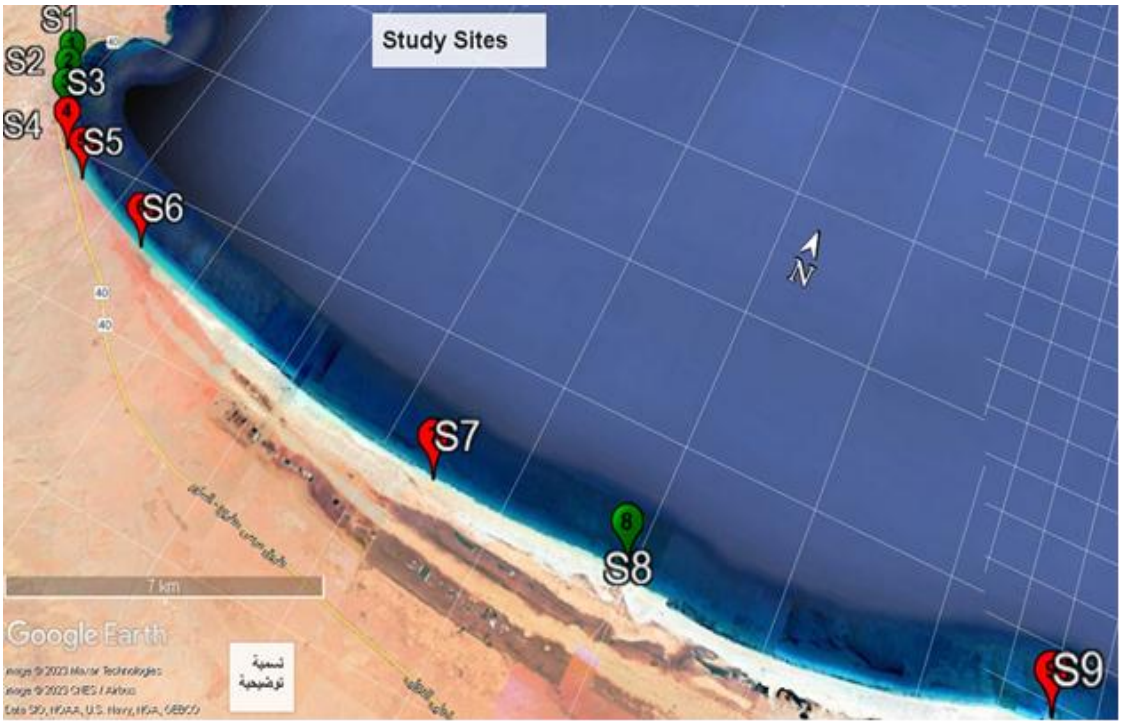


**Fig. 1.** Map showing the surveyed and chosen sites for seasonal intensive studies

**Sampling techniques**

Seasonal sampling for seagrass *P. oceanica* with the associated fauna was carried out between autumn 2018 and summer 2019 at the chosen sites (S1, S2, S3 and S8) using snorkeling and skin diving. At each site, three line intercept transects (**LIT**) were carried out according to **English *et al*. (1997)** along a distance of 100m, starting from the shore line to determine cover percentages of hard, soft and living components including seagrass meadows with the associated fauna.

At each site along LIT, 3 samples of seagrass beds with their associated fauna and soil sediment were directly collected by hand from an area of 25x25 $cm^2$ collection using sharp knife. The seagrass samples were collected during day time and directly put in clear plastic bags including all plants with soil to prevent any associated fauna from escaping out. By using sharp knife, the target seagrass was cut off the hard substrate manually. The plastic bags were tightly closed under water provided with labels, and all *Posidonia* samples of the same site were tied together in a serial sequence with strong soft plastic ribbon until the next step. The size of each collected seagrass sample is around 150g. Each sample was preserved in 10% formaldehyde solution containing few drops of eucine (1%) solution, and then transferred to the laboratory for further analyses.

**Laboratory investigation**

At the laboratory, each sample was washed under tab water and sorted through 0.1 mm mesh sieves to separate the macrofaunal elements from different parts of seagrass, *P. oceanica*. By using binuclear dissecting microscope and stereomicroscope, all faunal elements were sorted and counted as follows:

- All faunal elements in a good condition were sorted and identified by the traditional taxonomical method of identification using available literature and text books as those of **Campbell and Campbell (1976)** & **Fauchald (1977)** on polychaetes and other available text books and literature as those of **Abd Elnaby (2008, 2009a, b, 2019, 2020a, b)**.
- The identified species were preserved in separate vials or jars according to specimen size, containing 10% formaldehyde solution with full labels on date and site of collection.
- Fragments were identified into the nearest genera or groups as possible.
- The status of each species was recorded using the terms of frequent /most common (F) has >10 individuals; common (C), from 4- 10 individuals; and rare (R) which varied from 1-3 individuals in each visit or during all seasons.
- Photos for good identified specimens were taken either directly or by putting on a clear petri dish or on slide, using fitted camera Android HUAWEI Y6 Pro Phone Model (HUAWEI TIT-U02).
- After identification, each species of faunal elements was counted, and then grouped together in the major taxa.

## RESULTS

### 1. Faunal composition of polychaetes among seagrass meadows

The present results indicate that, a total of 37 annelid species were recorded from the meadows of *Posidonia oceanica*, distributed at the shallow water of Salloum Marine Protected Area, Egypt, Mediterranean Sea. These species belong to class Polychaeta within Phylum Annelida, distributed in 6 orders and belong to 18 families and 33 genera. Out of the recorded species, 30 were recorded at sites S1 and S2, but declined into 19 and 17 species at S3 and S8, respectively. These species are listed in Table (2) among which 4 species were alien. Photos of the best and good individuals are given in Plates (I, II).

The present results showed that, members of order Phylloidocida over dominated other orders and was represented by 14 species (37.84 % of all species) within 11 genera (36.67 %) and 6 families (33.33%). It was followed with orders Eunicida and Terebellida, represented by 4 families and 7 species for each. The number of associated polychaete species had declined to 6 species within two families in order Sabellida. However, orders Sednetaria and Spionida were represented by two and one species under only one family, respectively.

The results in Table (2) show that, there are 16 species distributed equally within families Nereididae, Syllidae, Serpulidae and Terebellidae. Each was represented by 4 species (10.81 %), which represented together 43.24 % from all recorded species. The number of species declined to only 3 species (8.11 %) within families Phyllodocidae and Polynoidae and showed a further decline into two species in families Hesionidae and Sabellidae, reaching only one species in the remaining 6 families. The ratios of recorded species within each family are represented in Fig. (2).

Out of the recorded species, only *Eumida sanguinea* , *Syllis gracilis*, *Platynereis dumerilii* and *Hydroides norvegica* were alien species and recorded for the first time from the northwestern Egyptian coast of the Mediterranean Sea.

**Table 2.** Annelid species of Class Polychaeta, Phylum Annelida recorded from the studied sites at Salloum Marine Protected Area during this study

| Order / family | Species | Sites | | | | No. | Status |
|---|---|---|---|---|---|---|---|
| | | S1 | S2 | S3 | S8 | | |
| **1-Order: Eunicida** Family: Dorvilleidae | *Dorvillea similis* (Crossland, 1924) | + | + | + | + | 35 | C |
| Family: Onuphidae | *Hyalinoecia tubicola* (Müller, 1776) | - | - | + | + | 2 | R |
| Family: Nereididae | *Hediste diversicolor* (Müller, 1776) | | + | | | 1 | R |
| | *Neanthes fucata* (Savigny, 1822) | + | + | + | + | 45 | F |
| | *Nereis pelagica* Linnaeus, 1758 | + | + | + | + | 33 | C |
| | *Platynereis dumerilii* (Audouin & Milne-Edwards, 1833)* | + | + | + | + | 13 | R |
| Family: Lumbrineridae | *Lumbrineris californiensis* Hartman, 1944 | + | | | | 1 | R |
| **2-Order:Phyllodocida** Family: Aphroditidae | *Aphrodita* sp. | + | + | | | 9 | R |
| Family: Hesionidae | *Hesione pantherina* Risso, 1826 | + | + | | + | 3 | R |
| | *Psamathi fusca* Johnston, 1836 | + | + | | + | 4 | R |
| Family: Phyllodocidae | *Clavadoce dorsolobata* (Hartmann-Schröder, 1987) | + | + | + | | 4 | R |
| | *Eumida sanguinea* (Orsted, 1843) * | + | + | | | 5 | R |
| | *Eteone* sp. | + | + | + | + | 4 | R |
| Family: Polynoidae | *Lepidonotus* sp. | + | + | + | + | 33 | C |
| | *Harmothoe imbricata* (Linnaeus, 1767) | | + | | | 2 | R |
| | *Aphelochaeta longisetosa* (Hartmann-Schroder, 1965) | + | + | + | | 12 | R |
| Family: Sigalionidae | *Sthenelais boa* (Johnston, 1833) | | + | | | 2 | R |
| Family: Syllidae | *Syllis garciai* (Campoy, 1982) | + | + | + | + | 11 | R |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Syllis gracilis* Grube, 1840 * | + | + | + | + | 33 | C |
| | *Syllis prolifera* Krohn, 1852 | + | + | + | + | 69 | F |
| | *Syllis variegata* Grube, 1860 | + | | | | 1 | R |
| **3-Order: Sabellida** Family: Sabellidae | *Acromegalomma vesiculosum* (Montagu, 1813) | + | + | | | 14 | R |
| | *Pseudopotamilla reniformis* (Bruguière, 1789) | + | + | + | + | 60 | F |
| Family: Serpulidae | *Hydroides norvegica* Gunnerus, 1768* | + | + | + | + | 51 | F |
| | *Serpula vermicularis* Linnaeus, 1767 | + | + | | + | 21 | C |
| | *Spirobranchus triqueter* (Linnaeus, 1758) | + | + | + | | 9 | |
| | *Spirorbis* sp. | + | + | + | + | 345 | F |
| **4-Order: Opheliida** Family: Opheliidae | *Ophelia* sp.1 | + | + | + | + | 35 | C |
| | *Ophelia* sp.2 | + | + | | | 9 | R |
| **5- Order: Spionida** Family: Spionidae | *Polydora* sp. | | + | | | 1 | R |
| **6- Order: Terebellida** Family: Ampharetidae | *Amphicteis gunneri* (Sars, 1835) | | + | | | 1 | R |
| Family: Flabelligeridae | *Flabelligera diplochaitus* (Otto, 1820) | + | | | | 1 | R |
| Family: Pectinariidae | *Pectinaria* sp. | | + | | | 1 | R |
| Family: Terebellidae | *Newamphitrite affinis* (Malmgren, 1866) | + | | + | | 4 | R |
| | *Amphitritides gracilis* (Grube, 1860) | + | | | | 1 | R |
| | *Polycirrus californicus* Moore, 1909 | + | + | + | | 3 | R |
| | *Lanice conchilega* (Pallas, 1766) | + | | | | 1 | R |
| **No. of species/ No. all individuals** | | 30 | 30 | 19 | 17 | 879 | |

* Denotes alien species.

## 2. Abundance of species

Tables (2, 3) display the 879 individuals of different species of polychaetes collected during this study. The number of recorded individuals showed spatial and seasonal fluctuations. The highest number of individuals was 352 collected at S1. However, the number of collected individuals declined into 295 at S2 and showed remarkable and sharp decline into 117 and 115 individuals at S3 and S8.

The same fluctuations were recorded during different seasons. The highest number of individuals was 283 collected during winter 2019. It declined gradually into 244 and 208 individuals during the following spring and summer 2019, respectively, but showed the lowest value (144 individuals) during autumn 2018.

## 3. Status of recorded polychaetes

Results in Table 2 exhibit that, there are 5 frequent species representing 13.51 % of all polychaetes. These species comprised *Pseudopotamilla reniformis*, *Neanthes fucata*, *Syllis prolifera*, *Hydroides norvegica* and *Spirorbis* sp. On the other hand, only 6 species were common (16.22%), while most recorded species (26) were rare and represented 70.27 % from all recorded species.

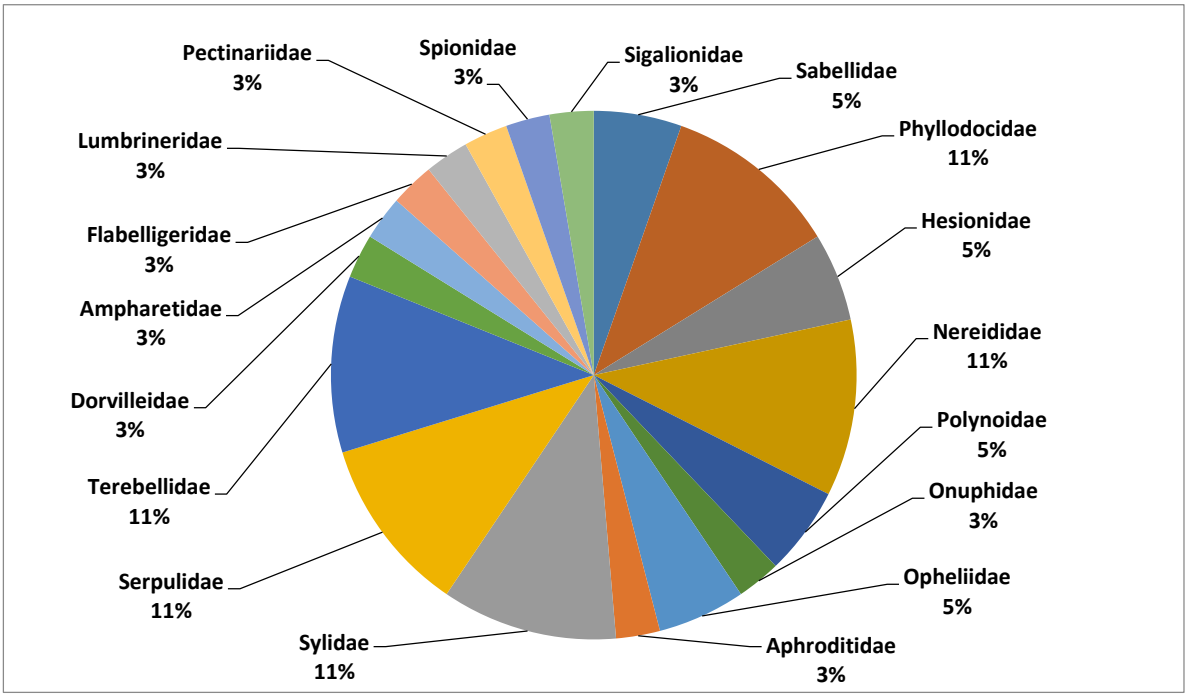


**Fig. 2.** Ratios of polychaete families associated with *P. oceanica* at Salloum Marine Protected Area

**Table 3.** Number of collected individuals during different seasons and study sites at Salloum Marine Protected Area

| Sites | S1 | S2 | S3 | S8 | Total |
|---|---|---|---|---|---|
| **No. of polychaetes** | 352 | 295 | 117 | 115 | **879** |
| **Seasons** | Autumn 2019 | Winter 2019 | Spring 2019 | Summer 2022 | Total |
| **No. of polychaetes** | 144 | 283 | 244 | 208 | 879 |

## 4. Occurrence of polychaetes among *P. oceanica*

The results in Table 2 exhibit that the recorded polychaete species among the seagrass *P. oceanica* meadows belong to two main types of life mode based on their occurrence. Therefore, they can be classified into:

### 4.1. Sessile (sedentary) or fixed associated species

The present results show that there are 6 sessile (sedentary) or fixed epibenthic species of polychaetes (16.22 %); they were recorded attached to seagrass leaves, stems (erect rhizome) and exposed parts of roots (horizontal rhizomes). The sedentary polychaetes were dominated with *Hydroides norvegica*, *Spirorbis* sp. and *Serpula vermicularis*. These species constructed remarkable calcareous white tubes on leaves and stems and were characterized with their appearance as shown in Plates (I &II).

### 4.2. Infaunal polychaetes

The infaunal polychaetes recorded from seagrass meadows of *P. oceanica* comprised both permanent burrowing and temporary berried soft bottom dwelling species. The results showed that, there are 31 species, representing 83.78 % from all recorded associated species. They were occurred in soft sediments around seagrass erect and horizontal rhizomes. The field observations showed that, there are several species constructed burrows in seagrass meadows or buried among eroded leaves around bases of erect stems.

### 4.3. Seasonal variation in occurrence

The results in Table (4) demonstrate the seasonal fluctuation in occurrence of recorded polychaetes during the present study. These data showed that, there were 13 species recorded during all seasons of this study. These species were dominated with *Spirorbis sp., Pseudopotamilla reniformis, Syllis prolefera* and *Neanthes fucata* which occurred continuously at all sites. In contrast, 13 species were recorded and occurred only in one season, such as *Amphicteis gunneri, Polydora* sp., *Flabelligera diplochaitus* and *Lanice conchilega*.

**Table 4.** Spatial and seasonal distributions of recorded polychaete species at Salloum Marine Protected Area during the present study, autumn 2018 summer 2019

| Sites / Species | S1 | | | | S2 | | | | S3 | | | | S8 | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | W | Sp | S | A | W | Sp | S | A | W | Sp | S | A | W | Sp | S | |
| *Dorvillea similis* | | + | + | + | + | | + | + | | | | + | | + | + | | All |
| *Hyalinoecia tubicola* | | | | | | | | | | | + | | | | + | | Sp. only |
| *Hediste diversicolor* | | | | | | + | | | | | | | | | | | W. only |
| *Neanthes fucata* | + | + | + | + | + | + | + | + | | + | | + | | + | | | All |
| *Nereis pelagica* | + | | + | + | + | + | + | | | + | + | + | | | + | + | All |
| *Platynereis dumerilii* | + | + | + | + | | | + | + | + | | | | | | | + | All |
| *Lumbrineris californiensis* | | | | + | | | | | | | | | | | | | S. only |
| *Aphrodita* sp. | + | + | + | | | + | + | + | | | | | | | | | All |
| *Hesione pantherina* | | + | | | | + | | | | | | | | + | | | W. only |
| *Psamathi fusca* | | | + | | + | | + | | | | | | | + | | | A,W , Sp. |
| *Clavadoce dorsolobata* | | | + | | | + | | | | + | | | | | | | Sp, W, |
| *Eumida sanguinea* | | | + | + | | | | + | | | | | | | | | Sp, S |
| *Eteone* sp. | | | + | | | + | | | | | + | | | | + | | W, Sp |
| *Lepidonotus* sp. | + | + | + | + | | | + | | | + | | + | | + | | | All |
| *Harmothoe imbricate* | | | | | + | | | | | | | | | | | | A, only |
| *Aphelochaeta longisetosa* | | + | + | + | | | + | + | | | | + | | | | | W, Sp., S |
| *Sthenelais boa* | | | | | + | | | | | | | | | | | | A, only |
| *Syllis garciai* | | + | + | | + | | + | + | | + | | | | + | | | All |
| *Syllis gracilis* | + | + | + | + | + | + | | + | + | | + | | | | | + | All |
| *Syllis prolefera* | + | + | + | + | + | + | + | + | | + | + | + | | | + | + | All |
| *Syllis variegate* | | + | | | | | | | | | | | | | | | W. only |
| *Acromegalomma vesiculosum* | + | + | + | | | + | | | | | | | | | | | A, W., Sp. |
| *Pseudopotamilla reniformis* | + | + | + | + | | + | + | + | | + | | + | | + | + | | All |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hydroides norvegica* | + | + | + | + | + | + | | | | | | + | | + | + | | All |
| *Serpula vermicularis* | + | + | | | + | + | | + | | | | | | + | | | A, W. S. |
| *Spirobranchus triqueter* | | + | | | | | + | | | | | + | | | | | W, Sp, S |
| *Spirorbis* sp. | + | + | + | + | + | + | + | + | + | + | + | + | | + | + | + | All |
| *Ophelia* sp.1 | | + | + | + | + | + | + | + | | | + | | | + | + | + | All |
| *Ophelia* sp.2 | | | + | | | + | + | | | | | | | | | | W. Sp. |
| *Polydora* sp | | | | | | | | + | | | | | | | | | S., only |
| *Amphicteis gunneri* | | | | | + | | | | | | | | | | | | A , only |
| *Flabelligera diplochaitus* | | + | | | | | | | | | | | | | | | W., only |
| *Pectinaria* sp | | | | | | | | + | | | | | | | | | S., only |
| *Newamphitrite affinis* | | + | + | | | | | | | | | + | | | | | W, Sp. S |
| *Amphitritides gracilis* | | | + | | | | | | | | | | | | | | Sp. only |
| *Polycirrus californicus* | + | | | | | + | | | | + | | | | | | | A, W |
| *Lanice conchilega* | | | + | | | | | | | | | | | | | | Sp. only |
| **No. species** | **30** | | | | **30** | | | | **19** | | | | **17** | | | | |

*Abbreviations: A; Autumn, Sp; Spring, S; Summer, W; Winter and all; All seasons.

On the other hand, 5 species were recorded during two seasons of which 4 were recorded during winter and spring, and only one species was recorded in both autumn and summer. On the other hand, 6 species were recorded during 3 seasons of which 2 species were detected during autumn, winter and spring; one species was obtained during autumn, winter and summer, and 3 species occurred during winter, spring and summer.

## DISCUSSION

Seagrass meadows provide fast and extended area for colonization of several marine organisms comprising invertebrates, fishes, macro and micro algae in addition to the occurrence of mega fauna as marine turtles and dugong, forming under water panorama and natural museum, with high biodiversity including all modes of life (sessile, infanal and nektonic organisms) in all tropical, subtropical and temperate seas and oceans around the world **(den Hartog, 1977; Wahheh, 1982; Jones *et al*., 1987; Nybakken, 1993; Mojetta, 1996; English *et al*., 1997; Karleskint *et al*., 2010)**. Seagrasses and in particular, *Posidonia oceanica* considers the lung of the Mediterranean Sea. The meadows of this species are habitat, nursery and spawning grounds for hundreds of associated species as described by **Romero *et al.*(1992)**. In addition, they serve as a food source for some species **(Mazzella *et al.*, 1989)**.

The present study was conducted on the northwestern part at the Egyptian Mediterranean Sea coast, focusing on sea grass *P. oceanica* meadows at foreshore habitat in the shallow sub-tidal water of Salloum Marine Protected Area including the western neighbor region (Salloum Bay). In the present results, 37 polychaete species were recorded among meadows of *P. oceanica*. They belong to 18 families and 6 orders of class Polychatea of phylum Annelida; they were represented by 879 individuals.

The majority of recorded species were Mediterranean in orging, but only four species comprised *Eumida sanguinea , Syllis gracilis, Platynereis dumerilii* and *Hydroides norvegica* that are alien and recorded for the first time from the northwestern Egyptian cosat of the Mediterranean Sea. These species were previously recorded from the Egyptian Mediterranean coasts and Suez Canal in several works **(Abd Elnaby, 2005, 2008, 2009a, b, 2019, 2020a, b; Abd Elnaby & Gab Allah, 2007; Abd Elnaby & San Martin, 2010, 2011)**. Besides, they were reported in studies from the eastern Mediterranea **(Ben Eliahu, 1972; Cinar, 2003, 2009, 2013;Galil, 2007; Zenetos *et al*., 2010)**.

Although the present study is the first intensive survey on the associated fauna on seagrass, *P. oceanica* at the studied sites; however, the number of recorded species is lower than that recorded previously at other sites along different regions of the Mediterranean Sea. These results are lower than those 46 species of Polychaeta reported by **Belgacem *et al.* (2011)** in Cap Zebib, Tunisia. Moreover, the obtained results are sharply lower than that recorded by **Cinar (2003)** along the eastern Mediterranean. He recorded 85 species and one subspecies of polychaetes from northern Cyprus. Additionally, the obtained results are remarkable lower than those reported by **Somaschini *et al.*(1994)** from Ponza Island (Central Tyrrhenian Sea). Those authors reported 218 polychaete species, a number which is sharply lower than those collected by **Gambi *et al,* (1995)** who reported 321 species, off them 179 species were occurred on the leaf stratum, compared with 101 species on the rhizomes, and 41species were common.

In the present study, spatial variations in polychaete species were detected; the highest number of recorded species was 30, recorded at S1and S2, which declined to a remarkable decrease of 19 and 17 species at S3 and S8, respectively, in the eastern side. This obvious variation may be due to topography of these sites as western sites (S1&S2) are more sheltered than eastern sites (S3&S8), which are exposed to strong wave action near to the shoreline and low percentage cover of seagrass meadows, which averaged only 3.2 and 3.0 % at the two sites, respectively.

The abundance of recorded species was also lower than those reported in other regions along eastern and central Mediterranean. During the present study, only 879 individuals of all species were collected in Salloum Marine Protected Area. This number is very low compared to the 2244 individuals reported in **Cinar (2003)** from northern Cyprus. Moreover, it is less than the 15, 232 individuals of polychaetes reported in **Somaschini *et al.* (1994)** from Ponza Island (Central Tyrrhenian Sea) and the 1,498 worms collected in the study of **Gambi *et al.* (1995)** from Sardinia Bay.

The obtained results showed remarkable spatial and seasonal fluctuations in the number of recorded polychaete species and abundance (number of individuals). Winter has the highest number of both species and individuals, followed by spring. On the other hand, autumn has the lowest number of species and individuals. The present results are in

agreement with the findings of **Gambi *et al.* (1992, 1995)**. They reported higher number of species and individuals in winter, particularly in February.

In the present study, *Pseudopotamilla reniformis, Neanthes fucata, Platynereis dumerilii, Syllis prolifera, Hydroides norvegica* were the most frequent species at all sites. But, *Spirorbis* sp. was the dominant and frequent species at S1 to S8, respectively. However, the previous study showed that, *Syllis gerlachi* **(Hartmann-Schröder, 1960)** and *Syllis garciai* **(Campoy, 1982)** were more or less dominant and frequently recorded. **Somaschini and Gravina (1994)** examined abundant syllid species in the Tyrrhenian Sea and found that dominant polychaete species in the *P. oceanica* beds belong to subfamilies Eusyllinae and Syllinae but members of subfamilies Exogoninae and Eusyllinae dominated in mud and fine sand substrates.

The field observation and laboratory examination during the present study showed that, there are 31 infaunal polychaetes species, represented 83.78 % from all recorded from *P. oceanica* meadows. These species comprised both permanent burrowing and temporary berried soft bottom dwelling species. They were occurred in soft sediments around seagrass erect and horizontal rhizomes. In contrast, the sessile or sedentary polychaetes were represented by 6 species, dominated with *Hydroides norvegica*, *Spirorbis* sp. and *Serpula vermicularis*. They were occurred on leaves and stems. These results agree well with that reported by **Claudio (2009)**. He reported that, most of polychaete families were burrowers, carnivores and deposit feeders and only three families of the most abundant ones were herbivores, i. e Eunicidae, Nereididae and Syllidae; therefore, the increasing number of infaunal polychates is attributed to best conditions for their feeding habits since the sedimentation was higher because of the lesser shoot density at Lacco Ameno.

The obtained results coincide with those reported in the study of **Gambi *et al.* (1995)**. They recorded that polychaete populations living on the rhizomes and within the matte show higher species richness and abundances than those living on leaf stratum that were collected from the leaves, rhizomes and bottom at Sardinia Bay.

Although the obtained results provided for the first time valuable information and shedded light on certain faunal groups associated with seagrass meadows of *P. oceanica* at Salloum Marine Protected Area, however, other faunal associated groups are in need of further studies.

## CONCLUSION

A total of 37 species of poychaetes were recorded in association with seagrass *P. oceanica* at four sites in Salloum Marine Protected Area, extending along the western Egyptian coast, Mediterranean Sea. The western sites (S1 and S2) are occupied with the highest number of species (30 for each). The number of species was declined eastward to 19 and 17 species at S3 to S8, respectively. The abundance of species took the same pattern and recorded the maximum number of individuals at sites S1and S2. The results

exhibited that, further studies are necessary to address other offshore *P. oceanica* meadows with their other associated biotic elements.

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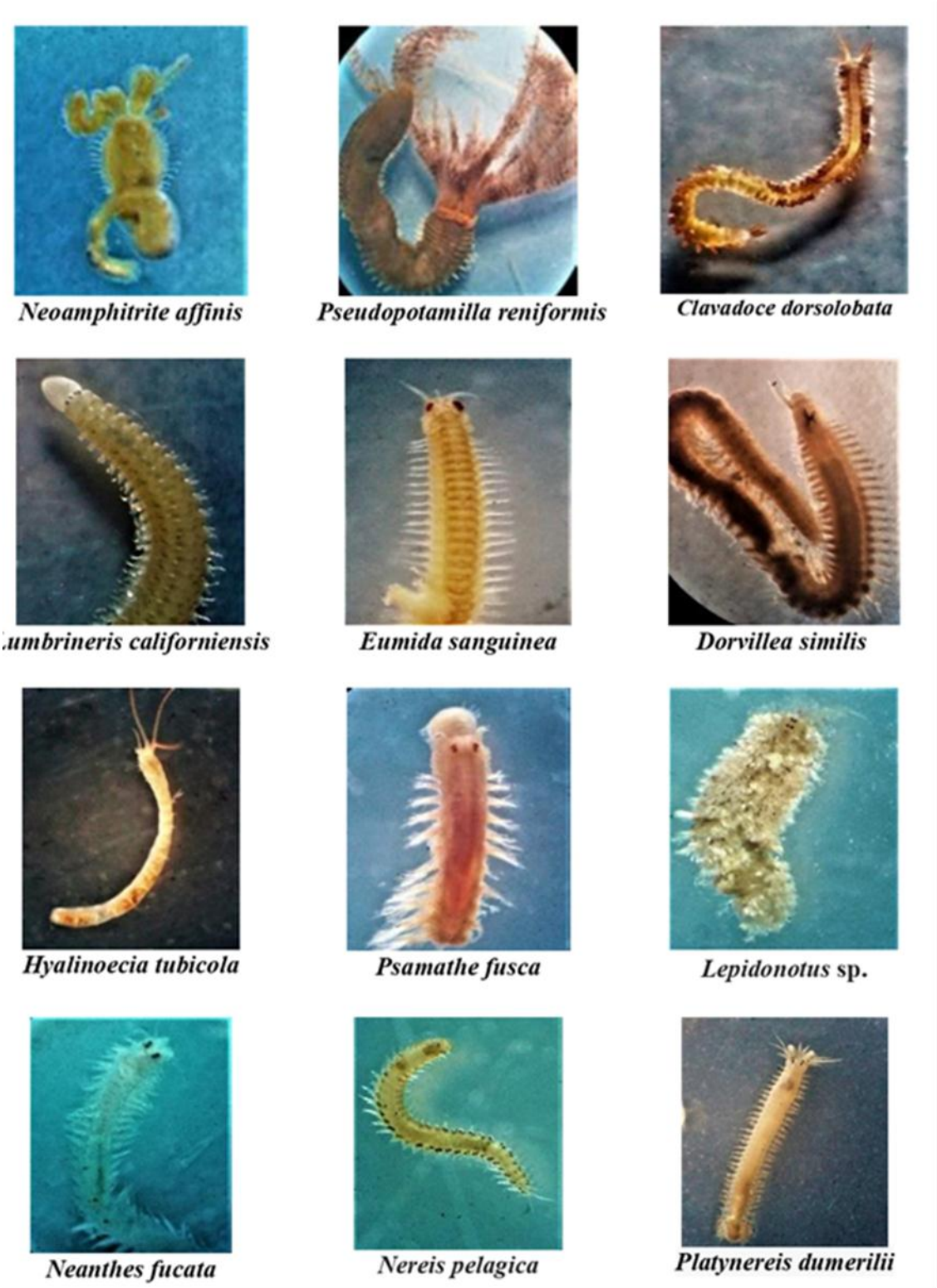


Plate (I): Polychaetes identified from the Salloum Marine Protected Area during this study.

*Amphitritides gracilis*

*Polycirrus californicus*

*Ophelia* sp.1

*Hydroides norvegica*

*Spirobranchus triqueter*

*Spirorbis* sp.

*Sthenelais boa*

*Syllis garciae*

*Syllis gracilis*

*Syllis prolifera*

*Syllis variegate*

*Aphelochaeta longisetos*

Plate (II): Polychaetes identified from the Salloum Marine Protected Area during this study.