

TABLES

Table 4.1 Check list of macro flora recorded at selected sampling sites.

NO	Name of the Species	Occurrence of the Sampling Sites			
		Navapara	Aadri	Vadodara	Chorwad
Class: Chlorophyceae					
1.	<i>Boergesenia forbesii</i>	P	P	P	P
2.	<i>Bryopsis plumose</i>	P	P	A	A
3.	<i>Caulerpa scalpelliformis</i>	A	P	P	P
4.	<i>Caulerpa racemosa</i>	P	P	P	P
5.	<i>Caulerpa taxifolia</i>	P	A	P	P
6.	<i>Chaetomorpha antennina</i>	A	P	A	P
7.	<i>Cladophora glomerata</i>	A	P	A	A
8.	<i>Enteromorpha intestinalis</i>	P	A	P	A
9.	<i>Stoechospermum marginatum</i>	A	P	A	A
10.	<i>Ulva fasciata</i>	P	P	A	P
11.	<i>Ulva lactuca</i>	P	P	P	P
12.	<i>Codium species</i>	P	P	P	P
Class: Phaeophyceae					
1.	<i>Padina gymnospora</i>	P	P	P	P
2.	<i>Padina tetrastromatica</i>	A	P	A	P
3.	<i>Sargassum swartzii</i>	P	P	P	P
4.	<i>Sargassum cinereum</i>	P	P	P	P
5.	<i>Cystoseria indica</i>	P	P	P	P
6.	<i>Dictyota dichotoma</i>	P	P	A	A
Class: Rhodophyces					
1.	<i>Champia compressa</i>	A	P	P	P
2.	<i>Champia indica</i>	P	P	P	P
3.	<i>Gracilaria corticata</i>	P	P	P	P
4.	<i>Galaxaura oblongata</i>	A	P	P	A

Abbreviations: P-Present, A-Absent

Table 4.2 Taxonomic position of reported intertidal macro fauna during the study period. All scientific nomenclature and taxonomic position of the observed animals are as per the latest updates of WoRMS.

Class	Order	Family	Species
Phylum: Porifera			
Calcarea	Leucosolenida	Grantiidae	Granita sp
Demospongiae	Clionaida	Clionaidae	Cliona Spe.
	Halichondrida	Halichondriidae	Halichondria panacea
	Haplosclerida	Chalinidae	Haliclona tubifera
	Hadromerida	Suberitidae	Suberite sp
Homoscleromorpha	Homosclerophorida	Oscarellidae	Oscareila lobularis
Phylum : Arthropoda			
Hexanauplia	Sessilia	Balanidae	Amphibalanus amphirite
	Lepadiformes	Lepadidae	Lepas anatifera
Malacostraca	Decapoda	Cancridae	Cancer pagurus
		Diogenidae	Clibanarius nathi
			Clibanarius zebra
		Grapsidae	Pachygrapsus crassipes
		Menippidae	Myomenippe hardwicki
		Pilumnidae	Pilumnus vespertilio
		Portunidae	Portunus pelagicus
Scylla serrate			
Phylum : Echinodermata			
Ophiuroidea	ophiurida	-	Ophiura ophiura

Table 4.2 Taxonomic position of reported intertidal macro fauna during the study period. All scientific nomenclature and taxonomic position of the observed animals are as per the latest updates of WoRMS. (Conti...)

Class	Order	Family	Species
Phylum: Cnidaria(Corals)			
Anthozoa	Scleractinia	merulinidae	goniastrea pectinata
		Poritidae	Goniopora
		Acroporidae	Montipora folisa
		Poritidae	Porites stephensoni
			Portis lutea
Phylum: (Other than corals)			
Anthozoa	Actiniaria	Actiniidae	Anthopleura sola
			Anthopleura elegantissima
			Actinia tenebrosa
			Utricina sp
			Actinia equine
	Zoantharia	Sphenopidae	Palythoa tuberculosa
			Palythoa matuki
		Zoanthidae	Isaurus tuberculatus
			Zoanthus kuroshio
			Zoanthus sansibaricus
			Zoanthus sociatus
			Zoanthus pulchellus
Phylum : Annelida			
Polychaeta	Phyllodocida	Nereididae	Neris sp
	-	Chaetopteridae	Chetopterus chetopterus
	Sabellida	Serpulidae	Serpula vermicularis

Table 4.2 Taxonomic position of reported intertidal macro fauna during the study period. All scientific nomenclature and taxonomic position of the observed animals are as per the latest updates of WoRMS. (Conti...)

Class	Order	Family	Species
Phylum: Mollusca			
Gastropoda	Littorinimorpha	Bursidae	<i>Bursa granularis</i>
		cypraeidae	<i>Cypraea depressa</i>
			<i>Cyprea grayaena</i>
			<i>Cyprea moneta</i>
			<i>Cyprea ocellata</i>
		Rostellariidae	<i>Tibia insulaechorab</i>
		littorinidae	<i>Littorina sp</i>
	Mesogastropoda	Cerithiidae	<i>Cerithium careuleum</i>
			<i>Cerithium scabridum</i>
		Buccinidae	<i>Cantharus undosus</i>
			<i>Cantharus spiralis</i>
		Columbellidae	<i>Pyrene flava</i>
		Conidae	<i>Conus cumnigii</i>
			<i>Conus inscriptus</i>
			<i>Conus miliaris</i>
		Muricidae	<i>Murex bruneus</i>
			<i>Murex virgineus</i>
			<i>Purpura panama</i>
		terebridae	<i>Hastula sp.</i>
		Mitridae	<i>Mitra scutulata</i>
		Olividae	<i>Oliva olive</i>
	-	Cerithiidae	<i>Rhinoclavis sinensis</i>
	-	Potamididae	<i>Telescopium telescopium</i>

Table 4.2 Taxonomic position of reported intertidal macro fauna during the study period. All scientific nomenclature and taxonomic position of the observed animals are as per the latest updates of WoRMS. (Conti...)

Class	Order	Family	Species
Phylum: Mollusca			
Gastropoda	Neogastropoda	Mitridae	<i>Mitra ambigua</i>
	Nudibranchia	Aplysiidae	<i>Aplysia oculifera</i>
	-	Architectonicidae	<i>Architectonica laevigata</i>
	Cycloneritimorpha	Neritidae	<i>Nerita chamaeleon</i>
			<i>Nerita undata</i>
	-	Patellidae	<i>Patella vulgata</i>
	Archaeogastropoda	Nacellidae	<i>Cellana radiata</i>
	Fissurelloidea	fissurellidae	<i>Clypidina notata</i>
	Haliotoidea	Haliotidae	<i>Haliotis species</i>
	Trochoidea	Trochidae	<i>Monodonta australis</i>
			<i>Trochus radiates</i>
	-	Turbinidae	<i>Astrea semicostata</i>
	Trochoidea		<i>Turbo intercostalis</i>
	Systellommatophora	Onchidiidae	<i>Onchidium verruculatum</i>
Cephalopoda	Octopoda	Octopodidae	<i>Octopus vulgaris</i>
Polyplacophora	Chitonida	Chitonidae	<i>Chiton peregrinus</i>
Bivalvia	Venerida	Veneridae	<i>Venus reticulate</i>
			<i>Sunetta donacina</i>
	Ostreida	Pteriidae	<i>Pinctada fucata</i>
			<i>Pinctada vulgaris</i>

Table 4.3 Checklist of the intertidal macro benthos recorded at selected sampling sites during the study period.

Sr No	Name of Species	Navapara	Aadri	Vadodara	Chorwad
Porifera					
1.	<i>Cliona Spe.</i>	A	P	A	A
2.	<i>Granita sp</i>	P	P	P	P
3.	<i>Halichondria panacea</i>	P	P	P	P
4.	<i>Haliclona tubifera</i>	A	P	P	A
5.	<i>Oscareila lobularis</i>	P	P	P	P
6.	<i>Suberite sp</i>	A	P	A	P
Arthropoda					
1.	<i>Amphibalanus amphirite</i>	P	P	P	P
2.	<i>Cancer pagurus</i>	A	P	P	P
3.	<i>Clibanarius nathi</i>	P	P	P	P
4.	<i>Clibanarius zebra</i>	P	P	P	P
5.	<i>Lepas anatifera</i>	P	P	A	P
6.	<i>Myomenippe hardwicki</i>	P	P	P	P
7.	<i>Pachygrapsus crassipes</i>	P	P	P	P
8.	<i>Pilumnus vespertilio</i>	P	P	A	P
9.	<i>Portunus pelagicus</i>	P	P	P	P
10.	<i>Scylla serrate</i>	A	P	A	P
Phylum: Echinodermata					
1.	<i>Ophiura ophiura</i>	A	P	A	A
Phylum : Annelida					
1.	<i>Chetopterus chetopterus</i>	P	A	A	P
2.	<i>Neris sp</i>	A	P	P	P
3.	<i>Serpula vermicularis</i>	A	P	A	P

(Abbreviations: P-Present, A-Absent)

Table 4.3 Checklist of the intertidal macro benthos recorded at selected sampling sites during the study period. (Cont...)

Sr No	Name of Species	Navapara	Aadri	Vadodara	Chorwad
Phylum: Cnidaria					
(Corals)					
1.	<i>Goniastrea pectinata</i>	P	P	A	P
2.	<i>Porites stephensoni</i>	A	P	A	P
3.	<i>Goniopora</i>	P	P	P	P
4.	<i>Portis lutea</i>	A	P	P	A
5.	<i>Montipora folisa</i>	P	P	P	P
(Other than Corals)					
6.	<i>Actinia equine</i>	P	P	P	P
7.	<i>Actinia tenebrosa</i>	P	P	P	P
8.	<i>Anthopleura sola</i>	A	P	P	P
9.	<i>Anthopleura elegantissima</i>	A	P	A	A
10.	<i>Isaurus tuberculatus</i>	P	P	P	P
11.	<i>Palythoa matuki</i>	P	P	P	P
12.	<i>Palythoa tuberculosa</i>	A	P	P	P
13.	<i>Utricina sp</i>	A	P	A	P
14.	<i>Zoanthus kuroshio</i>	P	P	A	P
15.	<i>Zoanthus pulchellus</i>	A	P	P	P
16.	<i>Zoanthus sansibaricus</i>	P	P	P	P
17.	<i>Zoanthus sociatus</i>	P	P	P	P

(Abbreviations: P-Present, A-Absent)

Table 4.3 Checklist of the intertidal macro benthos recorded at selected sampling sites during the study period. (Cont...)

Sr No	Name of Species	Navapara	Aadri	Vadodara	Chorwad
Phylum: Mollusca					
1.	<i>Aplysia oculifera</i>	P	P	P	P
2.	<i>Architectonica laevigata</i>	P	P	A	P
3.	<i>Astrea semicostata</i>	P	P	P	P
4.	<i>Bursa granularis</i>	P	P	A	P
5.	<i>Cantharus spiralis</i>	P	P	P	P
6.	<i>Cantharus undosus</i>	P	P	P	P
7.	<i>Cellana radiata</i>	P	P	P	P
8.	<i>Cerithium careuleum</i>	P	P	P	P
9.	<i>Cerithium scabridum</i>	P	P	P	P
10.	<i>Chiton peregrinus</i>	P	P	P	P
11.	<i>Clypidina notate</i>	P	P	P	P
12.	<i>Conus cumnigii</i>	A	P	A	P
13.	<i>Conus inscriptus</i>	P	P	P	P
14.	<i>Conus miliaris</i>	P	P	P	P
15.	<i>Cypraea depressa</i>	P	P	P	P
16.	<i>Cyprea grayaena</i>	P	P	P	P
17.	<i>Cyprea moneta</i>	P	P	A	P
18.	<i>Cyprea ocellata</i>	P	A	P	P
19.	<i>Haliotis species</i>	A	P	A	P
20.	<i>Hastula sp.</i>	A	P	P	A
21.	<i>Littorina sp</i>	P	P	P	P

(Abbreviations: P-Present, A-Absent)

Table 4.3 Checklist of the intertidal macro benthos recorded at selected sampling sites during the study period. (Cont...)

Sr No	Name of Species	Navapara	Aadri	Vadodara	Chorwad
Phylum: Mollusca					
22.	<i>Mitra ambigua</i>	A	P	P	A
23.	<i>Mitra scutulata</i>	P	P	P	P
24.	<i>Monodonta australis</i>	P	P	P	P
25.	<i>Murex bruneus</i>	P	P	P	P
26.	<i>Murex virgineus</i>	P	P	P	P
27.	<i>Nerita chamaeleon</i>	P	P	P	P
28.	<i>Nerita undata</i>	P	P	P	P
29.	<i>Octopus vulgaris</i>	A	P	A	P
30.	<i>Oliva olive</i>	P	P	P	P
31.	<i>Onchidium verruculatum</i>	P	P	P	P
32.	<i>Patella vulgate</i>	P	P	P	P
33.	<i>Pinctada fucata</i>	P	P	P	P
34.	<i>Pinctada vulgaris</i>	P	P	P	P
35.	<i>Purpura panama</i>	P	P	P	P
36.	<i>Pyrene flava</i>	P	P	P	P
37.	<i>Rhinoclavis sinensis</i>	P	P	P	P
38.	<i>Sunetta donacina</i>	A	P	A	A
39.	<i>Telescopium telescopium</i>	P	P	P	P
40.	<i>Tibia insulaechorab</i>	A	P	A	P
41.	<i>Trochus radiates</i>	P	P	P	P
42.	<i>Turbo intercostalis</i>	P	P	P	P
43.	<i>Venus reticulate</i>	P	P	P	P

(Abbreviations: P-Present, A-Absent)

Table 4.4 Total no of intertidal macro benthos species recorded in each phylum of all assemblage during the study period.

Phylum \ Assemblage	Navapara	Aadri	Vadodara	Chorwad
Porifera	3	5	4	4
Arthropoda	8	11	8	10
Mollusca ↑	36	42	35	40
Echinodermata	0	1	0	0
Annelida	1	2	1	3
Cnidaria	10	17	12	15
(Corals)	3	5	3	4
(Other than Corals)	7	12	9	11
Total Species	58	78	60	72

(Abbreviations: ↑ - Most dominant and divers phylum)

Table 4.5 Total contribution (%) of intertidal macro benthos species recorded in each phylum of all assemblage during the study period

Phylum \ Assemblage	Navapara	Aadri	Vadodara	Chorwad
Porifera	5	6	7	6
Arthropoda	14	14	13	14
Mollusca ↑	62	54	58	56
Echinodermata	0	1	0	0
Annelida	2	3	2	4
Cnidaria	17	13	17	14
(Corals)	5	6	5	6
(Other than Corals)	12	15	15	15

(Abbreviations: % - percentage, ↑ - Most dominant and divers phylum)

Table 4.6 Monthly and seasonal variations in density of *Onchidium verruculatum* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Density			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no /0.25 m ²	no/0.25 m ²
Winter	December	0.2	0.6	0.2	0.3
	January	0.2	0.7	0.2	0.4
	February	0.3	0.6	0.5	0.4
Summer	March	0.2	0.4	0.1	0.1
	April	0.1	0.2	0.2	0.3
	May	0.2	0.4	0.3	0.3
Monsoon	June	0.2	0.3	0.4	0.2
	July	0.2	0.4	0.4	0.2
	August	0.3	0.6	0.5	0.5
post monsoon	September	0.5	0.6	0.3	0.4
	October	0.4	0.5	0.3	0.3
	November	0.2	0.6	0.2	0.4
Mean		0.24	0.51	0.29	0.31
SD		0.116	0.154	0.121	0.129

Table 4.7 Monthly and seasonal variations in Abundance of *Onchidium verruculatum* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Abundance			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²
Winter	December	1.2	1.8	1.7	1.5
	January	1.5	2.1	0.7	1.4
	February	1.3	2.0	1.9	1.3
Summer	March	1.0	1.2	0.5	0.3
	April	0.7	0.8	1.0	1.7
	May	0.9	1.1	1.1	1.1
Monsoon	June	0.8	1.6	2.5	1.5
	July	0.7	1.5	1.4	1.0
	August	1.2	1.8	2.2	1.5
post monsoon	September	1.8	1.9	1.3	1.7
	October	1.4	1.7	1.2	1.1
	November	0.9	1.6	0.7	1.3
Mean		1.11	1.58	1.34	1.28
SD		0.345	0.396	0.632	0.375

Table 4.8 Monthly and seasonal variations in Frequency of *Onchidium verruculatum* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Frequency			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²
Winter	December	10.0	30.0	10.0	13.3
	January	10.0	30.0	10.0	16.7
	February	13.3	26.7	20.0	23.3
Summer	March	10.0	16.7	6.7	6.7
	April	3.3	10.0	13.3	16.7
	May	13.3	23.3	16.7	13.3
Monsoon	June	13.3	20.0	13.3	13.3
	July	10.0	23.3	16.7	10.0
	August	16.7	30.0	23.3	30.0
post monsoon	September	23.3	30.0	16.7	26.7
	October	16.7	20.0	16.7	16.7
	November	13.3	33.3	10.0	20.0
Mean		12.78	24.44	14.44	17.22
SD		4.889	6.866	4.785	6.792

Table 4.9 Various ecological attributes of *Onchidium verruculatum* in different littoral zones at selected sampling sites from December 2014 to November 2015. Values expressed as monthly mean $\pm$ SD.

	Navapara			Aadri			Vadodara			Chorwad		
	Intertidal zone											
	U	M	L	U	M	L	U	M	L	U	M	L
D	0.15	0.54	0.03	0.36	1.08	0.09	0.14	0.63	0.10	0.26	0.58	0.09
	±	±	±	±	±	±	±	±	±	±	±	±
	0.117	0.278	0.062	0.231	0.238	0.079	0.151	0.242	0.148	0.202	0.249	0.138
A	1.04	2.03	0.25	1.53	2.39	0.83	1.08	2.15	0.79	1.38	1.97	0.50
	±	±	±	±	±	±	±	±	±	±	±	±
	0.722	0.607	0.622	0.658	0.358	0.718	0.925	0.576	0.940	0.742	0.431	0.674
F	10.83	25.83	1.67	20.83	45.00	7.50	8.33	29.17	5.83	15.00	29.17	7.50
	±	±	±	±	±	±	±	±	±	±	±	±
	7.930	7.930	3.892	10.836	7.977	6.216	7.177	9.003	6.686	10.000	11.645	10.553

(Abbreviation: U- Upper, M-Middle, L-Lower, D-Density, A-Abundance, F-Frequency)

Table 4.10 Monthly and seasonal variations in density of *Conus miliaria* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Density			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²
Winter	December	0.3	0.2	0.2	0.3
	January	0.4	0.4	0.4	0.4
	February	0.2	0.3	0.4	0.4
Summer	March	0.3	0.2	0.2	0.1
	April	0.1	0.1	0.1	0.1
	May	0.3	0.3	0.2	0.2
Monsoon	June	0.3	0.5	0.5	0.5
	July	0.3	0.2	0.3	0.3
	August	0.1	0.3	0.2	0.2
Post monsoon	September	0.2	0.2	0.2	0.2
	October	0.1	0.2	0.3	0.1
	November	0.3	0.2	0.2	0.3
Mean		0.24	0.27	0.27	0.27
SD		0.094	0.098	0.118	0.131

Table 4.11 Monthly and seasonal variations in Abundance of *Conus miliaria* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Abundance			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²
Winter	December	1.2	1.2	1.0	1.2
	January	1.3	1.2	1.1	1.3
	February	1.3	1.1	1.2	1.4
Summer	March	1.0	0.7	0.9	0.3
	April	0.8	0.7	0.8	0.8
	May	1.2	1.3	1.4	0.8
Monsoon	June	1.2	1.1	1.5	1.2
	July	1.2	1.1	1.3	1.3
	August	0.7	1.1	0.7	0.8
post monsoon	September	1.1	0.8	0.7	0.7
	October	1.0	1.3	1.4	0.7
	November	1.0	1.1	0.8	1.0
Mean		1.08	1.05	1.07	0.96
SD		0.188	0.213	0.307	0.337

Table 4.12 Monthly and seasonal variations in Frequency of *Conus miliaria* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Perameter		Frequency			
Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²
Winter	December	23.3	20.0	23.3	26.7
	January	30.0	30.0	36.7	33.3
	February	20.0	26.7	33.3	33.3
Summer	March	26.7	20.0	13.3	13.3
	April	10.0	13.3	10.0	10.0
	May	30.0	26.7	16.7	20.0
Monsoon	June	26.7	43.3	36.7	40.0
	July	23.3	20.0	23.3	26.7
	August	10.0	23.3	16.7	16.7
post monsoon	September	16.7	13.3	16.7	16.7
	October	6.7	16.7	20.0	10.0
	November	23.3	20.0	20.0	26.7
Mean		20.56	22.78	22.22	22.78
SD		8.019	8.267	8.914	9.830

Table 4.13 Various ecological attributes of *Conus miliaria* in different littoral zones at selected sampling sites from December 2014 to November 2015. Values expressed as monthly mean $\pm$ SD.

	Navapara			Aadri			Vadodara			Chorwad		
	Intertidal zone											
	U	M	L	U	M	L	U	M	L	U	M	L
D	0.15	0.23	0.35	0.14	0.25	0.41	0.17	0.24	0.40	0.18	0.28	0.36
	±	±	±	±	±	±	±	±	±	±	±	±
	0.131	0.137	0.124	0.108	0.173	0.144	0.156	0.162	0.154	0.122	0.230	0.198
A	0.92	1.17	1.15	0.83	1.11	1.22	0.85	0.97	1.38	1.04	0.75	1.08
	±	±	±	±	±	±	±	±	±	±	±	±
	0.733	0.389	0.236	0.577	0.172	0.211	0.702	0.325	0.356	0.620	0.574	0.390
F	10.83	20.00	30.83	13.33	21.67	33.33	13.33	22.50	30.83	14.17	24.17	30.00
	±	±	±	±	±	±	±	±	±	±	±	±
	9.003	8.528	10.836	10.731	13.371	10.731	11.547	14.222	13.114	9.003	19.287	15.374

(Abbreviation Used: U- Upper, M-Middle, L-Lower, D-Density, A-Abundance, F-Frequency)

Table 4.14 Monthly and seasonal variations in density of *Cellana radiata* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²
Winter	December	0.3	0.7	0.3	0.5
	January	0.3	0.6	0.3	0.4
	February	0.4	0.8	0.5	0.6
Summer	March	0.2	0.8	0.5	0.5
	April	0.5	0.7	0.5	0.5
	May	0.3	0.8	0.4	0.4
Monsoon	June	0.3	0.6	0.3	0.4
	July	0.4	0.7	0.4	0.4
	August	0.2	0.6	0.2	0.3
post monsoon	September	0.2	0.7	0.2	0.5
	October	0.3	1.1	0.3	0.5
	November	0.4	0.9	0.4	0.7
Mean		0.32	0.74	0.36	0.49
SD		0.099	0.143	0.115	0.094

Table 4.15 Monthly and seasonal variations in Abundance of *Cellana radiata* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²	no/0.25 m ²
Winter	December	1.1	1.8	0.9	1.5
	January	1.1	2.0	1.3	1.3
	February	1.5	1.8	1.6	1.6
Summer	March	0.8	2.3	1.3	1.4
	April	1.7	1.7	1.2	1.6
	May	1.1	2.3	1.4	1.3
Monsoon	June	1.0	1.5	0.9	1.2
	July	1.2	1.9	1.3	1.4
	August	0.7	2.2	0.8	1.8
post monsoon	September	0.8	1.7	1.1	1.3
	October	1.1	2.0	0.9	1.3
	November	1.2	2.2	1.3	1.8
Mean		1.12	1.95	1.16	1.45
SD		0.280	0.253	0.258	0.219

Table 4.16 Monthly and seasonal variations in Frequency of *Cellana radiata* in intertidal zones of selected sampling sites from December 2014 to November 2015.

Sampling Sites		Navapara	Aadri	Vadodara	Chorwad
Season	Month	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²	%/0.25 m ²
Winter	December	23.3	33.3	20.0	30.0
	January	16.7	30.0	23.3	30.0
	February	33.3	40.0	33.3	36.7
Summer	March	16.7	33.3	36.7	36.7
	April	33.3	36.7	43.3	33.3
	May	23.3	33.3	30.0	33.3
Monsoon	June	20.0	26.7	23.3	33.3
	July	33.3	33.3	30.0	30.0
	August	10.0	26.7	16.7	16.7
post monsoon	September	16.7	36.7	13.3	33.3
	October	26.7	46.7	23.3	26.7
	November	30.0	40.0	30.0	36.7
Mean		23.61	34.72	26.94	31.39
SD		7.844	5.766	8.582	5.588

Table 4.17 Various ecological attributes of *Cellana radiata* in different littoral zones at selected sampling sites from December 2014 to November 2015. Values expressed as monthly mean $\pm$ SD.

	Navapara			Aadri			Vadodara			Chorwad		
	Intertidal zone											
	U	M	L	U	M	L	U	M	L	U	M	L
D	0.61 ±	0.26 ±	0.10 ±	1.12 ±	0.91 ±	0.20 ±	0.61 ±	0.33 ±	0.14 ±	0.72 ±	0.56 ±	0.18 ±
	0.156	0.138	0.104	0.301	0.173	0.085	0.215	0.161	0.124	0.190	0.144	0.094
A	1.55 ±	1.01 ±	0.79 ±	2.32 ±	2.23 ±	1.29 ±	1.47 ±	1.04 ±	0.96 ±	1.75 ±	1.55 ±	1.04 ±
	0.344	0.360	0.782	0.335	0.279	0.582	0.329	0.361	0.782	0.304	0.331	0.396
F	40.00 ±	23.33 ±	7.50 ±	48.33 ±	40.83 ±	15.00 ±	41.67 ±	29.17 ±	10.00 ±	41.67 ±	36.67 ±	15.83 ±
	10.445	11.547	7.538	11.146	6.686	6.742	11.934	13.790	8.528	11.146	8.876	6.686

(Abbreviation : U- Upper, M-Middle, L-Lower, D-Density, A-Abundance, F-Frequency)

Table 4.18 Sea water parameter observed from Navapara during December 14 to November 15. Values expressed as mean $\pm$ SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (July to August)	Post Monsoon (September to November)
Temperature ($^{\circ}$ C)	21.93 $\pm$ 0.25	25.47 $\pm$ 0.59	24.23 $\pm$ 0.97	25.20 $\pm$ 0.45
Ph	8.14 $\pm$ 0.06	8.20 $\pm$ 0.10	8.23 $\pm$ 0.06	8.23 $\pm$ 0.12
Total Solids (g/l)	40.2 $\pm$ 10.17	40.59 $\pm$ 0.22	42.55 $\pm$ 1.35	42.03 $\pm$ 0.78
TDS (g/l)	37.95 $\pm$ 0.70	40.55 $\pm$ 0.51	41.57 $\pm$ 1.78	41.00 $\pm$.40
Salinity(ppt)	32.45 $\pm$ 0.24	34.07 $\pm$ 0.80	33.63 $\pm$ 0.40	33.47 $\pm$ 0.84
DO (mg/l)	6.33 $\pm$ 0.15	5.90 $\pm$ 0.36	6.30 $\pm$ 0.17	6.50 $\pm$ 0.10
Ca (g/l)	0.43 $\pm$ 0.01	0.43 $\pm$ 0.02	0.42 $\pm$ 0.01	0.42 $\pm$ 0.01
Mg (g/l)	1.27 $\pm$ 0.05	1.26 $\pm$ 0.02	1.31 $\pm$ 0.03	1.32 $\pm$ 0.01

Table 4.19 Sea water parameter observed from Vadodara during December 14 to November 15. Values expressed as mean and SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (June to August)	Post Monsoon (September to November)
Temprature ($^{\circ}$ C)	22.73 $\pm$ 0.45	24.90 $\pm$ 0.66	24.63 $\pm$ 0.75	25.37 $\pm$ 0.306
Ph	8.15 $\pm$ 0.06	8.17 $\pm$ 0.06	8.10 $\pm$ 0.17	8.20 $\pm$ 0.100
Total Solids (g/l)	40.36 $\pm$ 0.32	40.74 $\pm$ 0.29	41.97 $\pm$ 0.95	42.17 $\pm$ 0.379
TDS (g/l)	38.27 $\pm$ 0.49	40.60 $\pm$ 0.53	42.67 $\pm$ 0.86	40.97 $\pm$ 1.250
Salinity(ppt)	32.77 $\pm$ 0.32	34.57 $\pm$ 0.42	33.27 $\pm$ 0.80	33.43 $\pm$ 0.802
DO (mg/l)	6.47 $\pm$ 0.21	6.43 $\pm$ 0.35	6.53 $\pm$ 0.15	6.57 $\pm$ 0.252
Ca (g/l)	0.42 $\pm$ 0.02	0.43 $\pm$ 0.01	0.42 $\pm$ 0.01	0.43 $\pm$ 0.010
Mg (g/l)	1.27 $\pm$ 0.03	1.28 $\pm$ 0.04	1.30 $\pm$ 0.04	1.32 $\pm$ 0.012

Table 4.20 Sea water parameter observed from Aadri during December 14 to November 15. Values expressed as Seasonal mean $\pm$ SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (July to August)	Post Monsoon (September to November)
Temperature ($^{\circ}\text{C}$)	22.23 $\pm$ 0.51	25.03 $\pm$ 0.91	24.43 $\pm$ 0.81	25.40 $\pm$ 0.36
pH	8.16 $\pm$ 0.08	8.16 $\pm$ 0.15	8.13 $\pm$ 0.12	8.23 $\pm$ 0.06
Total Solids (g/l)	40.35 $\pm$ 0.28	40.61 $\pm$ 0.16	42.49 $\pm$ 1.43	42.13 $\pm$ 0.42
TDS (g/l)	38.37 $\pm$ 0.42	40.62 $\pm$ 0.65	42.50 $\pm$ 0.70	41.13 $\pm$ 1.29
Salinity(ppt)	32.37 $\pm$ 0.64	33.90 $\pm$ 0.87	32.73 $\pm$ 1.51	33.73 $\pm$ 1.25
DO (mg/l)	6.27 $\pm$ 0.15	5.90 $\pm$ 0.10	6.27 $\pm$ 0.21	6.53 $\pm$ 0.15
Ca (g/l)	0.42 $\pm$ 0.01	0.45 $\pm$ 0.02	0.44 $\pm$ 0.02	0.43 $\pm$ 0.01
Mg (g/l)	1.25 $\pm$ 0.02	1.29 $\pm$ 0.02	1.29 $\pm$ 0.02	1.33 $\pm$ 0.01

Table 4.21 Sea water parameter observed from Chorwad during December 14 to November 15. Values expressed as mean and SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (June to August)	Post Monsoon (September to November)
Temprature ($^{\circ}\text{C}$)	22.27 $\pm$ 0.379	25.17 $\pm$ 0.569	24.57 $\pm$ 0.513	25.23 $\pm$ 0.21
pH	8.20 $\pm$ 0.105	8.27 $\pm$ 0.058	8.13 $\pm$ 0.115	8.13 $\pm$ 0.06
Total Solids (g/l)	39.81 $\pm$ 0.734	40.23 $\pm$ 0.456	42.23 $\pm$ 1.124	42.47 $\pm$ 0.42
TDS (g/l)	38.53 $\pm$ 0.503	41.03 $\pm$ 0.651	42.90 $\pm$ 1.453	41.43 $\pm$ 1.29
Salinity(ppt)	32.50 $\pm$ 0.624	34.13 $\pm$ 1.026	34.53 $\pm$ 0.473	33.57 $\pm$ 0.50
DO (mg/l)	6.50 $\pm$ 0.265	6.53 $\pm$ 0.351	6.50 $\pm$ 0.436	6.60 $\pm$ 0.17
Ca (g/l)	0.43 $\pm$ 0.010	0.43 $\pm$ 0.006	0.44 $\pm$ 0.026	0.44 $\pm$ 0.01
Mg (g/l)	1.25 $\pm$ 0.042	1.33 $\pm$ 0.053	1.31 $\pm$ 0.070	1.33 $\pm$ 0.01

Table 4.22 Sea water temperature observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	21.90	21.80	22.30	22.00
January	21.70	22.10	22.70	22.10
February	22.20	22.80	23.20	22.70
March	24.80	24.00	24.20	25.00
April	25.70	25.40	25.50	25.80
May	25.90	25.70	25.00	24.70
June	25.30	25.30	25.40	25.00
July	24.00	24.30	24.60	24.70
August	23.40	23.70	23.90	24.00
September	25.70	25.80	25.70	25.40
October	25.00	25.10	25.10	25.30
November	24.90	25.30	25.30	25.00
Mean	24.208	24.275	24.408	24.308
SD	1.5465	1.4091	1.1532	1.3153

Table 4.23 Sea water pH observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	vadodara	Chorwad
December	8.13	8.17	8.20	8.20
January	8.21	8.23	8.17	8.30
February	8.09	8.08	8.09	8.09
March	8.10	8.18	8.20	8.20
April	8.30	8.30	8.20	8.30
May	8.20	8.00	8.10	8.30
June	8.30	8.20	8.00	8.20
July	8.20	8.00	8.00	8.00
August	8.20	8.20	8.30	8.20
September	8.30	8.20	8.20	8.10
October	8.30	8.20	8.10	8.10
November	8.10	8.30	8.30	8.20
Mean	8.203	8.172	8.155	8.183
SD	0.0837	0.0986	0.0994	0.0946

Table 4.24 Sea water Total Solids observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	40.04	40.04	40.00	40.43
January	40.37	40.42	40.60	40.00
February	40.23	40.58	40.47	39.00
March	40.41	40.44	41.00	39.70
April	40.83	40.65	40.43	40.50
May	40.52	40.75	40.80	40.48
June	41.06	41.16	42.90	43.20
July	43.70	44.00	42.00	42.50
August	42.90	42.30	41.00	41.00
September	42.90	42.60	42.60	42.80
October	41.80	41.80	42.00	42.60
November	41.40	42.00	41.90	42.00
Mean	41.347	41.395	41.308	41.184
SD	1.2207	1.1668	0.9364	1.3823

Table 4.25 Sea water TDS observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	37.18	38.70	38.50	39.00
January	38.11	37.89	38.60	38.60
February	38.55	38.51	37.70	38.00
March	40.00	41.30	40.00	41.00
April	40.64	40.57	41.00	40.40
May	41.00	40.00	40.80	41.70
June	40.00	43.00	43.60	41.40
July	41.20	41.70	42.50	43.00
August	43.50	42.80	41.90	44.30
September	41.60	41.50	41.00	41.80
October	42.00	42.20	42.20	42.50
November	39.40	39.70	39.70	40.00
Mean	40.265	40.656	40.625	40.975
SD	1.7788	1.7090	1.7889	1.8719

Table 4.26 Sea water Salinity observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	32.19	32.00	32.40	32.70
January	32.67	33.10	32.90	33.00
February	32.48	32.00	33.00	31.80
March	33.30	32.90	34.70	33.00
April	34.90	34.50	34.10	34.40
May	34.00	34.30	34.90	35.00
June	34.00	33.80	34.10	34.00
July	33.70	33.40	33.20	34.70
August	33.20	31.00	32.50	34.90
September	32.50	32.50	32.60	33.50
October	33.90	33.70	33.50	33.10
November	34.00	35.00	34.20	34.10
Mean	33.403	33.183	33.508	33.683
SD	0.8187	1.1715	0.8702	0.9935

Table 4.27 Sea water DO observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	6.50	6.40	6.40	6.30
January	6.20	6.10	6.70	6.80
February	6.30	6.30	6.30	6.40
March	6.20	6.00	6.10	6.20
April	5.90	5.80	6.80	6.90
May	6.00	5.90	6.40	6.50
June	6.10	6.20	6.40	6.00
July	6.40	6.50	6.70	6.80
August	6.40	6.10	6.50	6.70
September	6.50	6.50	6.60	6.70
October	6.40	6.70	6.30	6.40
November	6.60	6.40	6.20	6.70
Mean	6.292	6.242	6.450	6.533
SD	0.2151	0.2712	0.2153	0.2774

Table 4.28 Sea water Ca(g/l)observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	0.43	0.42	0.42	0.44
January	0.42	0.43	0.43	0.42
February	0.43	0.41	0.40	0.43
March	0.41	0.45	0.44	0.42
April	0.44	0.43	0.44	0.43
May	0.43	0.47	0.42	0.43
June	0.43	0.46	0.41	0.41
July	0.42	0.43	0.43	0.45
August	0.42	0.44	0.42	0.46
September	0.42	0.43	0.42	0.44
October	0.42	0.42	0.44	0.45
November	0.41	0.43	0.43	0.43
Mean	0.423	0.435	0.425	0.434
SD	0.0089	0.0173	0.0124	0.0144

Table 4.29 Sea water Mg(g/l) observed from selected sites during December 14 to November 15.

Month	Sampling Sites			
	Navapara	Aadri	Vadodara	Chorwad
December	1.22	1.27	1.24	1.26
January	1.28	1.24	1.28	1.28
February	1.32	1.25	1.30	1.20
March	1.28	1.31	1.33	1.39
April	1.24	1.29	1.27	1.31
May	1.26	1.27	1.25	1.29
June	1.32	1.30	1.34	1.34
July	1.33	1.29	1.30	1.36
August	1.28	1.27	1.27	1.23
September	1.32	1.33	1.31	1.32
October	1.32	1.33	1.31	1.34
November	1.33	1.32	1.33	1.32
Mean	1.292	1.289	1.294	1.303
SD	0.0374	0.0300	0.0323	0.0545

FIGURES

Figure 4.1 Phylum wise distribution of the intertidal macro benthos species reported from all the selected sampling sites.

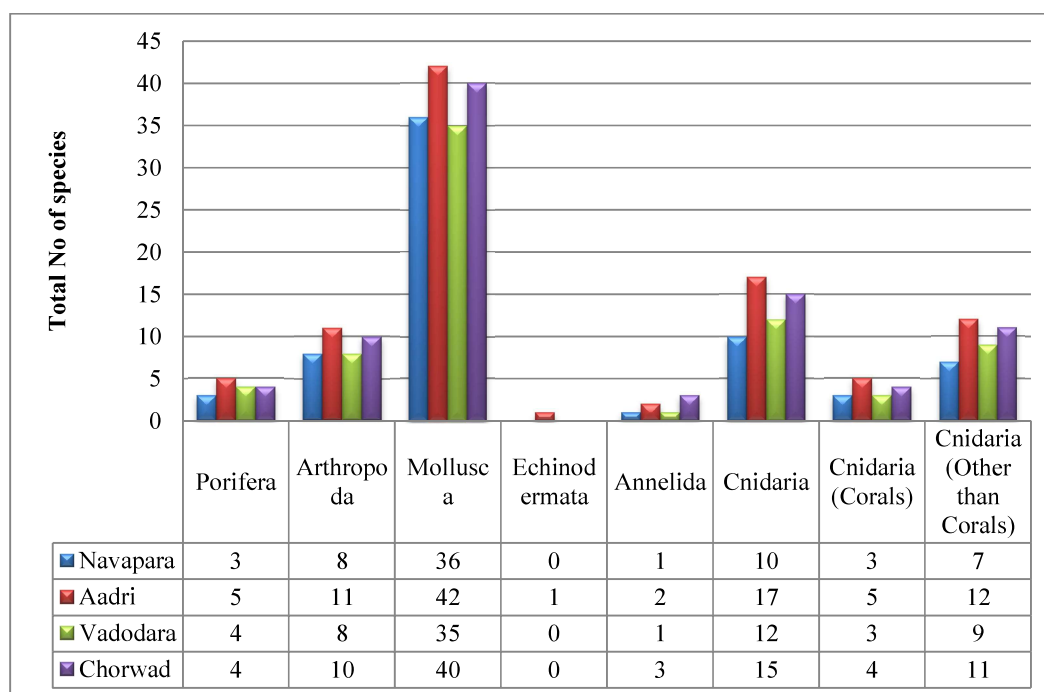


Figure 4.2 Community composition of sampled intertidal macro benthos at all selected sampling sites of study. Percentage in plot indicates the contribution of each phylum

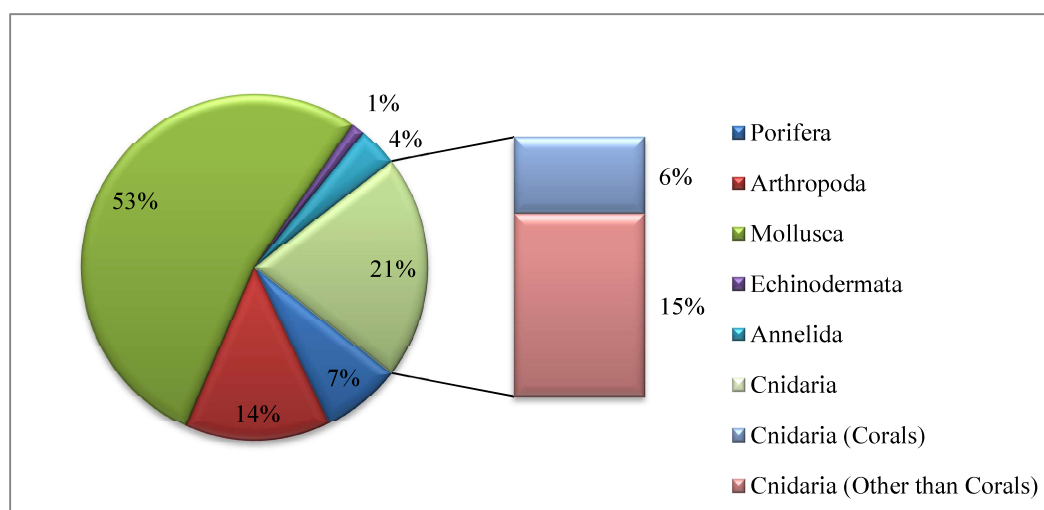


Figure 4.3 Community composition of sampled intertidal macro benthos at sampling site of Navapara. (Percentage in plot indicates the contribution of each phylum)

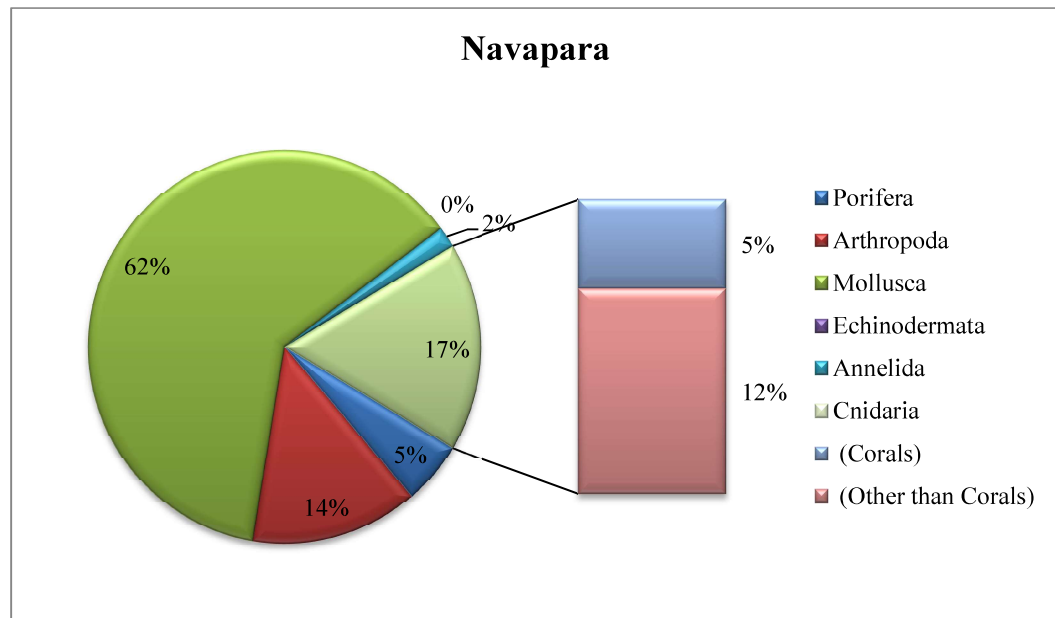


Figure 4.4 Community composition of sampled intertidal macro benthos at sampling site of Aadri. (Percentage in plot indicates the contribution of each phylum)

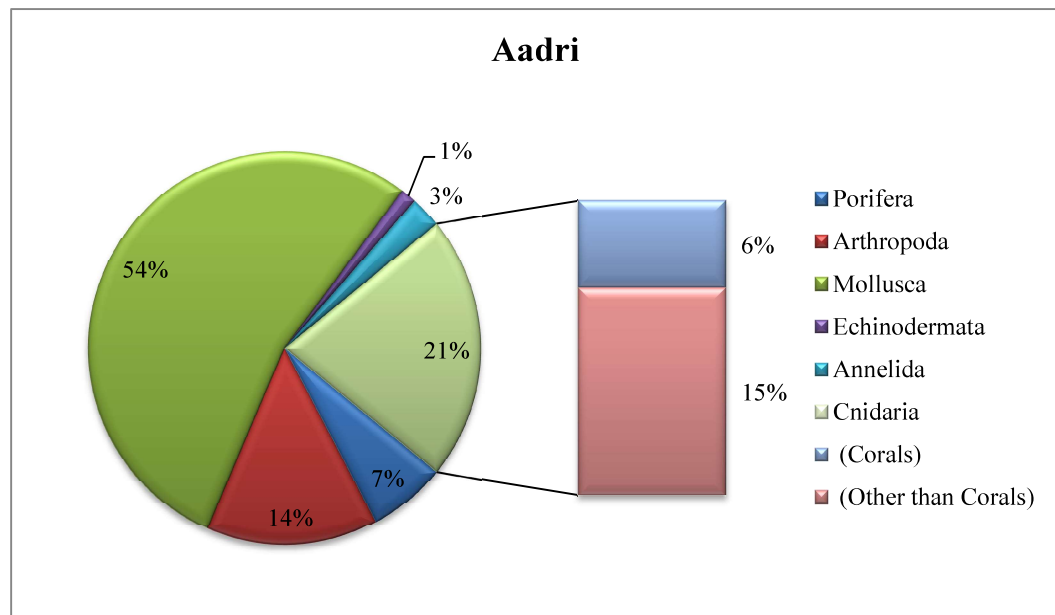


Figure 4.5 Community composition of sampled intertidal macro benthos at sampling site of Vadodara. (Percentage in plot indicates the contribution of each phylum)

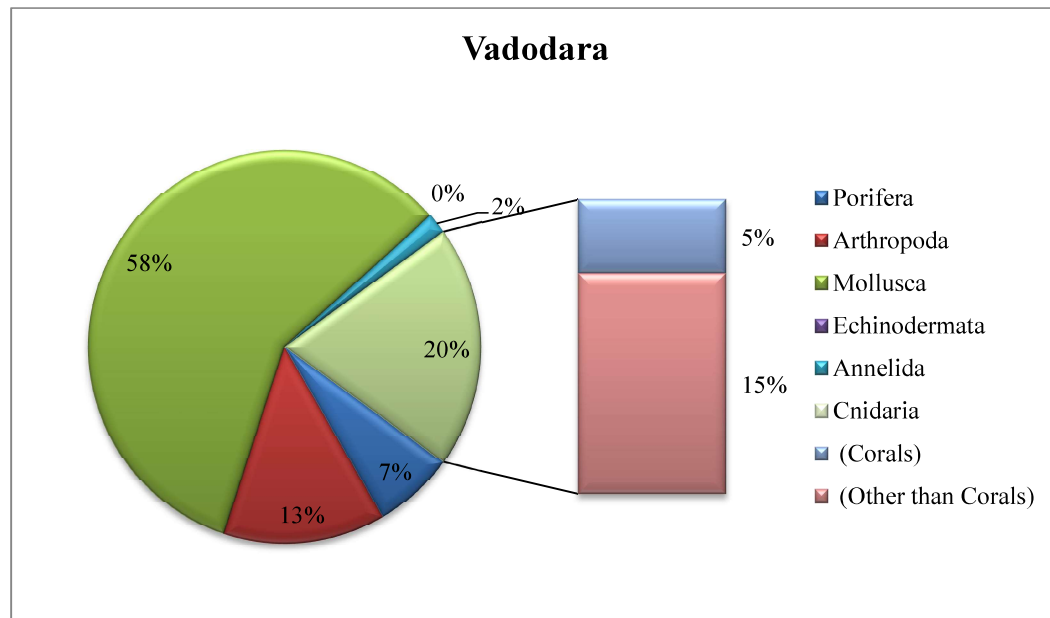


Figure 4.6 Community composition of sampled intertidal macro benthos at sampling site of Chorwad. (Percentage in plot indicates the contribution of each phylum)

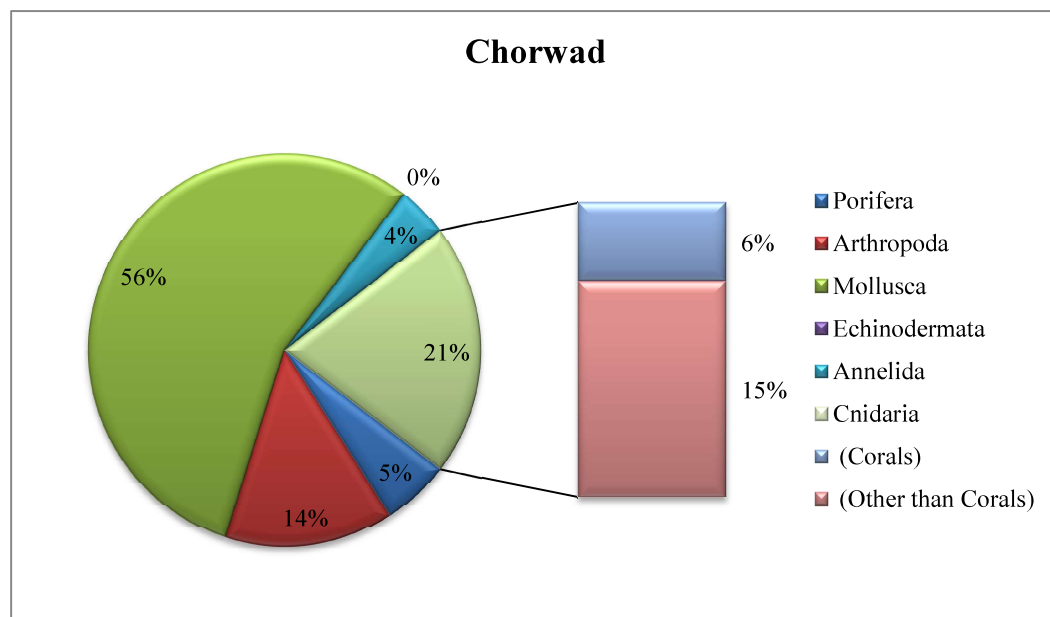


Figure 4.7 Monthly variations in various ecological attributes of *Onchidium verruculatum* in different littoral zones at Navapara from December 2014 to November 2015.

Figure 4.7-A

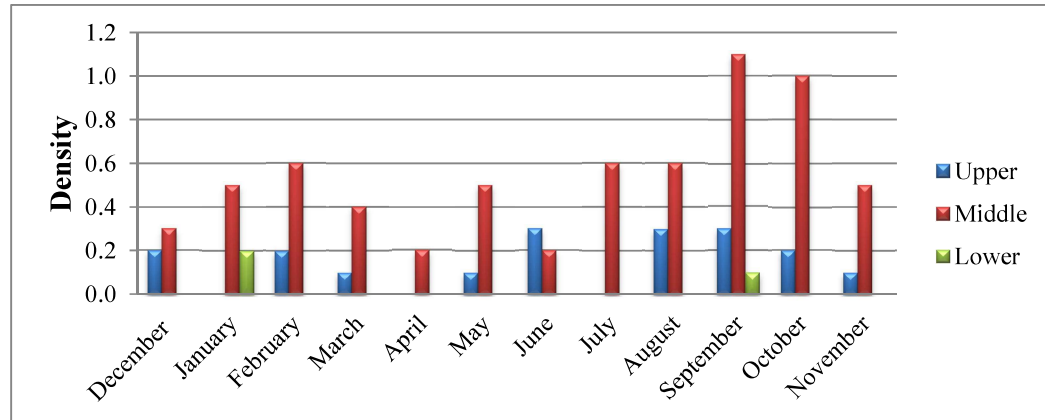


Figure 4.7-B

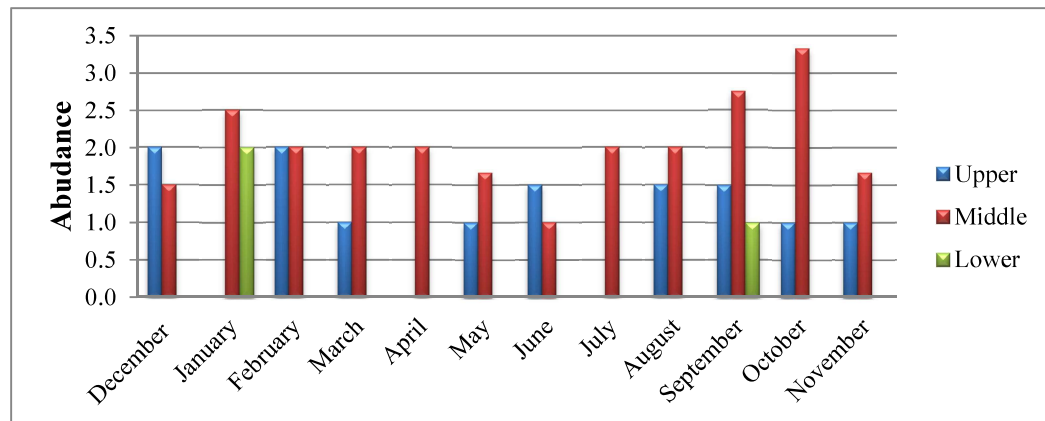


Figure 4.7-C

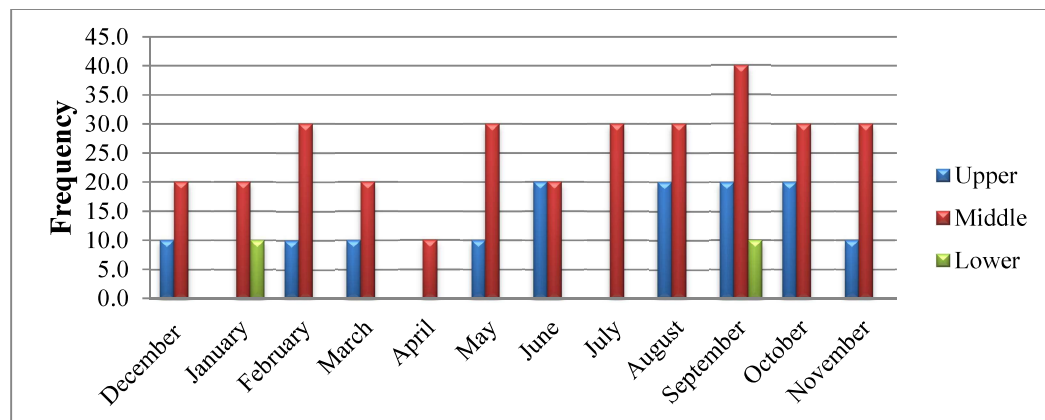


Figure 4.8 Monthly variations in various ecological attributes of *Onchidium verruculatum* in different littoral zones at Aadri from December 2014 to November 2015.

Figure 4.8-A

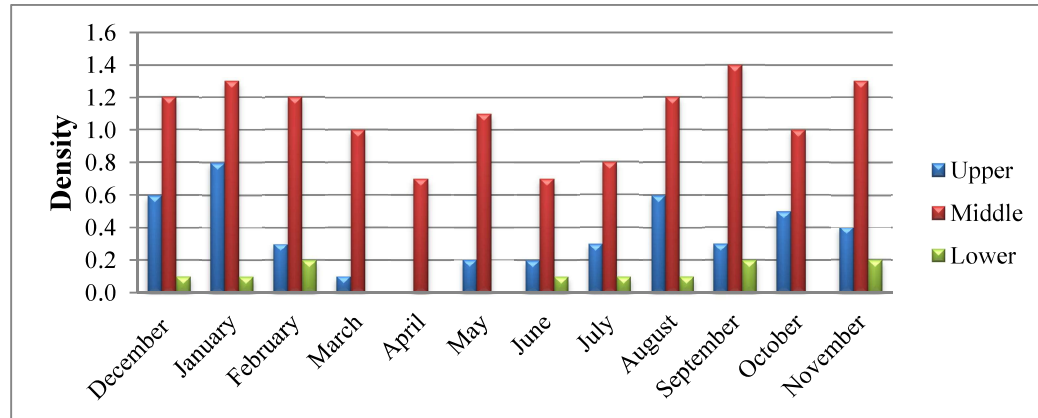


Figure 4.8-B

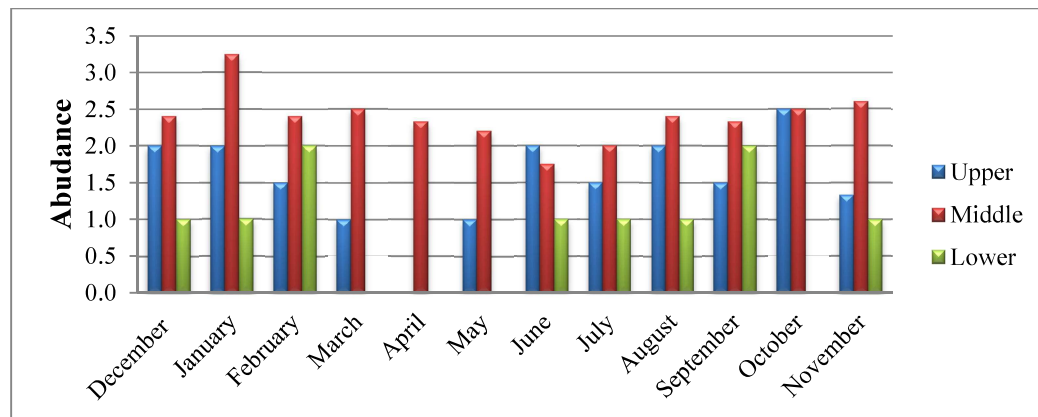


Figure 4.8-C

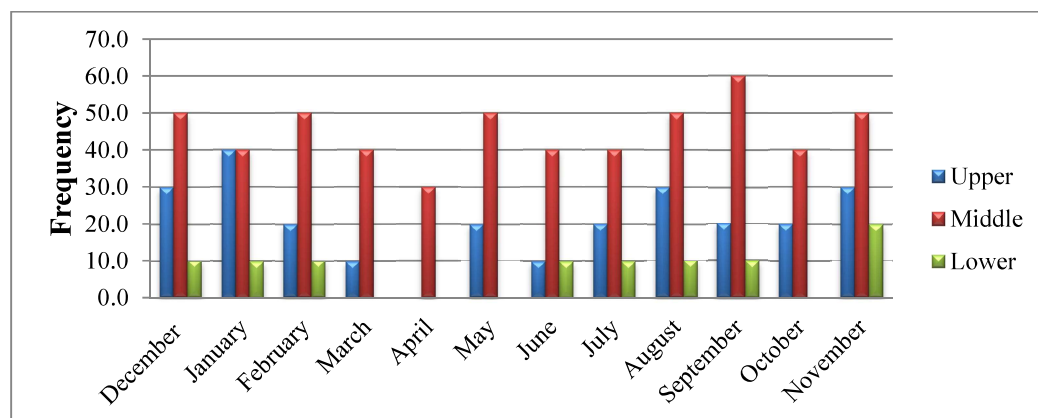


Figure 4.9 Monthly variations in various ecological attributes of *Onchidium verruculatum* in different littoral zones at Vadodara from December 2014 to November 2015.

Figure 4.9-A

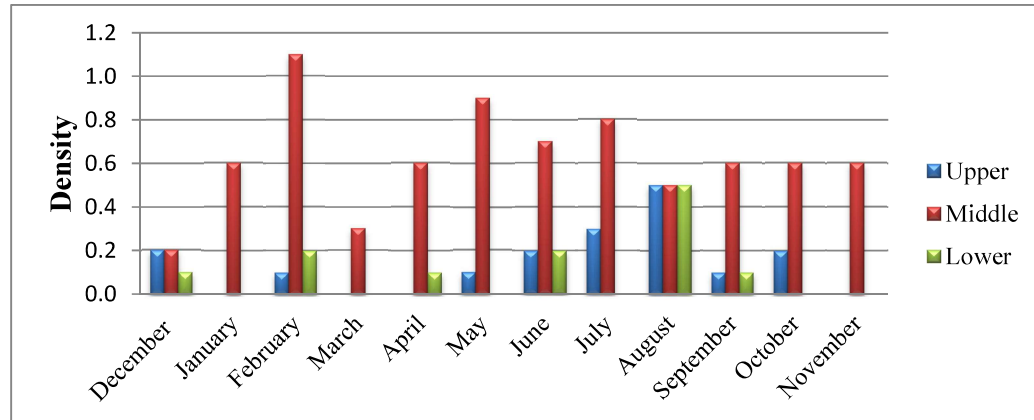


Figure 4.9-B

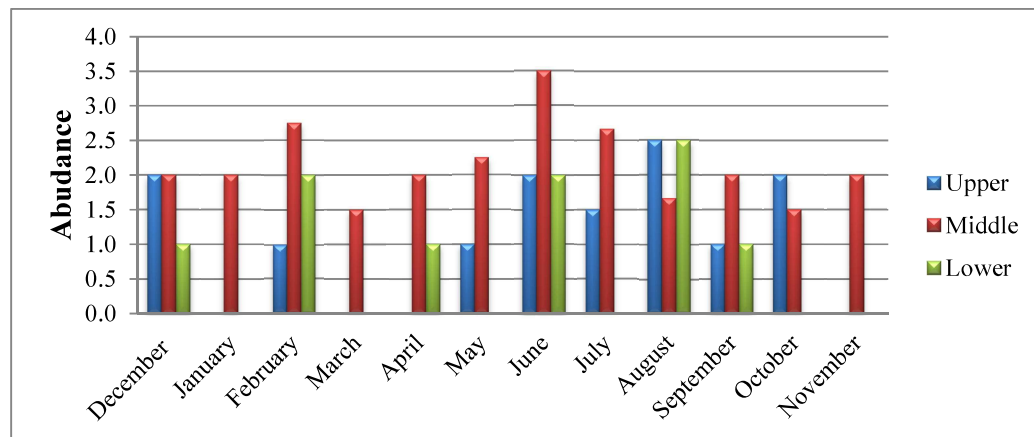


Figure 4.9-C

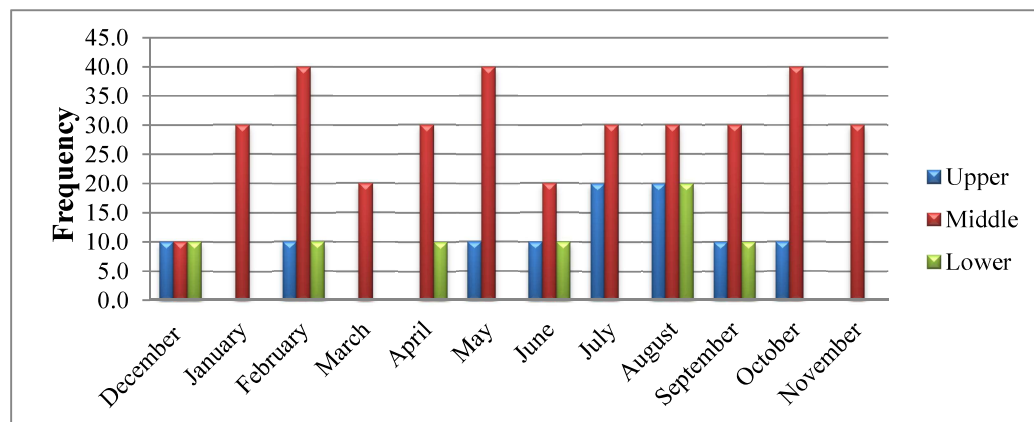


Figure 4.10 Monthly Variations in various ecological attributes of *Onchidium verruculatum* in different littoral zones at Chorwad from December 2014 to November 2015.

Figure 4.10-A

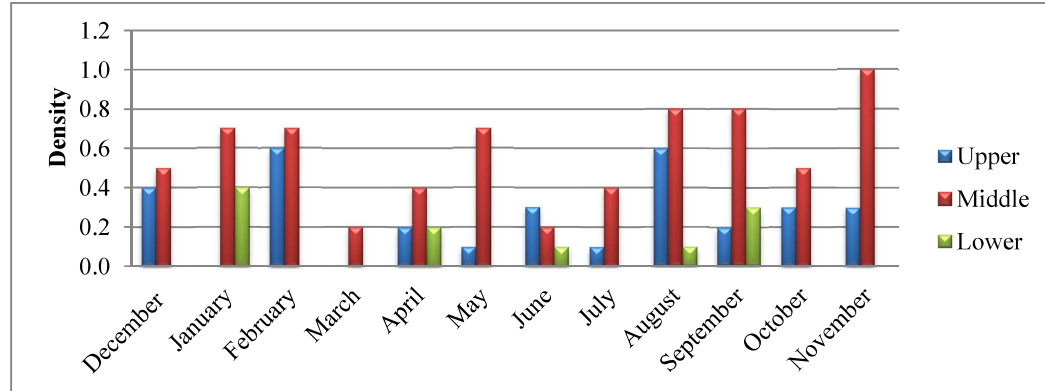


Figure 4.10-B

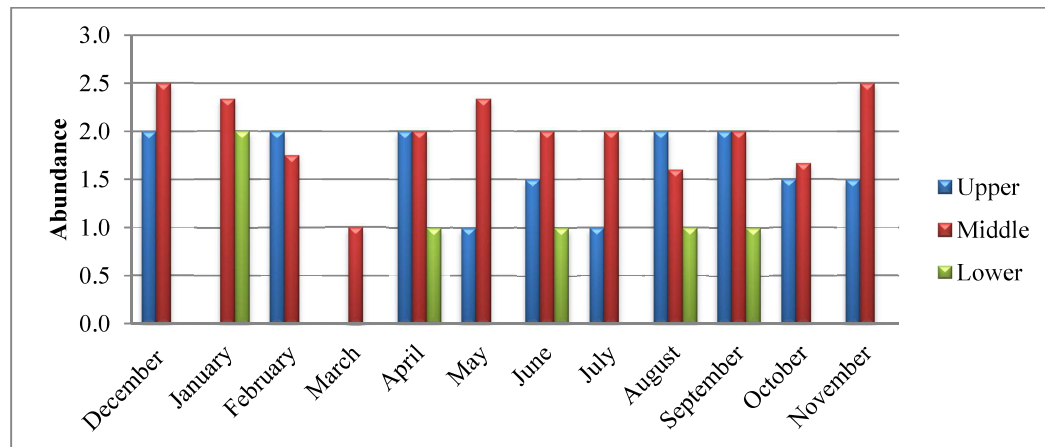


Figure 4.10-C

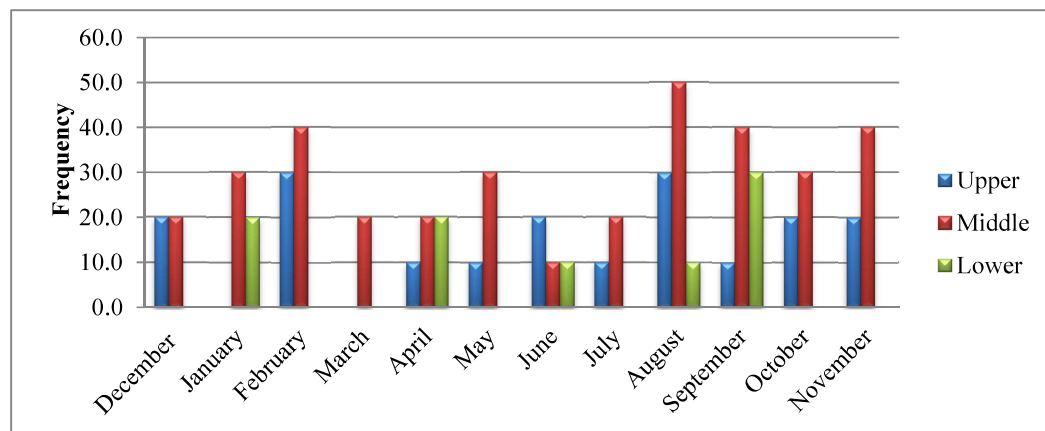


Figure 4.11 Monthly variations in various ecological attributes of *Cellana Radiata* in different littoral zones at Navapara from December 2014 to November 2015.

Figure 4.11-A

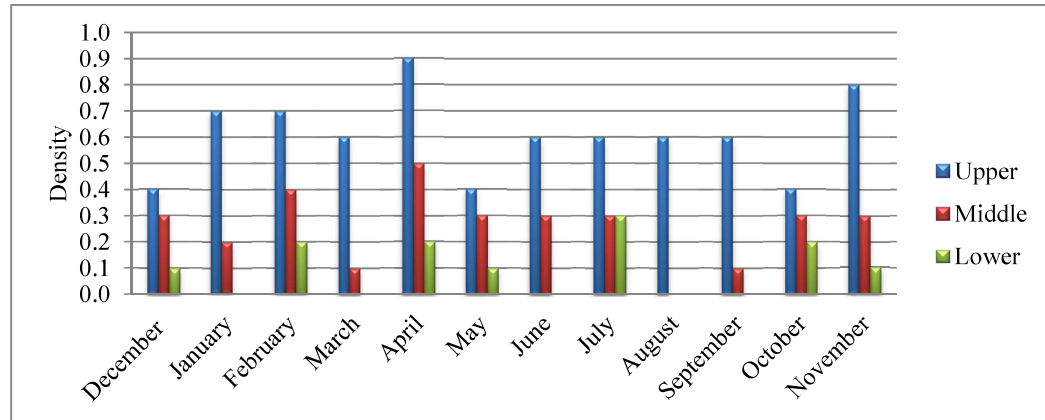


Figure 4.11-B

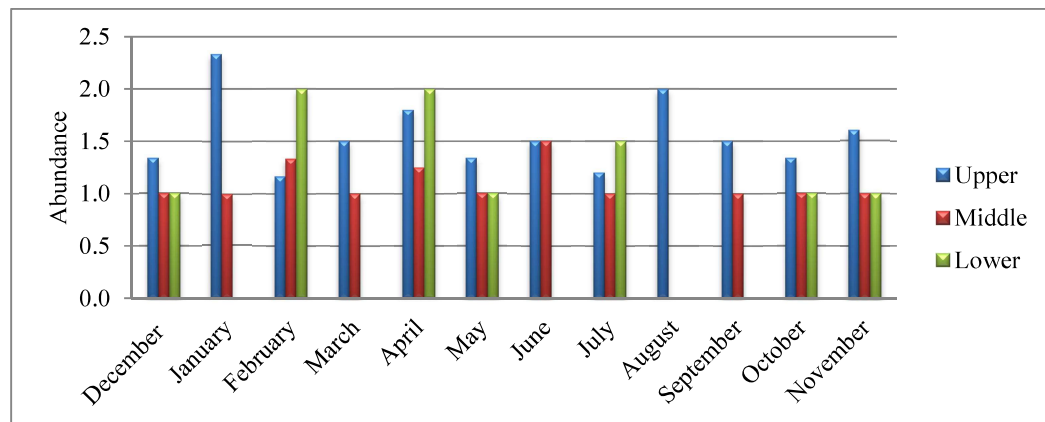


Figure 4.11-C

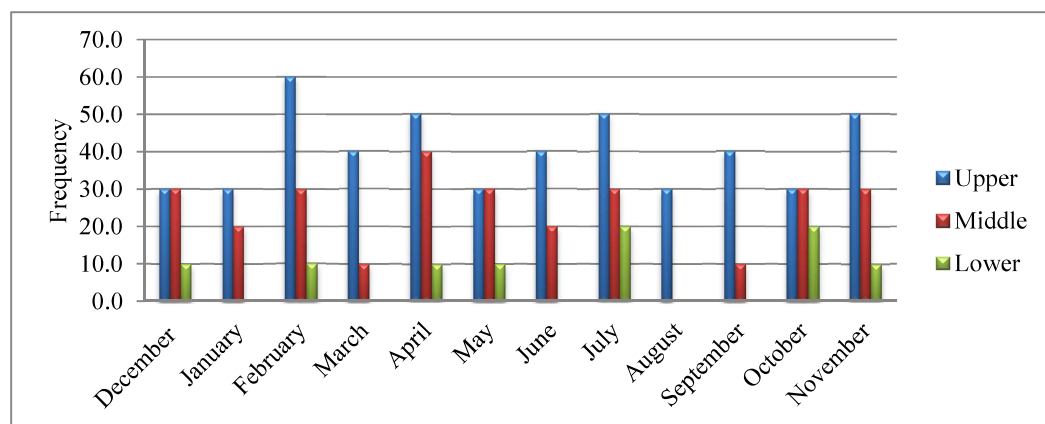


Figure 4.12 Monthly variations in various ecological attributes of *Cellana Radiata* in different littoral zones at Aadri from December 2014 to November 2015.

Figure 4.12-A

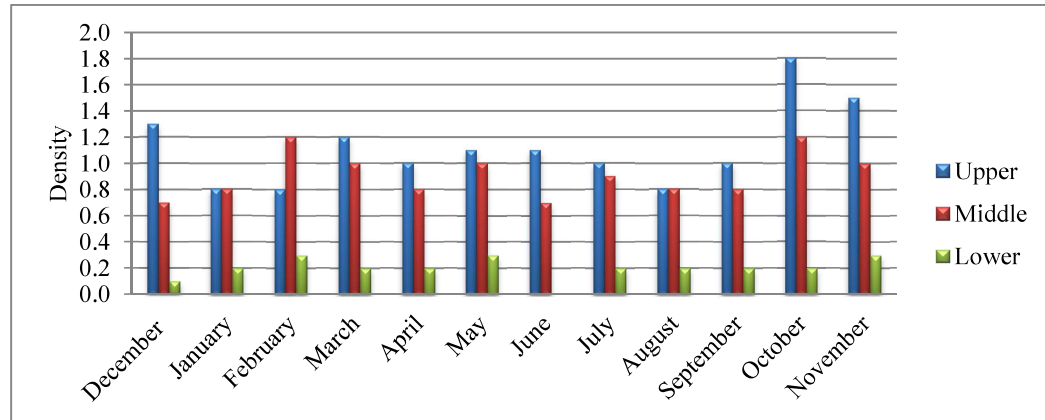


Figure 4.12-B

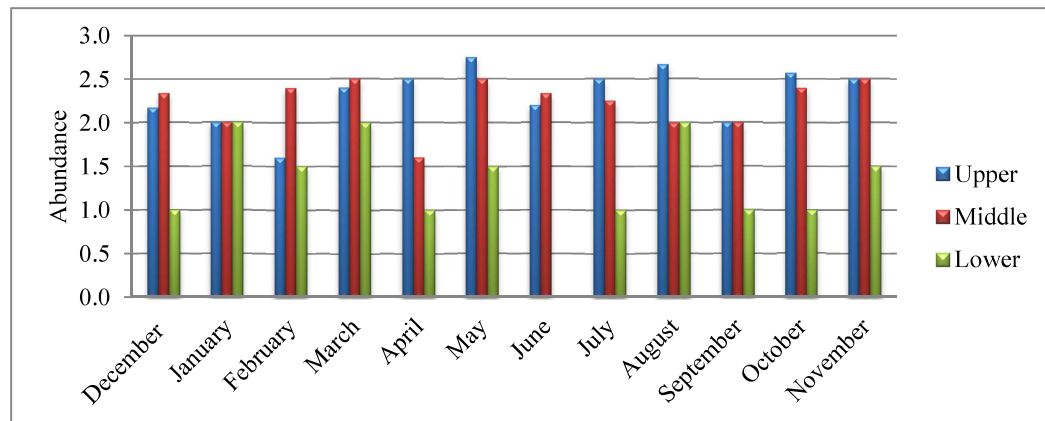


Figure 4.12-C

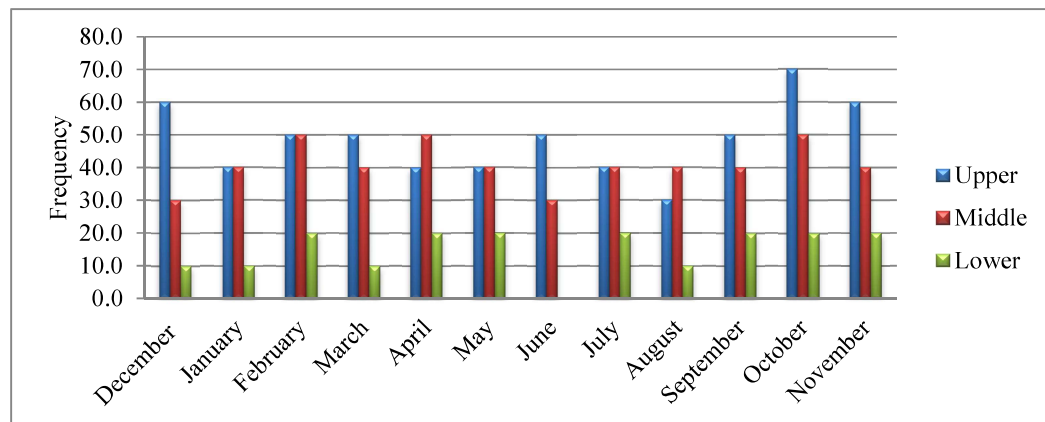


Figure 4.13 Monthly variations in various ecological attributes of *Cellana Radiata* in different littoral zones at Vadodara from December 2014 to November 2015.

Figure 4.13-A

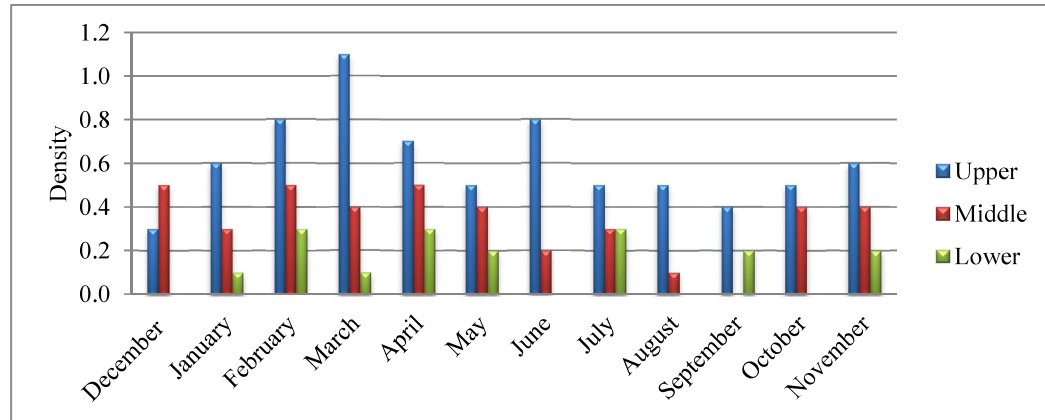


Figure 4.13-B

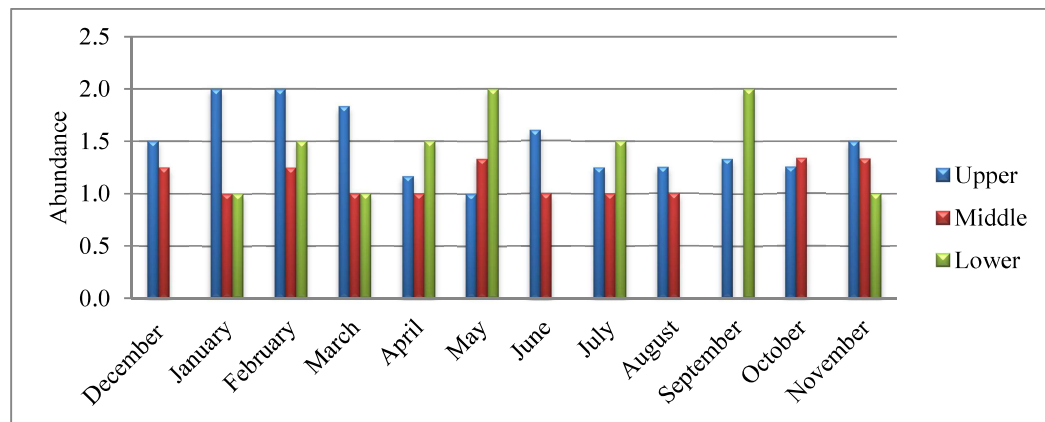


Figure 4.13-C

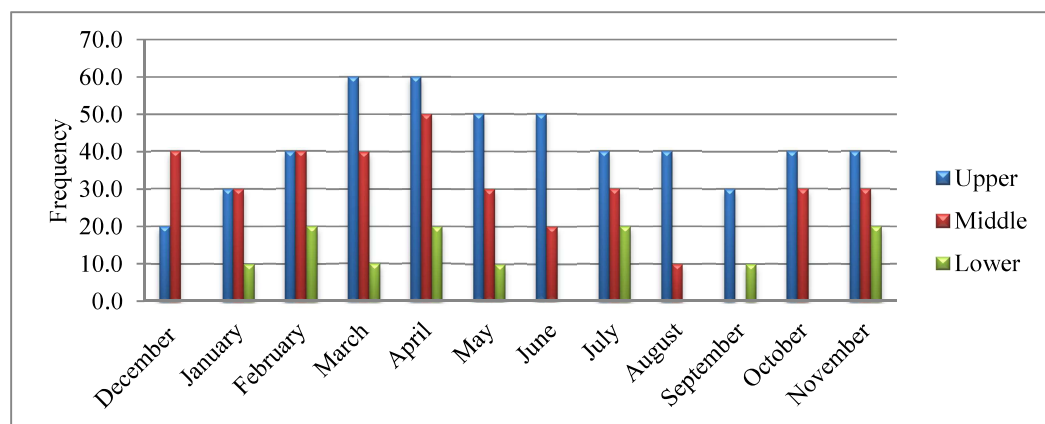


Figure 4.14 Monthly variations in various ecological attributes of *Cellana radiata* in different littoral zones at Chorwad from December 2014 to November 2015.

Figure 4.14-A

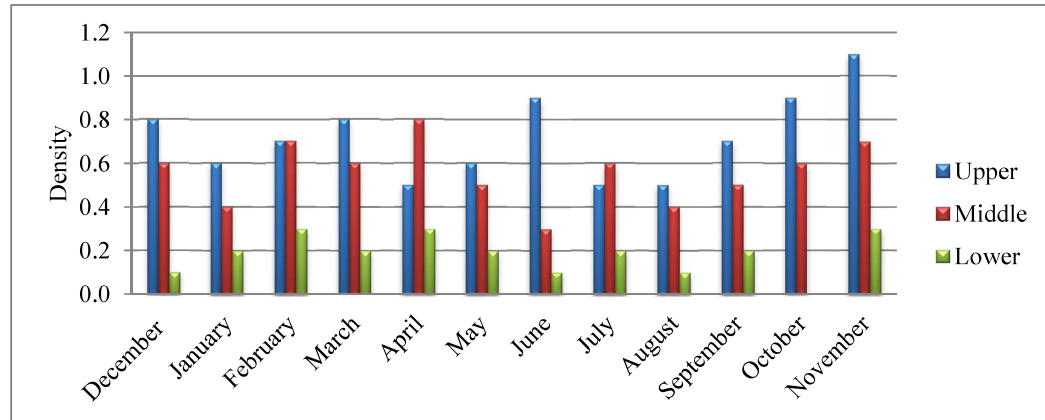


Figure 4.14-B

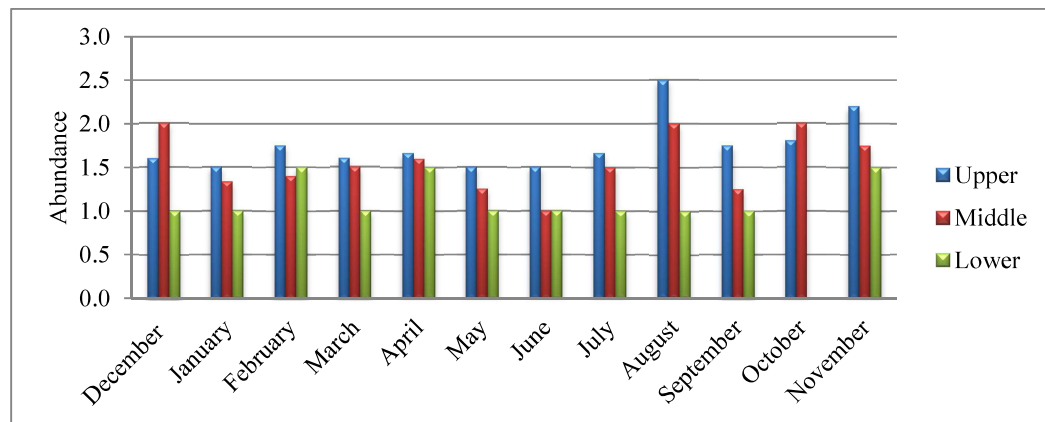


Figure 4.14-C

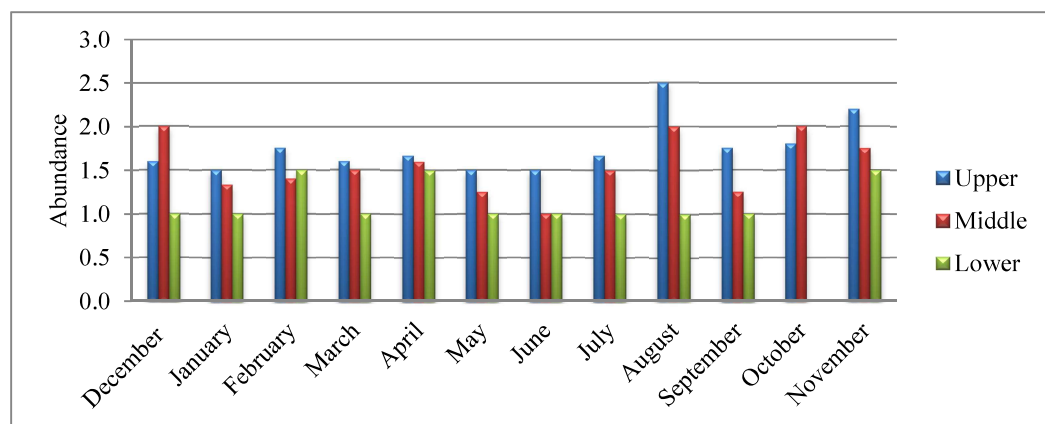


Figure 4.15 Monthly variations in various ecological attributes of *Conus Miliaris* in different littoral zones at Navapara from December 2014 to November 2015.

Figure 4.15-A

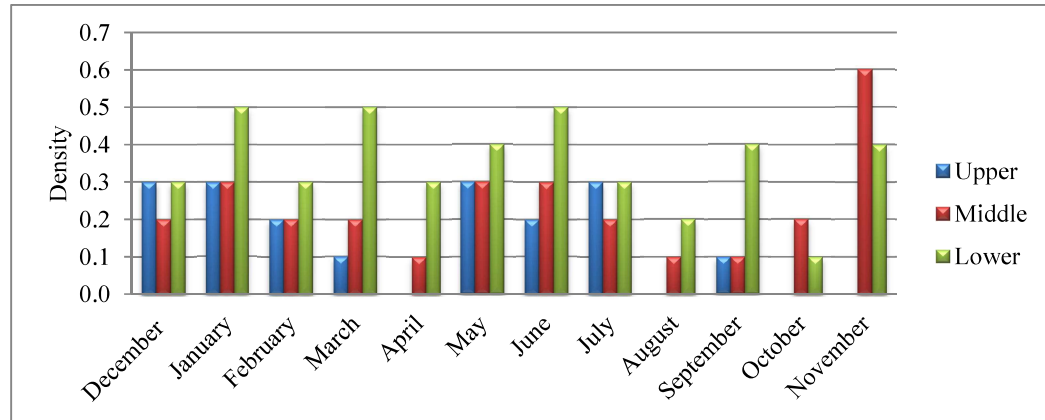


Figure 4.15-B

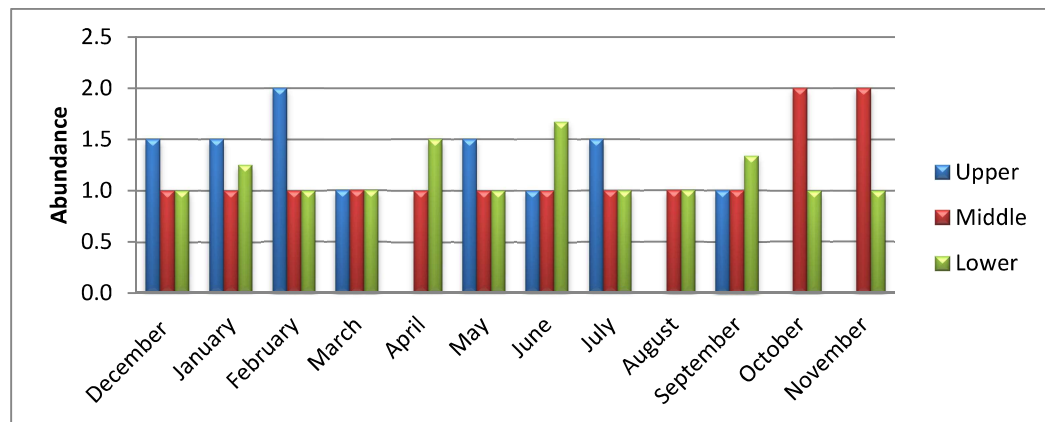


Figure 4.15-C

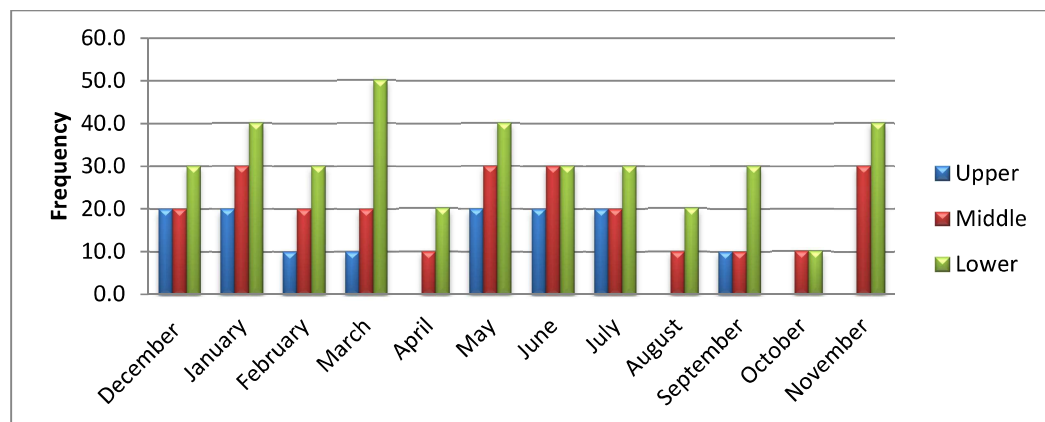


Figure 4.16 Monthly variations in various ecological attributes of *Conus Miliaris* in different littoral zones at Aadri from December 2014 to November 2015.

Figure 4.16-A

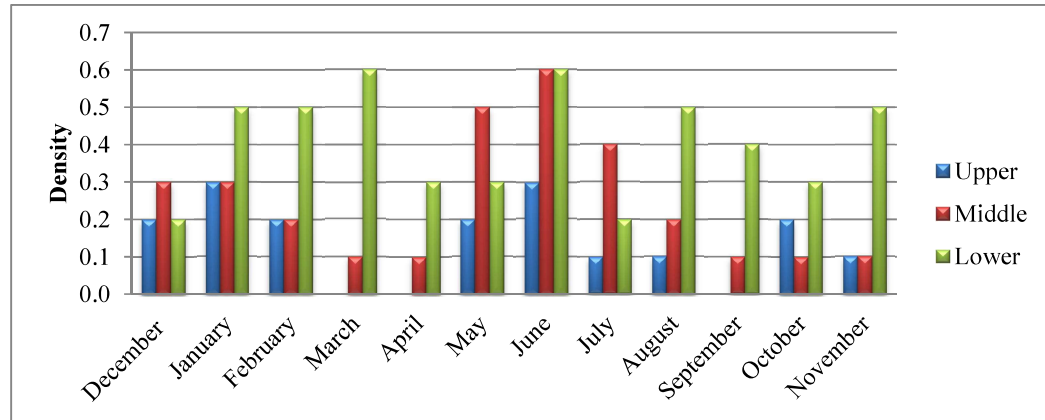


Figure 4.16-B

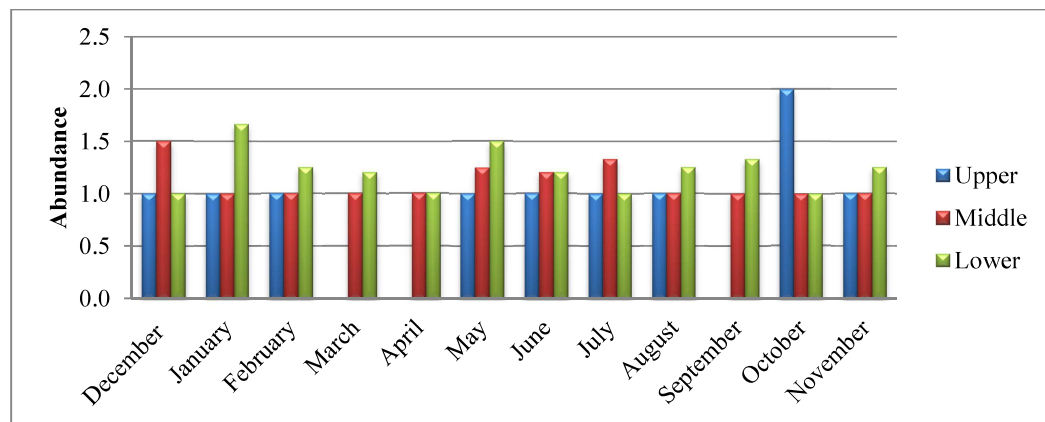


Figure 4.16-C

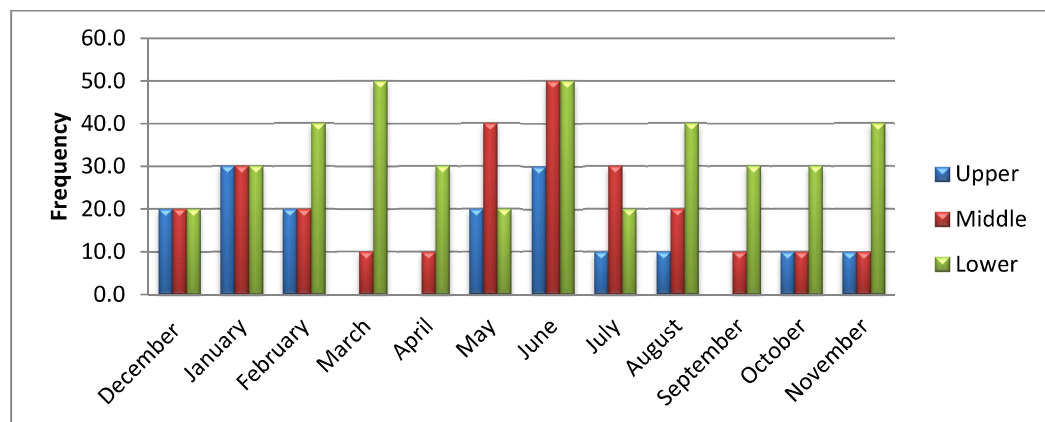


Figure 4.17 Monthly variations in various ecological attributes of *Conus Miliaris* in different littoral zones at Vadodara from December 2014 to November 2015.

Figure 4.17-A

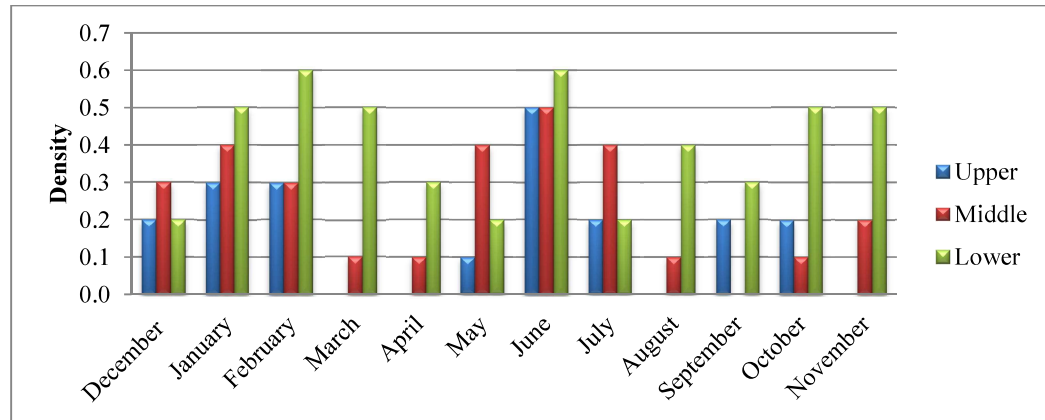


Figure 4.17-B

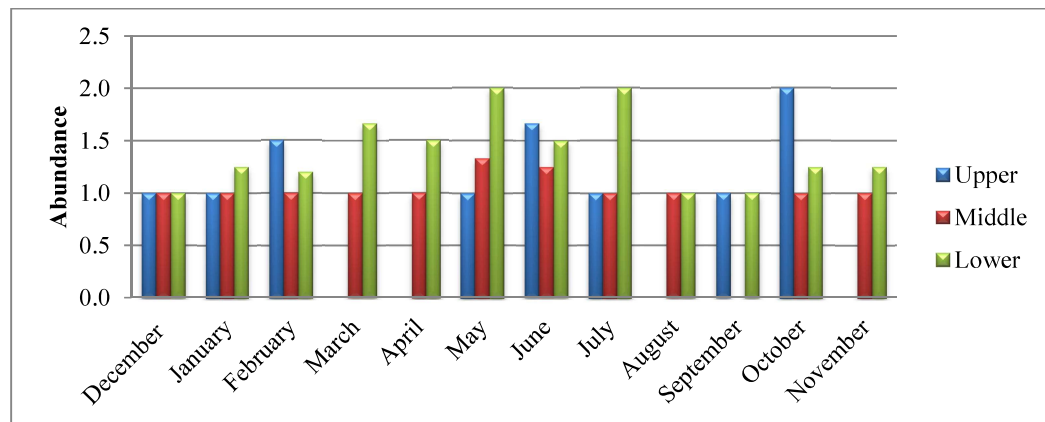


Figure 4.17-C

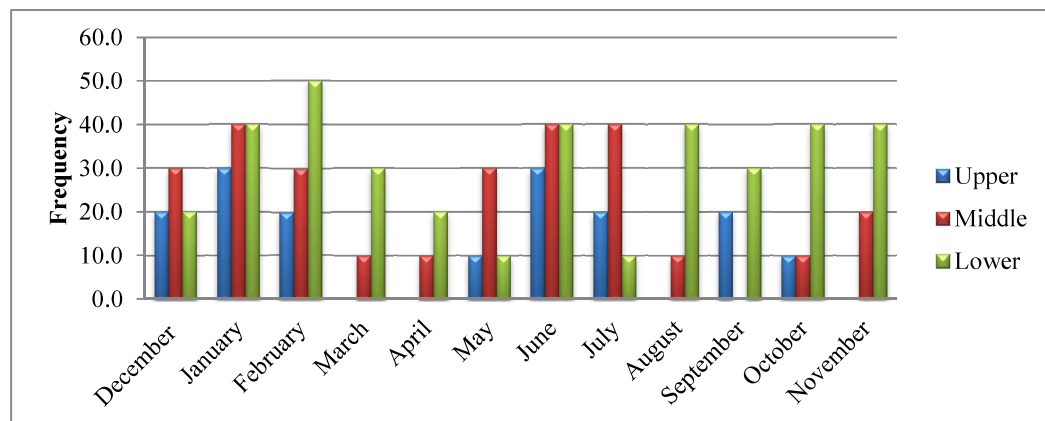


Figure 4.18 Monthly variations in various ecological attributes of *Conus Miliaris* in different littoral zones at Chorwad from December 2014 to November 2015.

Figure 4.18-A

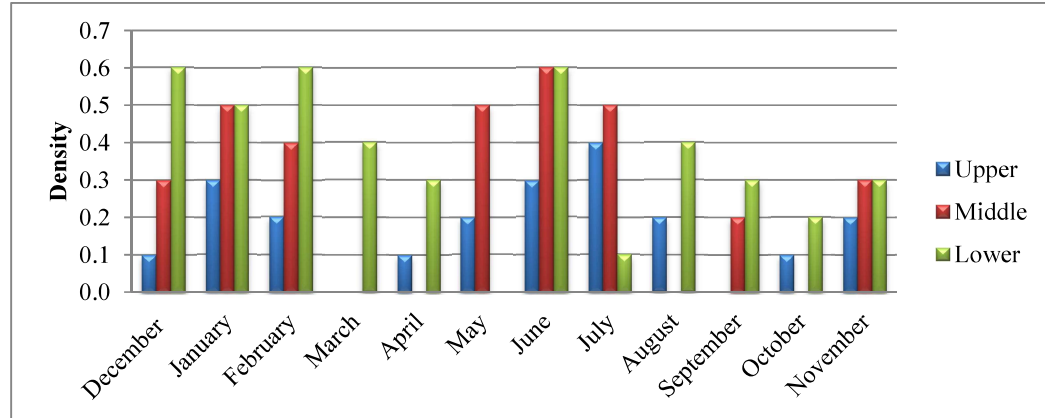


Figure 4.18-B

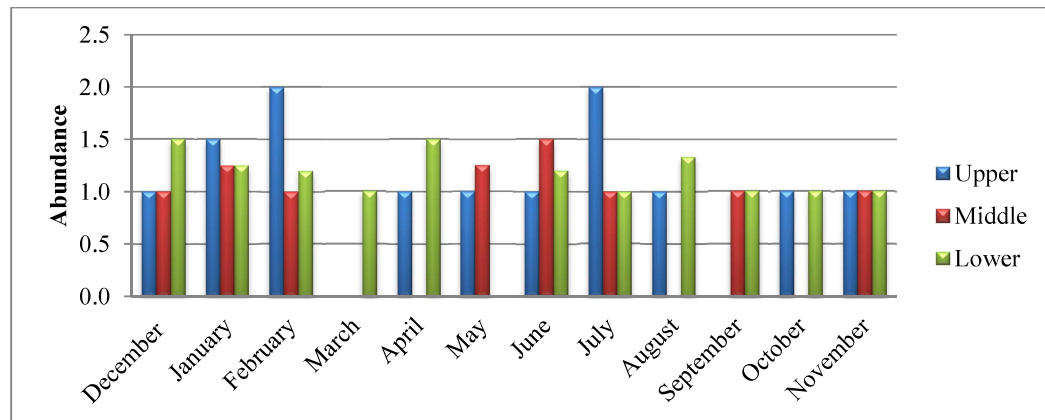


Figure 4.18-C

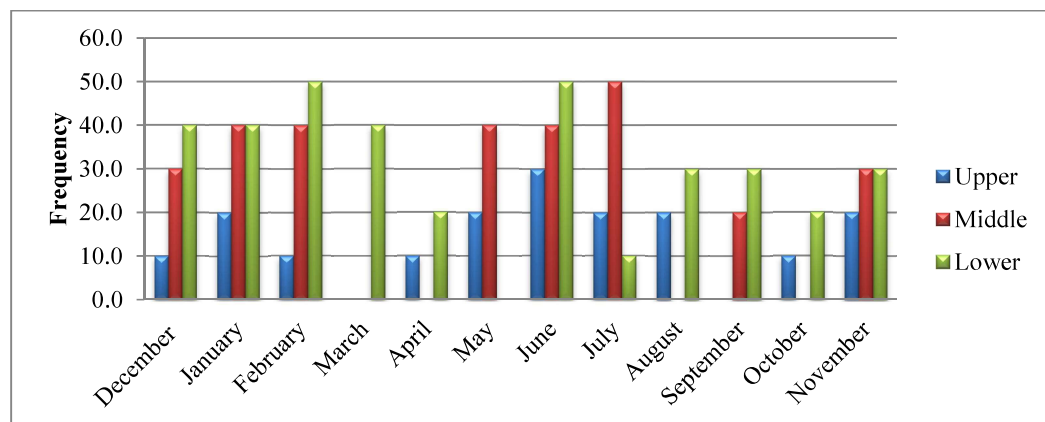


Figure 4.19 Month wise distribution of Temperature ($^{\circ}\text{C}$) of the seawater samples of selected sampling sites.

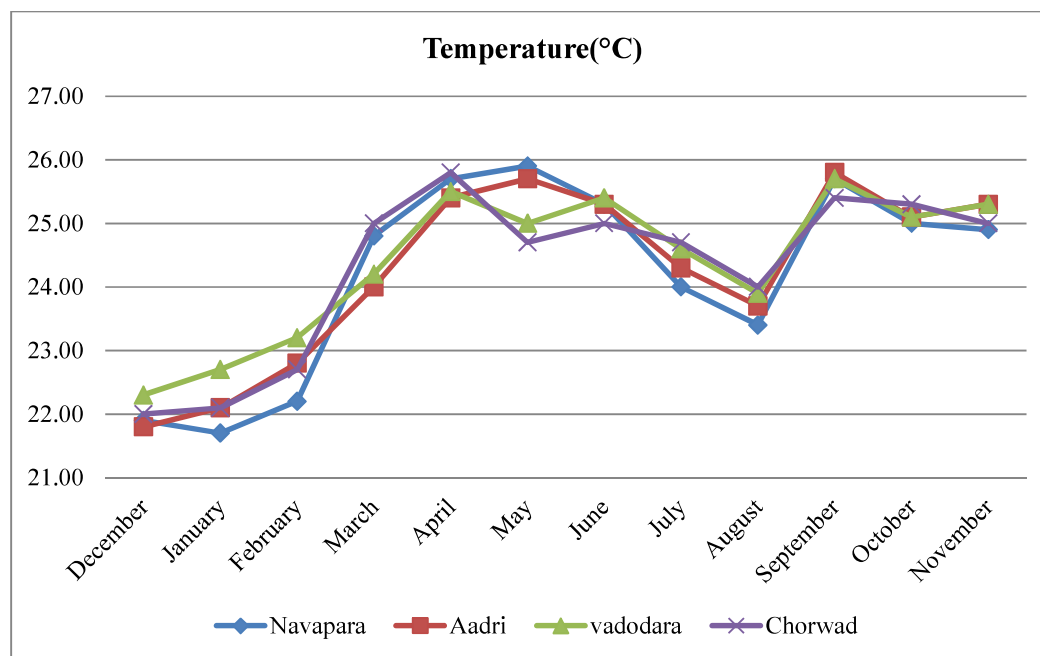


Figure 4.20 Month wise distribution of pH of the seawater samples of selected sampling sites.

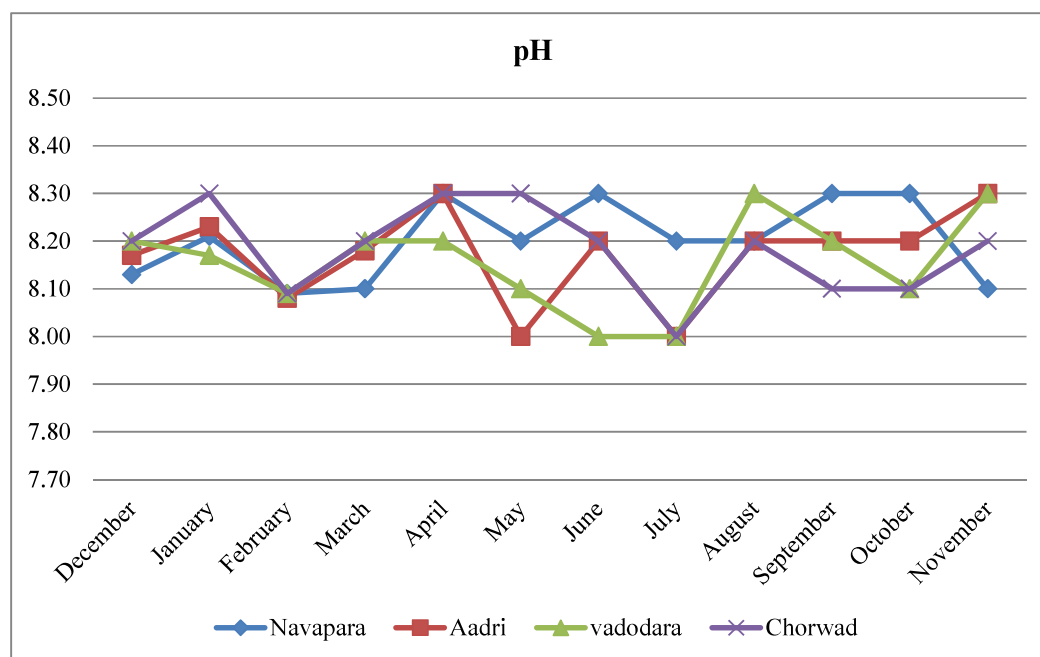


Figure 4.21 Month wise distribution of Total Solids (g/l) of the seawater samples of selected sampling sites.

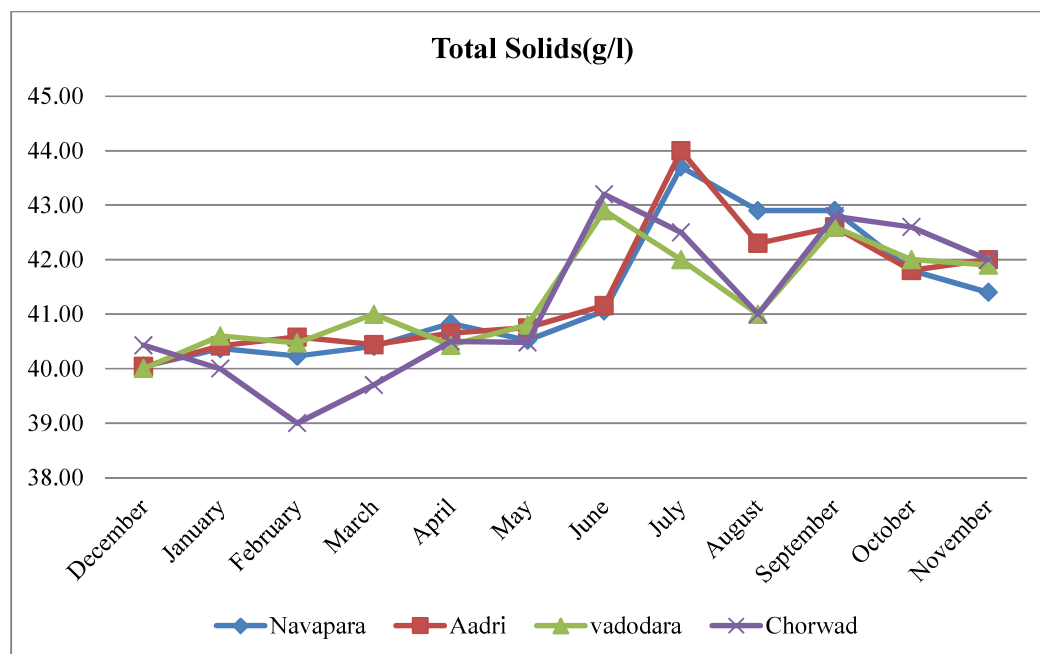


Figure 4.22 Month wise distribution of TDS (g/l) of the seawater samples of selected sampling sites.

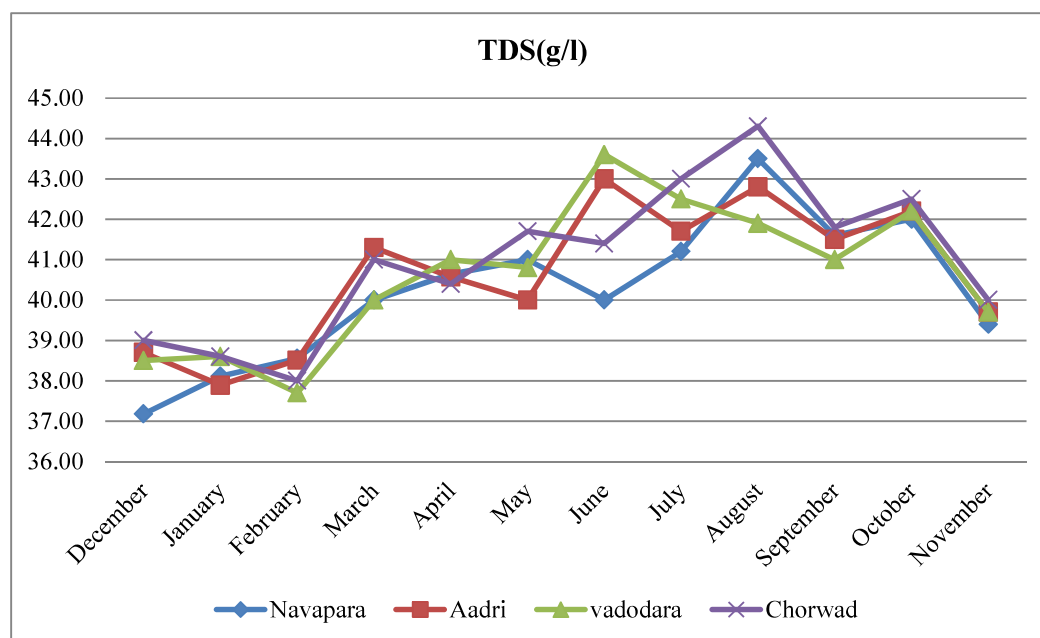


Figure 4.23 Month wise distribution of Salinity (ppt) of the seawater samples of selected sampling sites.

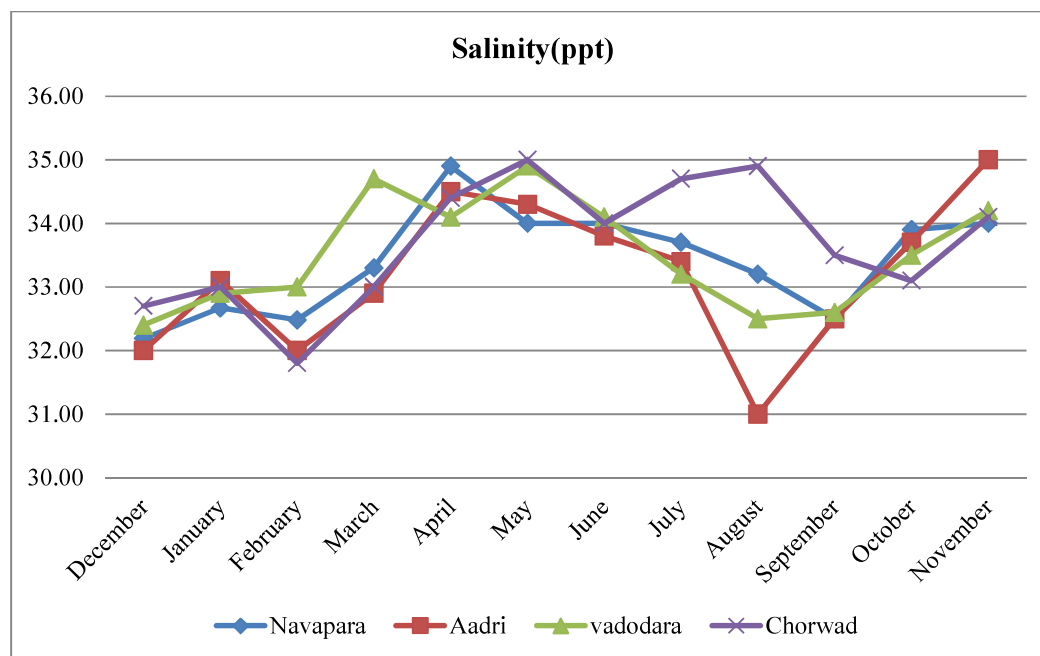


Figure 4.24 Month wise distribution of DO (mg/l) of the seawater samples of selected sampling sites.

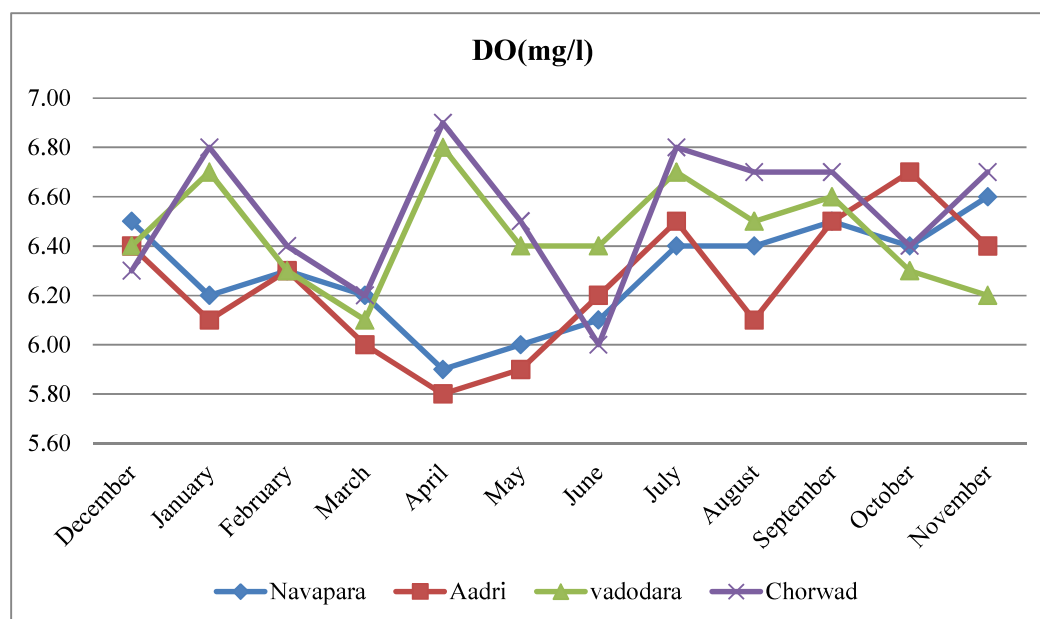


Figure 4.25 Month wise distribution of Ca (g/l) of the seawater samples of selected sampling sites.

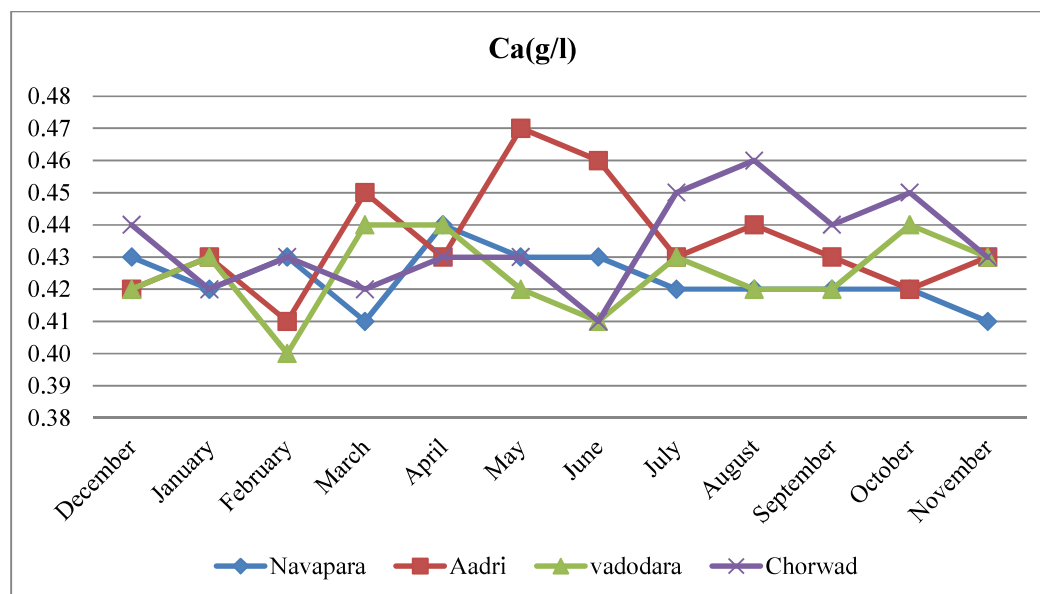
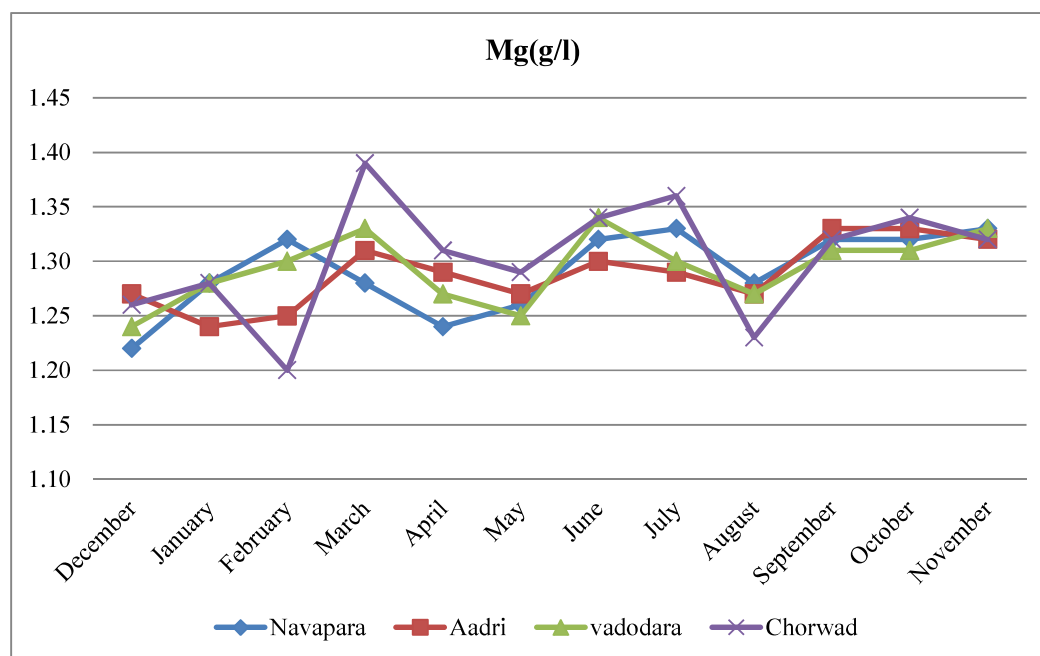


Figure 4.26 Month wise distribution of Mg (g/l) of the seawater samples of selected sampling sites.



PLATES

Plate 3.1 Map of the study sites

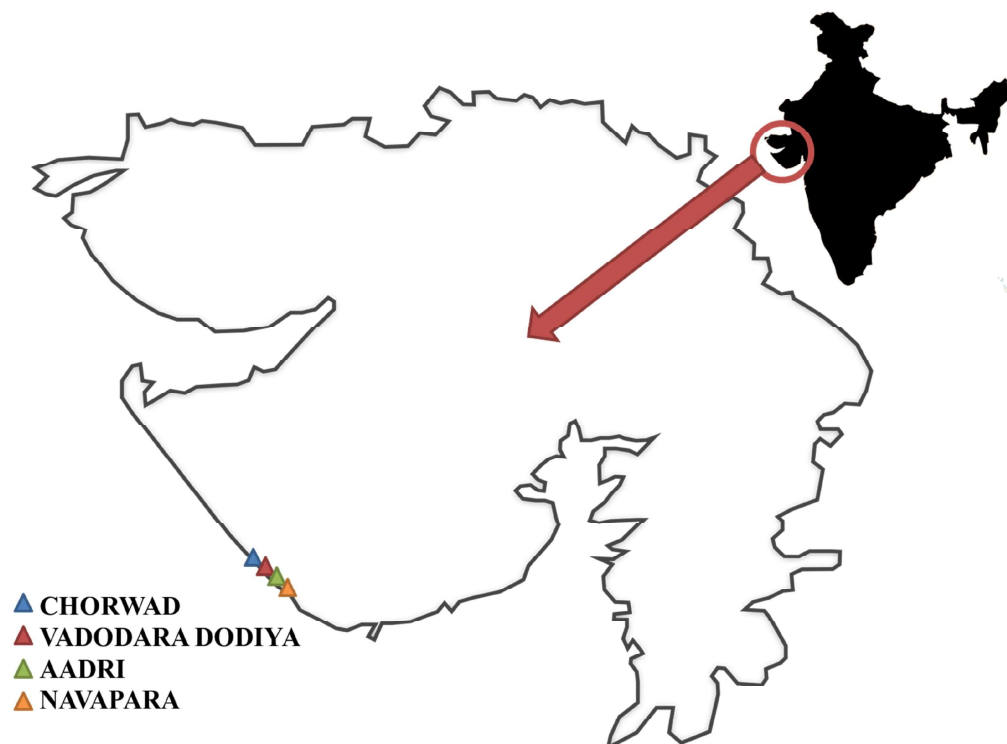
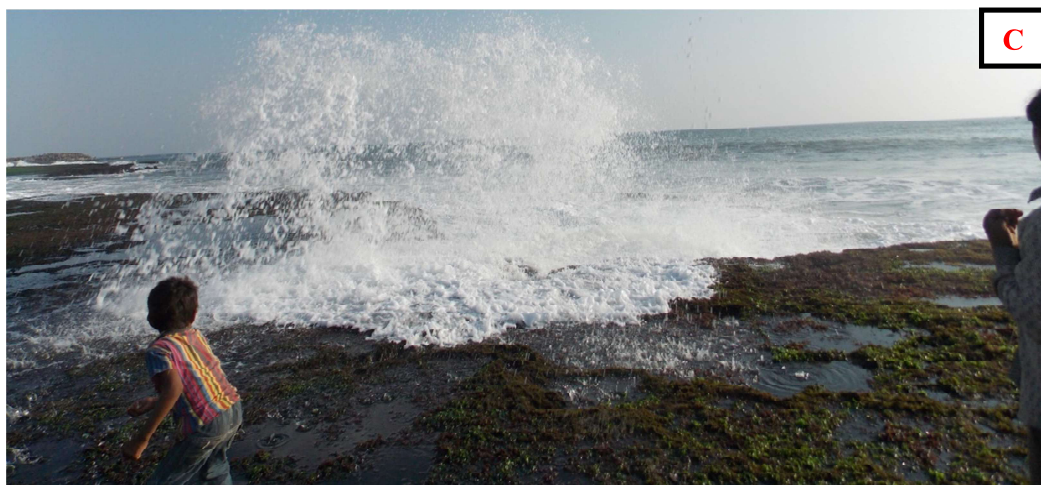


Plate 3.2 Sampling site of study area



A, B-Sampling site Navapara, C-Sampling site Aadri

Plate 3.2 Sampling site of study area (Conti...)



A-Sampling site Aadri, B, C-Sampling site Vadodara Dodiya

Plate 3.2 Sampling site of study area (Cont...)



A, B, C-Sampling site of Chorwad

Plate 3.3 Species selected for population ecology



A, B-*Onchidium verruculatum*, C, D-*Cellana radiata*, E-*Conus miliaris*

Plate 4.1 Intertidal macro benthos - Mollusca



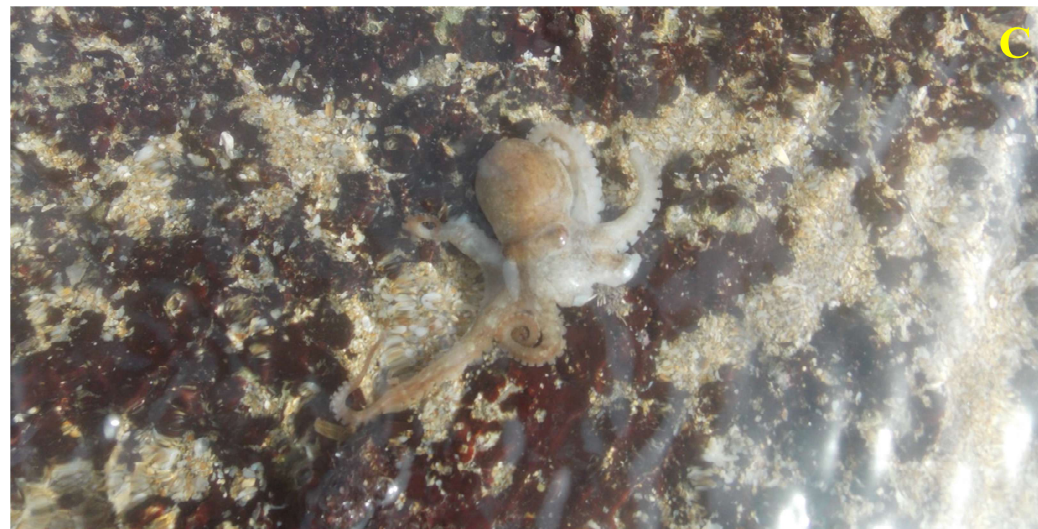
**A- *Purpura panama*, B- *Cypraea depressa*, C- *Littorina* spe., D- *Trochus radiatus* ,
E- *Purpura panama***

Plate 4.1 Intertidal macro benthos – Mollusca (Cont...)



A-*Bursa granularis*, B- *Cantharus undosus*, C- *Chiton peregrinus*, D- *Murex bruneus*, E- *Rhinoclavis sinensis*, F- *Turbo intercostalis*

Plate 4.1 Intertidal macro benthos - Mollusca (Cont...)



A,B- *Aplysia oculifera*, C- *Octopus vulgaris*,

Plate 4.2 Intertidal macro benthos - Annelida, Echinodermata, Porifera



A- *Neris spe*, B- *Brittle star*, C- *Halichondria panacea*, D-*Granita spe*.

Plate 4.3 Intertidal macro benthos - Arthropoda



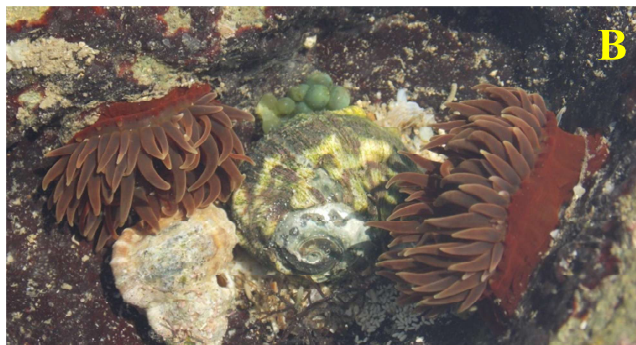
A- Pilumnus vespertilio*, *B- Pachygrapsus crassipes*, *C- Portunus pelagicus*, *D- Scylla serrata*, *E- Cancer pagurus

Plate 4.3 Intertidal macro benthos - Arthropoda(Cont...)



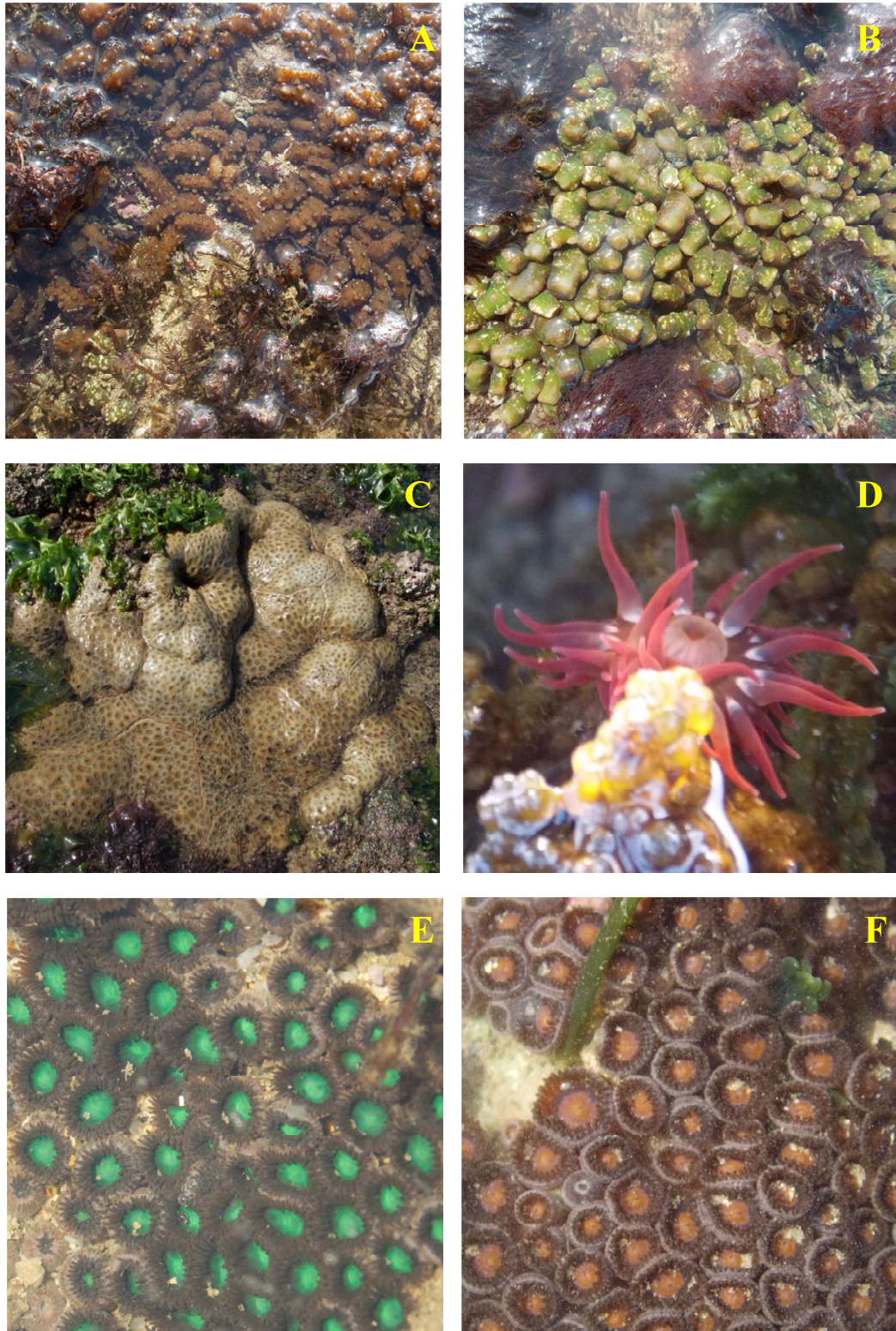
A- *balanus amphirite*, B,C-*Lepas anatifera*

Plate 4.4 Intertidal macro benthos - Cnidaria



A,B- *Actinia equina*, C- *Anthopleura sola*

Plate 4.4 Intertidal macro benthos - Cnidaria(Cont...)



A,B- Isaurus tuberculatus, C- Palythoa tuberculosa, D- utricina spe., E,F- Zoanthus sansibaricus

Plate 4.4 Intertidal macro benthos - Cnidaria(Cont...)



A- *Zoanthus sociatus*, B- *Zoanthus kuroshio*, C- *Montipora foliosa*, D-*Goniopora* Spe.

Plate 4.5 Intertidal macro benthos - Flora



**A- *Caulerpa racemosa*, B- *Cladophora glomerata*, C- *Boergesenia forbesii*,
D- *Sargassum swartzii*, E- *Champia compressa*, F- *Galaxaura oblongata***