6. ECOLOGY OF AMPHIPODS

6.1. Introduction

The amphipods are most important benthic faunal groups in the marine ecosystems. They are significant not only as food for fishes and some larger crustaceans but also play an important function in the decomposition of wastes in the cyclic process of nutrients. Since they are endemic in many environments, the biodiversity of amphipods is a tool to assess the good health of any biotope. The present study investigates species composition, diversity, richness and evenness of gammaridean amphipods at four ecosystems of Pulicat lake.

6.2. Materials and methods

The samples were collected using Petersen grab (23 X 23 cm). The sorted amphipods were preserved in 4% buffered formalin and animals were stained with 1% Rose Bengal solution. The animals were identified using standard reference (Barnard and Karaman, 1991; Lincoln, 1979; Lecroy, 2002) and expressed in Nos/sq. meter. The species diversity (Shannon - Weiner, 1963); richness (Margalef, 1957) and evenness index (Pielou’s, 1966) were calculated.

**Shannon – Wiener Diversity Index (H’)**

To assess the amphipod diversity, the following formula of Shannon and Wiener (1963) was used.

\[
H' = -\sum_{i=1}^{n} p_i \log p_i
\]
Which can be rewritten as

\[ H' = \frac{3.3219 (N \log N - \sum ni \log ni)}{N} \]

where \( H' \) = Species diversity
\( ni \) = Number of individuals of the \( i^{th} \) species
\( N \) = Total number of individuals in the collection
and \( \sum \) = Sum

**Species Richness (D')**

Species richness was calculated using the following formula given by Margalef (1957)

\[ D = 1 - C \]
where, \( C = \sum Pi \times 2 \)
\( Pi = \frac{ni}{N} \)
\( ni \) = Number of individuals of \( i_{1,2} \) etc and
\( N \) = Total number of individuals

**Pielou’s evenness (J')**

Evenness or equality (J), in the distribution of individuals among various species was calculated, using the formula of Pielou (1966).

\[ J' = \frac{H'}{\log S} \text{ or } \frac{H'}{\log 2s} \]

Where, \( J' \) = Evenness
\( H' \) = Species diversity and
\( S \) = Total number of species

6.3. Result

Sixteen species of amphipods were identified in the present study. Their taxonomical position and their key characters were presented here under
6.3.1. Species composition

A total of 16 species of amphipods were recorded during the present study (Table.5). Among, 14 species were recorded from both mangrove and seagrass ecosystem followed by 13 species from oyster bed and 11 species in muddy substratum (Fig.38 & 39).

Table. 5. Composition of amphipod in the present study

<table>
<thead>
<tr>
<th>S.No</th>
<th>Species</th>
<th>Oyster Bed (St-I)</th>
<th>Mangrove ecosystem (St-II)</th>
<th>Seagrass ecosystem (St-III)</th>
<th>Muddy Substratum (St-IV)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Ampithoe rubricata</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td><em>Ampithoe ramondi</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td><em>Isaea montagui</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td><em>Elasmopus rapax</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
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</tr>
<tr>
<td>5</td>
<td><em>Maera othonis</em></td>
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<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td><em>Melita</em> sp.</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>7</td>
<td><em>Gammarus maculata</em></td>
<td>+</td>
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<td>+</td>
<td>+</td>
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<tr>
<td>8</td>
<td><em>Gammarus locusta</em></td>
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<td>+</td>
<td>+</td>
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<tr>
<td>9</td>
<td><em>Dexamine</em> sp.</td>
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<td></td>
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<td>+</td>
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<tr>
<td>10</td>
<td><em>Hyale honoluluensis</em></td>
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<tr>
<td>11</td>
<td><em>Grandidierella</em> sp.</td>
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<tr>
<td>12</td>
<td><em>Leptocheirus</em> sp.</td>
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<tr>
<td>13</td>
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<tr>
<td>14</td>
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<td>15</td>
<td><em>Talorchestia</em> sp.</td>
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<tr>
<td>16</td>
<td><em>Pectenogammarus</em> sp.</td>
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</table>
1. *Ampithoe rubricata* (Fig.22)

- **Class**: Crustacea
- **Subclass**: Malacostraca
- **Superorder**: Peracarida
- **Order**: Amphipoda
- **Suborder**: Gammaridea
- **Family**: Ampithoidae
- **Genus**: *Ampithoe*
- **Species**: *rubricata*

Body elongate and compressed. Head with small oval eyes. Antennae 1, peduncle article 3, almost half length of article 2. Flagellum slender upto about 35 articulate. Antennae 2 peduncle robust, flagellum short, upto about 15 articulate. Gnathopod 1 moderately setose, basis with moderately large anterodistal lobe, propodus oval, palm oblique, weakly convex, delimited by small spine, dactylus longer than palm. Uropod 3 peduncle inner distal margin with about 6 small spines, outer ramus with 2 strong hooks and small group of long distal setae, inner ramus with long apical setae and 3 to 4 small spines.
2. *Ampithoe ramondi* (Fig. 23)

- **Class**: Crustacea
- **Subclass**: Malacostraca
- **Superorder**: Peracarida
- **Order**: Amphipoda
- **Suborder**: Gammaridea
- **Family**: Ampithoidae
- **Genus**: *Ampithoe*
- **Species**: *ramondi*

Length up to about 13mm, colour greenish speckled with brown or uniform reddish brown with white markings. Head with prominent truncated lateral lobes, eyes moderately large, rounded-oval. Antennae 1 peduncle article 3 about one third length of 2, flagellum very long and slender, up to 50 articulate, antennae 2 shorter than 1. Gnathopods very densely setose, basis with very large anterodistal lobe. Gnathopod 1 carpus with 2-4 spines on anterior margin, posterior lobe laminar, propodus oval, palm convex, delimited by stout spine. Uropod 3 peduncle with about 5-8 small spines on inner distal margin, outer ramus with 2 strong hooks, inner ramus with 2-3 small spines and few long setae.
3. *Isaea montagui* (Fig.24)

Class : Crustacea  
Subclass : Malacostraca  
Superorder : Peracarida  
Order : Amphipoda  
Suborder : Gammaridea  
Family : *Isaeidae*  
Genus : *Isaea*  
Species : *montagui*  

Scale Bar – 2mm

Colour reddish brown or red and yellow banding. Coxal plates 1-5 elongate. Epimeral plate 3 posterodistal angle with small tooth. Head, lateral lobes broadly angular, apex narrowly rounded, eyes very large, oval, bright red in colour. Antennae 1 about one third body length, peduncle article 2 slightly longer than 1 and 3, flagellum as long as peduncle, upto about 12-articulate, accessory flagellum 6-articulate. Antennae 2 peduncle elongate, moderately robust, article 4 little longer than 5, flagellum upto about 11-articulate. Gnathopod 1 small, setose, propodus broadly oval, about as long as carpus, palm convex, spinulose, delimited by 2-3 splender spines, dactylus elongate. Uropod 3 rami slender, sub equal, longer than peduncle. Telson rounded.
4. *Elasmopus rapax* (Fig.25)

Class : Crustacea
Subclass : Malacostraca
Superorder : Peracarida
Order : Amphipoda
Suborder : Gammaridea
Family : *Melitidae*
Genus : *Elasmopus*
Species : *rapax*

Body robust, smooth, coxal plates moderately large, plate 1 rounded anteriorly. Epimeral plate 3 quadrate, posterior margin weakly crenulate. Head, lateral lobes broadly rounded, eyes large, oval. Antennae 1 robust, half body length, pedicle article 1 and 2 subequal length, article 3 half length of 2, flagellum setose. Accessory flagellum small, 2 articulate. Antennae 2 much shorter than 1, slender, peduncle articles 4 and 5 subequal. Gnathopod 1 basis robust, propodus oval, little longer than carpus, both strongly setose, palm oblique, convex, delimited by 2 small spines. Uropods 1-2 spinous, uropod 3 rami broad, truncated distally, spinous, outer rami slightly longer than inner. Telson deeply cleft, each lobe rounded apically with small group of submarginal spines.
5. *Maera othonis* (Fig.26)

Class : Crustacea
Subclass : Malacostraca
Superorder : Peracarida
Order : Amphipoda
Suborder : Gammaridea
Family : Melitidae
Genus : *Maera*
Species : *othonis*  

Body slender, smooth. Coxal plate 1 produced acutely forwards, plate 2 longer than 1 and 3. Epimeral plate 3 posterodistal angle acute, distal margin serrate. Head with lateral lobes rounded, eyes small oval to reniform. Antennae 1 about two-thirds body length, slender, peduncle article 1 quite robust and little shorter than article 2, article 3 small, flagellum longer than peduncle, accessory flagellum 3-7 articulate. Antennae 2 much shorter than 1 and very slender. Gnathopod 1 carpus and propodus about equal length, densely setose, propodus oval, palm poorly delimited. Pereopods 5-7 robust, basis oval, posterior margin serrate. Uropod 1 peduncle with large proximal lower-marginal spine and strong distal spine. Uropods 1-2 rami subequal, spinose. Telson deeply cleft, lobes divergent, each with acute apex and small subapical spinule and tooth.
6. *Melita* sp. (Fig. 27)

<table>
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</thead>
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<tr>
<td>Genus</td>
<td><em>Melita</em> sp.</td>
</tr>
</tbody>
</table>

Scale Bar – 1.8mm

Body slender and compressed, pleon often tooth and urosome often with dorsal teeth and spines. Coxal plates small or moderately large. Antennae 1 longer than 2. Accessory flagellum variable, 2 or more articulate. Uropods 1-2 biramous, spinose, uropod 3 reaching well beyond uropod 1, outer ramus 1 articulate or with spine like distal article, inner ramus very small and scale like. Telson deeply cleft.
7. *Gammarus maculata* (Fig.28)

Class : Crustacea  
Subclass : Malacostraca  
Superorder : Peracarida  
Order : Amphipoda  
Suborder : Gammaridea  
Family : Gammaridae  
Genus : *Gammarus*  
Species : *maculata*  

Scale Bar – 2.5mm

Urosome segments 1 and 2 with the pair of dorsal spinules. Epimeral plate 3 distal angle with the small tooth. Head with broad lateral lobes, narrowly rounded epically; eyes large kidney shaped. Antennae fringed with long ventromarginal setae; antenna 1 more than half body length, peduncle articles 1 and 3 about equal length, article 2 little longer, article 1 distroventral angle with slender spine, flagellum upto about 17-articulate; accessory flagellum elongate, about 6-articulate. Antenna 2 equal to length of I, article 3 distoventral angle with slender spine, peduncle articles 4 and 5 about equal, flagellum about 15-articulate. Uropod 1-3 spinose; uropod 1 peduncle distoventral angle with large curved spine; uropod 1 and 2 inner ramus little longer than outer; uropod 3 rami about equal. Telson rounded, apex angular.
8. *Gammarus locusta* (Fig. 29)

<table>
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<tr>
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<tbody>
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<tr>
<td>Genus</td>
<td><em>Gammarus</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>locusta</em></td>
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</table>

Scale Bar – 2.7mm

Length upto 33mm in male, about 20mm in female. Urosome segments 1-3 with very prominent angular dorsal humps, spine groups with few setae. Antennae 1 peduncle sparsely setose, article 1 with 0-1 ventral setal groups, article 2 with 1-2 setal groups, article 3 with 0-1 setal groups, accessory flagellum elongate, longer than peduncle article 1, about 8-15 articulate. Uropod 3 rami subequal length, margins strongly spinose and with plumose setae. Telson lobes with 3 epical spines and few short setae, 1 subepical spine and setae, and 1-3 lateral spines with few setae.
9. *Dexamine* sp. (Fig.30)

Class : Crustacea  
Subclass : Malacostraca  
Superorder : Peracarida  
Order : Amphipoda  
Suborder : Gammaride  
Family : Dexaminidae  
Genus : *Dexamine* sp.

Scale Bar – 1.5mm

Body stout, not strongly compressed, often carinate or tooth dorsally, pereon segments short, pleosome segments elongate, strongly developed. Head with small rostrums, accessory flagellum absent, antennae 2 peduncle articles 3-5 in male with tufts of short fine setules on anterior margin. Gnathopod 2 longer and more slender than 1, both sub chelate. Pereopods 5-7 with basal articles successively less expanded, merus shorter than carpus and propodus combined. Coxal gills weakly pleated. Uropod 3 rami lanceolate, spinose and setose. Telson long and deeply cleft.
10. *Hyale honoluluensis* (Fig. 31)

<table>
<thead>
<tr>
<th>Class</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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<td>Gammaridea</td>
</tr>
<tr>
<td>Family</td>
<td>Hyalidae</td>
</tr>
<tr>
<td>Genus</td>
<td><em>Hyale</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>honoluluensis</em></td>
</tr>
</tbody>
</table>

Body robust. Head without rostrum. Antenna 1 shorter than 2 but distinctly longer than peduncle of antenna 2; accessory flagellum absent. Antenna 2 peduncle often robust, flagellum rather short. Coxal plates broad, moderately long, plates 1-4 with distinct posterior process. Gnathopods 1 and 2 sub chelate in both sexes; in male gnathopod 2 very much larger than 1; in female both gnathopods of about equal size. Pereopods increasing in length from 5 to 7, spinose. Telson deeply cleft.

Scale Bar – 2mm
11. *Grandidierella* sp. (Fig. 32)

Class : Crustacea  
Subclass : Malacostraca  
Superorder : Peracarida  
Order : Amphipoda  
Suborder : Gammaridea  
Family : Aoridae  
Genus : *Grandidierella* sp.

Scale Bar – 1.5mm

Antenna 1, accessory flagellum vestigial, 1 articulate; antenna 2 peduncle extending well beyond peduncle of antenna 1, articles slender to moderately stout. Well developed, articles 3-4, width similar to that of article 5. Article 4 without marginal notch, flagellum of male with proximal articles fused, forming single article, article 1 shorter than remaining flagellar articles combined; male gnathopod 1 large, caprochelate, article 5 bearing a tooth or two, article 6 simple, gnathopod 2 smaller, normally sub chelate or slightly chelate. Uropod 1-2, inner ramus not reduced. Subequal to outer ramus in length. Outer ramus slender, length 5-6 times width; uropod 3, peduncle without distomedial expansion.
12. *Leptocheirus* sp. (Fig. 33)

Class : Crustacea
Subclass : Malacostraca
Superorder : Peracarida
Order : Amphipoda
Suborder : Gammaridea
Family : Aoridae
Genus : *Leptocheirus* sp

![Scale Bar – 2.5mm](image)

Body moderately compressed, pleon segment 3 much longer than 1-2. Coxal plates elongate, overlapping, plate 2 much larger than the rest and occasionally concealing plate 1 entirely, plate 5 with anterior lobe much longer than posterior lobe. Antennae 1 often little longer than 2, or subequal, peduncle article 3 shorter than 1, accessory flagellum small or absent. Gnathopod 1 sub chelate, basis with 2 rows of anteromarginal setae, ischium, merus and carpus with posterior margin very densely setose. Gnathopod 2 slender, simple; basis, merus, carpus and propodus with extremely long plumose marginal setae. Pereopods robust, increasing in length from 5-7, basis broadly expanded. Telson short and broad, entire, dorsolateral angles usually prominent.
13. *Ampelisca scabripes* (Fig.34)

- **Class**: Crustacea
- **Subclass**: Malacostraca
- **Superorder**: Peracarida
- **Order**: Amphipoda
- **Suborder**: Gammaridea
- **Family**: Ampeliscidae
- **Genus**: *Ampelisca*
- **Species**: *scabripes*

Scale Bar – 2.5mm

Eyes 2 pairs, 1 sub-cutaneous pair on dorsal apex behind 1<sup>st</sup> antenna, one pair of corneal lens below laterally and small 3<sup>rd</sup> pair placed in between 1<sup>st</sup> and 2<sup>nd</sup>. 1<sup>st</sup> antenna reaches middle of 5<sup>th</sup> peduncular article of 2<sup>nd</sup> antenna, dactyli of 1<sup>st</sup> and 2<sup>nd</sup> gnathopods without plumose setae, uropods less spinous, distal half of expanded basis of 5<sup>th</sup> pereopods heavily setose, atleast near apex.
14. *Orchestia* sp. (Fig.35)

- **Class**: Crustacea
- **Subclass**: Malacostraca
- **Superorder**: Peracarida
- **Order**: Amphipoda
- **Suborder**: Gammaridea
- **Family**: Talitridae
- **Genus**: *Orchestia* sp.

Scale Bar – 4mm

Body robust, smooth, pereon broad, pleon compressed. Coxal plates moderately large, rounded. Antennae 1 not reaching beyond peduncle article 4 of antennae 2; antennae 2 often quite robust. Gnathopod 1 smaller than 2, sub chelate although palm often short and indistinct. Pereopods 5-7 robust and spinose. Uropods 1-2 biramous; uropod 3 uniramous, peduncle short and broad, ramous very small. Telson entire or weakly notched.
15. *Talorchestia* sp. (Fig.36)

- **Class**: Crustacea
- **Subclass**: Malacostraca
- **Superorder**: Peracarida
- **Order**: Amphipoda
- **Suborder**: Gammaridea
- **Family**: Gammaridae
- **Genus**: *Talorchestia* sp.

Body robust, compressed, smooth. Coxal plates of moderate size. Head without rostrum. Antenna 1 shorter than peduncle of antenna 2, accessory flagellum absent. Gnathopod 1 smaller than 2, sub chelate although palm often short and indistinct. Gnathopod 1 of both sexes simple or poorly subchelate. Pereopods 5-7 robust and spinose. Uropods 1-2 biramus; uropod 3 uniramus, peduncle short and broad, ramus very small. Telson entire or weakly notched.
16. *Pectenogammarus* sp. (Fig.37)

<table>
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<tr>
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<tr>
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</tr>
<tr>
<td>Genus</td>
<td>: <em>Pectenogammarus</em> sp.</td>
</tr>
</tbody>
</table>

Scale Bar – 4mm

Body gammarus like; distal margins of coxal plates, margins of pereopods and uropods, in male densely fringed with long setae. Coxal plates moderately large. Epimeral plate 3 quadrate. Head with lateral lobes broadly truncated; eyes elongate and reniform. Antennae 1 slender, little longer than 2; accessory flagellum prominent. Gnathopod subchelate; gnathopod 2 larger than 1; carpus short and triangular. Pereopods broad and robust, spinose. Uropod 3 biramous, outer ramous elongate, 2-articulate; inner ramous very small. Telson deeply cleft, each lobe with lateral and apical spines and setae.
Three species were recorded separately from the family Melitidae and Gammaridae. Two species in each family of Ampithoidae, Aoridae and Talitridae were recorded and only one species recorded from each family of Isaeidae, Dexaminidae, Hyalidae and Ampeliscidae (Fig.40).
6.3.2. Percentage composition

In the present study, Melitidae and Gammaridae families were represented 19% respectively followed by Ampithoidae, Aoridae and Talitridae represented 13% each and Isaeidae, Dexaminidae, Hyalidae and Ampeliscidae were recorded with 6% respectively (Fig.41).

**Fig. 41. Percentage contribution of different amphipod families**
In oyster bed ecosystem, 29% of contribution was noticed in monsoon season and 17% during summer. The pre monsoon and post monsoon seasons recorded with 27% respectively (Fig.42).

**Fig. 42. Percentage contribution of species in different seasons in oysterbed**

![Pie chart showing percentage contribution of species in different seasons in oysterbed](image)

In seagrass ecosystem 32% of species contribution was found in monsoon, followed by post monsoon (29%) and pre monsoon season (25%). The least contribution was noticed in 14% in the summer season (Fig.43).

**Fig. 43. Percentage contribution of species in different seasons in seagrass ecosystem**

![Pie chart showing percentage contribution of species in different seasons in seagrass ecosystem](image)

In mangrove ecosystem, 31% of species contribution was recorded in monsoon season and 28% in post monsoon, 26% in pre monsoon and 15% contribution in summer were noticed (Fig.44).
Fig. 44. Percentage contribution of species in different seasons in mangrove ecosystem

In the muddy substratum, monsoon season was noticed with 31% of species contribution followed by 28% in post monsoon, 25% in pre monsoon and 16% in summer season (Fig.45).

Fig. 45. Percentage contribution of species in different seasons in substratum

6.3.3. Population density

High population density (10,605 nos/sq.m) was observed during monsoon and less density (559 nos/sq.m) was noticed in summer from the study area. The population density was varied from 559 nos/sq.m (low in summer) to 8,034 nos/sq.m (high in monsoon) in the oyster bed and in mangroves the range varied from 907 nos/sq.m (low in summer) to 10,605 nos/sq.m (high in
monsoon). The maximum and minimum density of amphipods in seagrass ecosystem is 10,056 nos/sq.m (monsoon) and 661 nos/sq.m (summer) respectively. In muddy substratum the lower density (284 nos/sq.m in summer) and higher density (5235 nos/sq.m in monsoon) were recorded (Fig.46).

**Fig. 46. Amphipods in oysterbed, mangrove, seagrass and muddy substratum ecosystem**

6.3.4. Shannon and Wiener’s diversity index (H’)

The diversity of amphipods observed from 1.178 to 1.362. It was lower in summer and higher in monsoon and post monsoon. In mangroves ecosystem it was noted 0.73, seagrass (0.72), oyster bed (0.708) and muddy substratum (0.696) (Fig.47). The diversity was noticed in the following order.

Mangrove > seagrass > oyster bed > muddy substratum
6.3.5. Evenness (J)

The evenness was noticed from 0.28 to 0.29. Lower values recorded in summer and higher values were in monsoon and post monsoon. The high rate of evenness was noticed from mangrove ecosystem (0.29) followed by seagrass (0.29), oysterbed (0.28) and muddy substratum (0.28) (Fig.48). The evenness was noticed in the following order.

Mangrove > seagrass > oysterbed > muddy substratum

Fig. 48. Evenness of amphipods
6.3.6. Richness (d)

The species richness of amphipods varied from 0.32 to 0.47. Lower species richness was found in monsoon and higher in summer. Spatially the richness was higher in the muddy substratum (1.19) followed by oyster bed (1.13), seagrass (1.11) and mangrove (1.1) (Fig. 49). The richness was noticed in the following order.

Muddy substratum > oyster bed > seagrass > mangrove

Fig. 49. Richness of amphipods

<table>
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<th>MS</th>
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The two way analysis shows not significant in diversity of amphipods in different stations and seasons (Table 6).
6.4. Discussion

A total of 16 species of amphipods were recorded during the present study in all four stations. Among, 13 species were recorded in the mangrove ecosystem during monsoon and post monsoon and the lesser number of only 2 species recorded in muddy substratum during summer.

In the present study, Melitidae and Gammaridae were recorded with 19% respectively. Ampithoidae, Aoridae and Talitridae with 13% each and Isaeidae, Dexaminidae, Hyalidae and Ampeliscidae were recorded with 6% respectively. From the oyster bed ecosystem 29% was noticed with higher contribution during monsoon season and lower level of 17% during summer. The pre monsoon and post monsoon period were recorded with 27% each. In the seagrass ecosystem, 32% of species contributed during monsoon followed by 29% in the post monsoon and 25% in pre monsoon. The least was noticed with 14% in the summer season.

In the mangrove environment, 31% of species noticed in monsoon followed by 28% in post monsoon, 26% in pre monsoon and only 15% was contributed in summer. In the muddy substratum, monsoon season shared with 31% of species, 28% of the species in post monsoon, 25% of the species in pre monsoon and only 16% of the species were contributed in summer season. High population density (10,605nos/sq.m) was observed during monsoon and less density (559nos/sq.m) was noticed in summer from the study area. The population density varied from 559nos/sq.m (low in summer) to 8,034nos/sq.m (high in monsoon) in the oyster bed and in mangroves the range varied from 907 nos/sq.m (low in summer) to 10,605 nos/sq.m (high in monsoon). The maximum and minimum density of amphipods in seagrass ecosystem is 10,056 nos/sq.m (monsoon) and 661nos/sq.m (summer) respectively. In muddy substratum the lower density (284 nos/sq.m in summer) and higher density (5,235 nos/sq.m in monsoon) were recorded.
Kathiresan (2000) recorded four species of amphipods from the Pichavaram mangroves. Only two species of amphipods – *Photis geniculata* and *Pedocercus* sp. were reported from Sundarban mangroves. In Vellar estuary mangroves, Mondal *et al.* (2010) reported ten species of amphipods.

The amphipod abundance and abiotic factors suggest that a single factor does not appear to be responsible for the recruitment, dispersion and abundance of animals. Therefore, it is obvious that a combination of several factors, such as temperature, salinity, dissolved oxygen, pH, availability of food, substrate, running water and sediments acts on the distribution and relative abundance of animals. In tropical areas, a high species diversity and abundance of various groups are associated with the presence of seagrass and seaweed meadows.

In the present study, species composition and diversity were very high in mangrove habitat followed by seagrass ecosystem, oyster bed and muddy substratum. It is due to mangrove, seagrass and oyster beds are better habitats than the substratum as reported in earlier studies. One of the reason for high species composition and diversity is the high organic load by taller leaves in mangroves and seagrass. Oyster beds might have trap the organic material from the adjacent ecosystem.

The maximum species diversity was recorded during the monsoon with fair conditions. During the monsoon season high hydrological changes were induced by the heavy fresh water flow. The species richness index ranging from 1.1 to 1.19 showed a trend similar to the species diversity index. There were three species noted from the family Melitidae and Gammaridae respectively. Whereas, Ampithoidae, Aoridae and Talitridae were recorded with two species each. Only one species recorded from the Isaeidae, Dexaminidae, Hyalidae and Ampeliscidae. In
species distribution from the different ecosystems, mangrove and seagrass with 14 species, oyster bed with 13 species and muddy substratum with 11 species.

High temperature recorded in summer season deplete the oxygen in water might have caused low species richness (Batcha, 1997). Low temperature recorded in monsoon seasons enriched amphipod density. Population was higher in monsoon followed by post monsoon, pre monsoon and lower in summer. The species diversity index \((H')\) ranged from 1.178 to 1.362, evenness \((J)\) had noticed from 0.85 to 0.98 and the richness \((D)\) of amphipods from 0.32 to 0.47.

Species diversity index showed similar trend in all the ecosystems. The uniformity in the distribution of individuals among species is measured by the species evenness index. Evenness index values were quite similar in the four ecosystems (1.1 to 1.19). This may be due to availability of food, a continuous breeding and a high reproductive capacity.