Associated faunas of seaweeds and seagrasses in the Southern Rakhine coastal zone

Abstract
A total of 62 taxa of associated faunas were recorded from seaweeds and seagrasses of Southern Rakhine coastal zone. The percentage of associated faunal composition was represented by 55% of Annelida, 27% of Arthropoda, 11% of Mollusca and others. Polychaetes and amphipods were constituted the highest number of species among the other groups. Seaweeds were more favourable for syllid polychaetes than seagrass. Melita zeylanica and Maera quadrimana were commonly distributed in both habitats at all stations. Pardesamine rewa was only recorded from seagrasses of Wet bay station. The associated faunas were more favourable to inhabit in seaweeds than seagrasses. The composition and distribution of associated faunas were varied with seaweeds and seagrasses according to their different structure of plants, types of substrate and sediment retention capacity.

Keywords: associated faunas, amphipods, polychaetes, seaweed, seagrass, Southern Rakhine coast

Introduction
Marine environments, such as mangroves, coral reefs, seaweeds and seagrasses, are important for marine organisms. Seaweed and seagrass habitats support as the primary producer to link with higher trophic level in the marine food chain. Not only their physical structure (blades and leaves) provides food for invertebrate and vertebrate grazers but their highly organic content substrate persuades to detritus and deposit feeders. The diversity and abundance of benthic fauna may vary based on their habitat preference. Anandavelu et al., Sarma & Ganapati, Sarma et al., Jansi & Ramadhas found that the physical and developmental state of algae affected on the composition and abundance of phytal fauna. Moreover the capacity of sediment retaining of the algae was also influenced on the density of some organisms like foraminiferas, polychaetes and nematodes. Naufal & Padmavati also stated that the plant morphology of different seaweed species influence on associated faunal communities.

Benthic faunal studies on different substrate (sand, mud and mangrove swamp) were made from the different coastal regions of the world. But those on the micro- and macrobenthic fauna associated with seaweeds and seagrasses were little. Ranjitham et al., studied the associated fauna of seaweeds and seagrasses in Vellar estuary. Jansi and Ramadhas studied the diversity of fauna associated with four different species of seaweeds of Manakkudy estuary. Jaya et al., reported the diversity of meiofauna associated with nine different species of algae at Visakhapatnam coast. Azhagu et al., recorded twenty-one species of associated fauna in Chaetomorpha aerea. Muralikrishnamurthy studied the distribution of phyal macro and meiofauna on nine species of intertidal algae off Gangavaram, East coast of India. In Myanmar, Ei Ei Mon studied the invertebrate fauna associated with red seaweed, Laurencia sp. from Setse and Kyikkhami coastal areas. The objective of this study is to know the species composition and distribution of associated fauna inhabited in the seaweeds and seagrasses from the Southern Rakhine coastal zone.

Materials and Methods
The study areas, Chaungtha (Lat. 16°57’N, Long. 94°26’E), Magyi (Lat. 17°5’N and Long. 94°27’E) and Wetbay (Lat. 17°10’N and Long. 94°28’E), were situated in the Ayeyarwaddy Region, Southern part of Rakhine coast. Sampling location from the study areas are shown in Figure 1. Seaweeds and seagrass samples were collected randomly from each station at low tide. A PVC frame of 50cm x 50cm was placed over the area covered by seaweeds and seagrasses and the contents of which are picked up and kept immediately in plastic bag separately and preserved in 5% of formaldehyde and seawater. Plants are rinsed thoroughly with water and shaken to dislodge the fauna from them. The specimens were taken into a Petri dish and carefully examined under a binocular microscope. The faunas (polychaetes, mollusks, amphipods, isopods) are identified to genus or species level as possible and others are group (phylum) level in the laboratory by using compound microscope. The identifications are followed by Barnard, Dance, Day, Fish and Myers.

Results and Discussion
The investigation of associated fauna from three stations of Southern Rakhine coastal zone showed that the presence of a high diversity polychaetes and amphipods. Moreover, a number of isopods, gastropods and ostracods were also recorded. In the present study, a total of 62 species of associated faunas were recorded in seaweeds and seagrasses from three stations (Table 1) (Figures 2-6). Of these, 34 species of polychaetes, 9 species of amphipods, 7 species of mollusks, 4 species of isopods, 2 species of tanaids and 1 species of Platyhelminthes, Nemartina, sipunculid and echinoderm respectively. The percentage of faunal composition was represented by 55 % of Annelida, 27% of Arthropoda, 11 % of Mollusca and others. Jaya et al., recorded 18 diverse taxa of meiobenthos from the different species of algae at Visakhapatnam coast. The rich variety of nematodes, harpacticoids, amphipods, polychaetes, ostracods and gastropods were revealed from the four species of algae in Vellar estuary by Ranjitham et al., Azhagu Raj et al., Muralikrishnamurthy found that associated faunal groups like isopods, gastropods, polychaetes and amphipods were high number in the intertidal algae off Gangavaram coast. Azhagu Raj recorded twenty one species of seaweed associated fauna from Pulicat estuary.
Table 1: Classified list of associated faunas

| Phylum         | Class         | Order               | Family             | Genus             | Sr.No. | Species                                    |
|----------------|---------------|---------------------|--------------------|-------------------|--------|--------------------------------------------|
| Platyhelminthes| Turbellaria   | Polycladida         | Leptopanidae       | Leptopana         | 1      | Leptopana sp.                             |
| Sipunculid-ae |               |                     |                    |                   |        |                                            |
| Nemertina      | Anopla        |                     |                    |                   | 2      | Sipunculid worm                           |
| Annelida       | Polychaeta    | Phylloidea          | Flabelligeridae    | Piromis           | 3      | Piromis sp.                               |
| Capitellida    | Malaniidae    | Clymenura           |                    | Clymenure         | 4      | Clymenure sp.                             |
|                |               | Euclymene           |                    | Euclymene lunderitziana Augener | 5      | E. oerstedi Day                         |
|                | Praxillella   | Polyophthalmus      |                    | Polyophthalmus pictus Dujardin | 6      | Polyophthalmus sp.                        |
| Opheliida      | Opeliiidae    | Syllis              |                    | Syllis            | 7      | Syllis amica Quatrefages                  |
|                |               |                     |                    | S. hyalina Grube  | 8      | S. exilis Gravier                         |
|                |               | Syllis              |                    | S. gracilis Grube | 9      | S. nigrifrons Day                         |
|                | Praxillella   | Polyophthalmus      |                    | Polyophthalmus pictus Dujardin | 10     | Polyophthalmus sp.                        |
|                |               | Trypanosyllis       |                    | Trypanosyllis     | 11     | Trypanosyllis sp.                         |
|                | Pionosyllis   |                    |                    | Pionosyllis molingreni McIllosh | 12     | Pionosyllis molingreni McIllosh           |
|                | Spermosyllis  |                    |                    | Spermosyllis capensis Day | 13     | Spermosyllis capensis Day                 |
|                | Sphaerosyllis |                    |                    | Sphaerosyllis seminervoscus Ehlers | 14     | Sphaerosyllis seminervoscus Ehlers        |
|                | Autolytous    |                    |                    | Autolytous sp.    | 15     | Autolytous sp.                            |
|                |               | Scoloplos           |                    | Scoloplos sp.     | 16     | Scoloplos sp.                             |
|                | Hyboscolex    |                    |                    | Hyboscolex sp.    | 17     | Hyboscolex sp.                            |
|                | Lysidice      |                    |                    | Lysidice ninetta Audouin & Milne Edwards | 18     | Lysidice ninetta Audouin & Milne Edwards |
|                | Nematonereis  |                    |                    | Nematonereis unicornis Grube | 19     | Nematonereis unicornis Grube              |
|                | Arabella      |                    |                    | Arabella iricolor Montagu | 20     | Arabella iricolor Montagu                |
| Phyllodoci-da  | Nereididae    | Platyneris          |                    | Platyneris isloito Gravier | 21     | Platyneris isloito Gravier               |
|                | Nereis        |                    |                    | Nereis jacksoni Kinberg | 22     | Nereis jacksoni Kinberg                  |
|                |               | Nereis              |                    | N. trifasciata Grube | 23     | N. trifasciata Grube                      |
|                |               | Nereis              |                    | N. persica Fauvel | 24     | N. persica Fauvel                        |
|                |               |                     |                    | N. opereta Stimpson | 25     | N. opereta Stimpson                      |

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## Table Continued

| Phylum            | Class         | Order       | Family          | Genus         | Sr.No. | Species                                                                 |
|-------------------|---------------|-------------|-----------------|---------------|--------|-------------------------------------------------------------------------|
| Annelida          | Polychaeta    | Nereididae  | Ceratonereis     | 32. Ceratonereis mirabilis Kinberg |
|                   |               |             | Perinereis      | 33. Perinereis capensis Kinberg |
| Sabellida         | Sabellidae    | Euchone     | 34. Euchone sp.  |
| Terebellida       | Terebellid-ae | Terebella   | 36. Terebella ehrenbergi Grube |
|                   | Serpulidae    | Hydroides   | 37. Hydroides uncinata Philippi |
| Mollusca          | Polyclaco-phora | Chitonida  | Chaetopleura sp. | 38. Chaetopleura sp. |
| Gastropoda        | Neogastro-poda | Columbell-ida | Pyrene sp. |
|                   | Mitridae      | Mita        | 40. Mita sp.    |
| Mesogastropoda    | Cerithidae    | Cerithium   | 41. Cerithium sp. |
| Bivalvia          | Pelecypoda    | Cardiidae   | Clinoardium sp. |
|                   | Mytilidae     | Mactra      | 43. Mactra sp.  |
|                   | Setifera      | Setifera sp.|
| Arthropoda        | Crustacea     | Ostracoda   | 45. Ostracod     |
| Pantogoda         | Pycnogon-idae | Pycnogonum | 46. Pycnogonum sp. |
| Amphipoda         | Dexamini-idae | Paradexamine | 47. Paradexamine rewa Myers |
| Eophiliantiidae   | Bircenna      | 48. Bircenna drango Myers |
| Hyalidae          | Hyale         | 49. Hyale galateoe distorta Myers |
| Parhyale          |              | 50. Parhyale hawaiensis Dana |
| Isaeidae          | Gammaroptis   | 51. Gammaroptis atlantica Stebbing |
| Gammaridae        | Melita        | 52. Melita zeylonica Stebbing |
|                   | Elasmopus     | 53. Elasmopus rapox Costa |
| Isopoda           | Aega          | 54. E. pectenicrus Bate |
|                   | Maera         | 55. Maera quadrimana Dana |
| Tanaidacea        | Apsueid-ae    | Apsueudes    | 56. Apsueudes sp. |
| Paratanaid-ae     | Paratanais    | 57. Paratanais batei Sars |
| Isopoda           | Gnathiidae    | Gnathio     | 58. Gnathio maxillories M. Edw |
|                   |               | 59. Gnathio sp. |
|                   | Aegidae       | Aego        | 60. Aego tridens Leach |
|                   |               | 61. Aego sp. Lutken |
| Echinodermata     | Ophiuroid-ae  | 62. Ophiuroid brittle star |

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The distribution and composition of associated fauna from three stations was presented in Figures 64–66 and (Table 2). It can be seen clearly that seaweeds were more favourable for associated faunas to inhabit than seagrasses. Sarma\(^{17}\) suggested that the stable sediment of algal belts, the fronds of algae and the organic detritus content in sediment from the death and decay of algal fronds were supported to different types of organisms. Moreover, the polychaetes were also the highest diversity of species among the other groups in all stations. In contrast to seagrass habitats, seaweed habitats were more number of polychaete species. It may be due to the different structure of plants, types of substratum and the ability of sediment retained by plant Sarma\(^{17}\), Sarma et al.,\(^{3}\) Azhagu Raj et al.,\(^{8}\) Muralikrishnamurty,\(^{9}\) Sarma and Gnapati\(^{2}\), Pati et al.,\(^{18}\) and Mohan Joseph\(^{19}\). Naufal\(^{5}\) found that the morphology of the different leaf blades of the seagrass species was a major factor for the attachment of organisms. Ranjitham et al.,\(^{6}\) reported that the environmental factors including temperature, salinity, turbidity, oxygen concentration, pollution, water movement and level of nutrients also influence animal distributions. Anandavelu et al.,\(^{1}\) suggested that the sediment retention capacity of weeds might play an important role in the assemblage of epifaunal community. Ranjitham et al.,\(^{6}\) Jani and Ramadas\(^{4}\) found that the filamentous algae of Enteromorpha compressa with poor sediment retention capacity may be comparatively lower faunal association than that of other algae.

In this present study, malidanid and syllid polychaetes were constituted in great quantities. The maldanids are highly specialized burrowers feeding on organic particles buried in the mud Day.\(^{14}\) They can be found in the tube forms attached to seaweeds. Mohan Joseph\(^{19}\) stated that the majority of polychaetes inhabited in algal fronds were the tube dwelling or living in the sediments retained by the holdfast.

**Figure 1** Map showing the sample collection sites of the study area.

The syllids are also a large and diverse group of small active worms in this present study and most of which are found creeping over algae. Ei Ei Mon\(^{10}\) indicated that the syllid polychaetes were outnumbered in Laurcencia sp. of Kyaikkhami coastal area. Mohan Joseph\(^{19}\) found that Syllis (Typosyllis) krohnii and Syllis prolifera were abundant in the sediments retained by the algae. Nereid polychaetes are also equally diverse group and inhabited among the complex structures of seaweeds and seagrasses.

A large variety of amphipods and isopods were also found in this study. Their grasping appendages could hold firmly the cylindrical filaments of the algae Sarma and Gnapati.\(^{2}\) Melita zeylanica and Maera quadrimana were commonly distributed in both habitats at all stations. Paradexamine rewa was only recorded from seagrasses of Wetthay station. Ranjitham et al.,\(^{6}\) suggested that seagrass fauna rarely associate to particular seagrass species but respond to a restricted set of physical environmental parameters. Consequently many animal species are common to adjacent beds of different seagrass species. The bivalve mytid mollusks were endowed with their byssus adhere to the holdfasts of the seaweeds. The gastropods, Pyrene sp. and Mitra sp. were distributed on both habitats. Leptoplana sp., the ophiuroids, Pycnogonum sp. and nemartine were also distributed in both seaweeds and seagrasses.

**Figures 2-17** Associated faunas. (2) Leptoplana sp., (3) Sipunculid worm. (4) Nemertine sp., (5) Paralepidonotus sp., (6) Promis sp., (7) Cymenura sp., (8) Euclymene lunderitziana, (9) E. oerstedi, (10) Praxillella sp., (11) Polyophthalmus pictus, (12) Polyophthalmus sp., (13) Syllis amica (14) S. hyaline (15) S. gracilis (16) S. exilis (17) S. nigropharyngea.

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Table 2 The distribution of associated faunas along the study areas

| No. | Species name                  | Chaungtha seaweed | Chaungtha seagrass | Magyi seaweed | Magyi seagrass | Wetthay seaweed | Wetthay seagrass |
|-----|-------------------------------|-------------------|-------------------|---------------|---------------|----------------|-----------------|
| 1.  | Leptoplana sp.                | +                 | +                 | +             | +             | +              | +               |
| 2.  | Sipunculid worm               | +                 | +                 | -             | -             | -              | -               |
| 3.  | Nemertine sp.                 | +                 | +                 | +             | +             | +              | +               |
| 4.  | Paralepidonotus sp.           | +                 | +                 | -             | -             | -              | -               |
| 5.  | Pimia sp.                     | +                 | -                 | -             | -             | -              | -               |
| 6.  | Clymenura sp.                 | +                 | -                 | -             | -             | -              | -               |
| 7.  | Euclymene kunderitziana       | +                 | -                 | +             | -             | -              | -               |
| 8.  | E. oerstedi                   | +                 | -                 | -             | -             | -              | -               |
| 9.  | Praxillella sp.               | +                 | -                 | -             | -             | -              | -               |
| 10. | Polyopthalmus pictus          | +                 | -                 | +             | +             | +              | +               |
| 11. | Polyopthalmus sp.             | +                 | -                 | +             | +             | +              | +               |
| 12. | Syllis amica                  | +                 | -                 | +             | -             | -              | -               |
| 13. | S. hyalina                    | +                 | -                 | -             | -             | -              | -               |
| 14. | S. exilis                     | -                 | -                 | +             | +             | -              | -               |
| 15. | S. gracilis                   | -                 | -                 | +             | +             | -              | -               |
| 16. | S. nigopharyngea              | +                 | -                 | -             | -             | -              | -               |
| 17. | Trypanosyllis sp              | -                 | -                 | -             | -             | -              | -               |
| 18. | Pionosyllis malngreni         | +                 | -                 | -             | -             | -              | -               |
| 19. | Spermooxysyllis capensis      | +                 | -                 | -             | -             | -              | -               |
| 20. | Sphaeroosyllis semiverrucosa  | -                 | -                 | +             | -             | -              | -               |
| 21. | Autorlytous sp.               | -                 | -                 | -             | -             | +              | +               |
| 22. | Scoloplos sp                  | -                 | +                 | -             | -             | -              | -               |
| 23. | Hyboscolex sp.                | -                 | -                 | -             | -             | +              | +               |
| 24. | Lysidice ninetta              | -                 | +                 | -             | -             | -              | -               |
| 25. | Nematonereis unicornis        | +                 | +                 | -             | -             | -              | -               |
| 26. | Arabella iricolor             | -                 | -                 | -             | -             | +              | +               |
| 27. | Platynereis isolata           | -                 | -                 | -             | -             | +              | +               |
| 28. | Nereis jacksoni               | +                 | +                 | -             | -             | -              | -               |
| 29. | N. trifasciata                | -                 | -                 | +             | +             | +              | +               |
| 30. | N. persica                    | -                 | -                 | +             | +             | +              | +               |
| 31. | N. operta                     | -                 | -                 | +             | +             | +              | +               |
| 32. | Ceratonereis mirabilis        | +                 | +                 | +             | +             | +              | +               |
| 33. | Perineris capensis            | +                 | -                 | -             | -             | -              | -               |
| 34. | Euchone sp.                   | -                 | -                 | -             | -             | -              | -               |
| 35. | Oriopsis sp.                  | +                 | +                 | -             | -             | -              | -               |
| 36. | Terebella ehrenbergi          | +                 | +                 | -             | -             | +              | +               |
| 37. | Hydroides uncincta            | -                 | -                 | +             | -             | -              | -               |
| 38. | Chaetopleura apiculata        | +                 | -                 | -             | -             | -              | -               |
| 39. | Pyrene sp.                    | +                 | +                 | -             | -             | -              | -               |
| 40. | Mino sp.                      | +                 | +                 | +             | +             | +              | +               |
| 41. | Cerithium sp.                 | -                 | -                 | +             | +             | +              | +               |
| 42. | Clinocardium sp.              | -                 | -                 | -             | -             | +              | +               |
| 43. | Mactra sp.                    | +                 | +                 | +             | +             | -              | -               |
| 44. | Setifera sp.                  | +                 | +                 | +             | +             | +              | +               |
| 45. | Ostracod sp.                  | +                 | -                 | -             | -             | +              | +               |
| 46. | Pycnogonum sp.                | +                 | +                 | +             | +             | +              | +               |
| 47. | Paradoxamine rewa             | -                 | -                 | -             | -             | -              | -               |
Table Continued

| No. | Species name          | Chaungtha seaweed | Chaungtha seagrass | Magyi seaweed | Magyi seagrass | Wetthay seaweed | Wetthay seagrass |
|-----|-----------------------|-------------------|-------------------|--------------|---------------|----------------|-----------------|
| 48. | Bircenna dronga       | -                 | -                 | -            | +             | +              | +               |
| 49. | Hyale galatiae distorta | +                 | -                 | +            | -             | -              | -               |
| 50. | Parhyale hawaiensis   | +                 | +                 | +            | +             | +              | +               |
| 51. | Gammaropsis atlantica | -                 | -                 | +            | +             | +              | +               |
| 52. | Melia zeylanica       | +                 | +                 | +            | -             | -              | -               |
| 53. | Elasmoster ephippium  | +                 | -                 | -            | +             | -              | +               |
| 54. | E. pecten-irradians   | +                 | -                 | -            | +             | -              | -               |
| 55. | Maera quadrimana      | +                 | +                 | +            | +             | +              | +               |
| 56. | Apsides sp.           | -                 | -                 | +            | -             | -              | -               |
| 57. | Paratanais batei      | -                 | +                 | -            | -             | -              | -               |
| 58. | Gnathia maxillaries   | -                 | +                 | +            | +             | +              | +               |
| 59. | Gnathia sp.           | -                 | -                 | +            | +             | +              | +               |
| 60. | Aega tridens          | +                 | -                 | +            | -             | -              | -               |
| 61. | Aega sp.              | -                 | -                 | -            | -             | -              | -               |
| 62. | Ophiuroid brittle star| +                 | +                 | +            | +             | +              | +               |

|   | Total                  | 36                | 20                | 30            | 20            | 33            | 25              |

Figures 18-32 Associated faunas. (18) Trypanosyllis sp., (19) Pionosyllis malincri, (20) Spermosyllis capensis, (21) Sphaerosyllis semiverrucosa, (22) Autolytus sp., (23) Scoloplos sp., (24) Hybascolea sp., (25) Lyside lineata, (26) Nematoseres unicorns, (27) Araella iricolor, (28) Platynereis isola, (29) Nereis jacksoni, (30) N. trifasciata, (31) N. persica, (32) N. operta.

Figures 33-48 Associated faunas. (33) Ceratonereis mirabilis, (34) Perinereis capensis, (35) Perinereis capensis, (36) Oriopsis sp., (37) Terebellahenribergi, (38) Hydroides uncinata, (39) Chaetopleura sp., (40) Pyrene sp., (41) Mitra sp., (42) Cerithium sp., (43) Clinoanthe sp., (44) Mactra sp., (45) Setifer sp., (46) Ostracod, (47) Pycnogonum sp., (48) Paradexamine rewa.

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Figure 49-63 Associated faunas. (49) Bircenna dronga (50) Hyale galathea distorta (51) Parhyale hawaiiensis (52) Gammaropsis atlantica (53) Elasmopus pectorinus (54) E. rapax (55) Melita zeylanica (56) Maera quadrimana (57) Apsides sp., (58) Gnathia mousiaries (59) Gnathia sp., (60) Aega tridens (61) Paratanais batei (62) Aega sp., (63) Ophiuroid brittle star.

Figure 64 The composition of associated faunas in seaweeds and seagrasses from three stations.

Many species inhabiting seaweeds and seagrasses depend on them for food. The most common are polychaetes, amphipods and gastropods. The feeding relationship of the faunas was also varied. Many are filter feeders, detritus feeders, scavengers or carnivores; algivores ranging from minute crustaceans to large sized gastropods Sarma & Gnapati, Ranjitham, Azhagu Raj, Mohan Joseph, Sarma, et al. 26,28,17,19

Figure 65-67 Percentage composition of associated faunas in seaweeds and seagrasses from three.

Conclusion

It is well known from this study that seaweed and seagrass habitats provide high diversity of associated fauna. These habitats are important for shallow water marine organisms in order to get food and shelter from biotic and abiotic factors (predators and waves). This study revealed that baseline information for associated faunas of seaweeds and seagrasses from Southern Rakhine Costal zone. Seasonal and spatial abundance of associated fauna with respect to these habitats should be continued thoroughly in future. Because of seaweeds and seagrasses and their associated fauna support directly and indirectly to the route of energy transfer linked with the higher trophic level in marine food web, they are needed to be protected from human activities like overharvesting of seaweeds and seagrass from their habitats, habitats lost by coastal development, recreational activities and beach cleaning.

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Conflict of interest

The author declares that there is no conflict of interest.

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