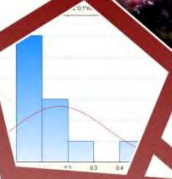
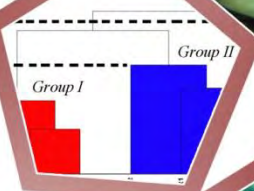
Intercalibration Report

Benthos





Black Sea

monitoring harmonization process

Intercalibration Report

Benthos

Black Sea monitoring harmonization process

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I. Description of the Intercalibration

This report presents the results from the MISIS cruise intercalibration, on macrozoobenthos and meiobenthos in the intercalibration stations (M10 and M18). There are reported results from 3 institutes from two countries. The participating institutes are listed in Annex 1.

Total abundance and biomass of macrozoobenthic organisms at the intercalibration stations were compared among three institutes. On the other hand, abundance and biomass values of meiobenthic organisms were compared only between two institutes. The raw data from the institutes can be found in Annex 2.

The sampling methodologies of the countries are given in Annex 3.

Statistical calculations were run on raw data under two titles as Z-Score calculation and Similarity/Dissimilarity analysis. The methodology of the statistical analyzes is given in the relevant chapter.

II. Samples used for Intercalibration

Samples were taken during MISIS cruise on 26th of July 2013 from station M10 int, longitude East 28.5000, latitude North 43.166667, bottom depth 76.1 m and 30th of July 2013 from station M18 int, longitude East 28,1128666, latitude North 41,82991666, bottom depth 27.2 m, each station in three replicates. Meiobenthos samples were taken as two replicates at the same stations.

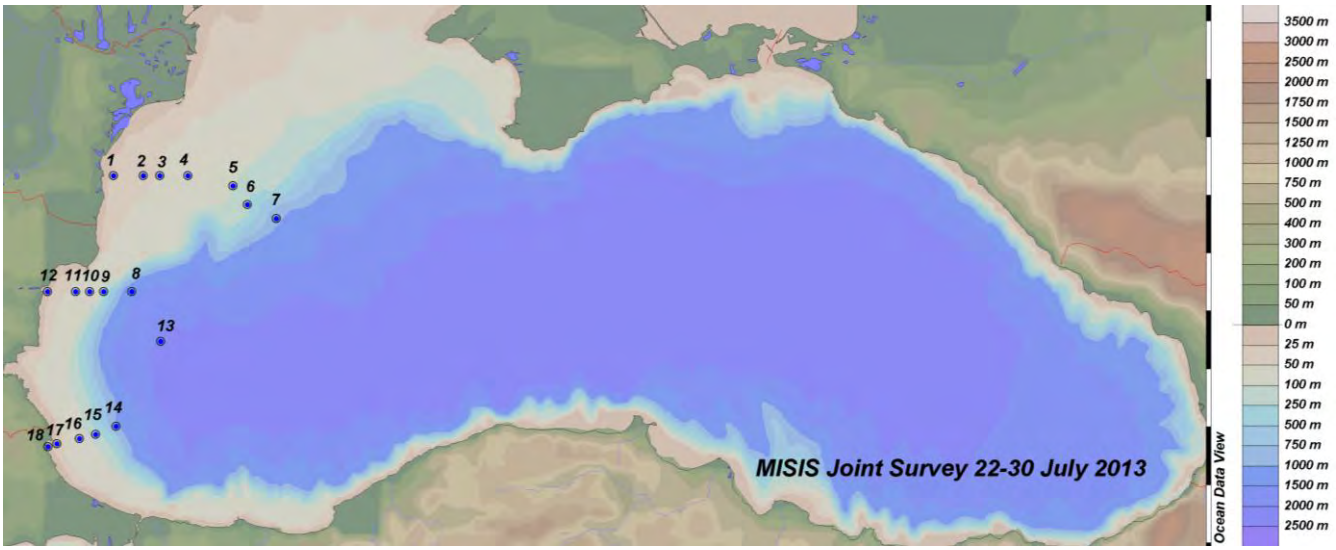

Figure 1. Map of the MISIS cruise stations – intercalibration, station 10 and 18.

The methodologies of the institutes included in the intercalibration studies are given in Annex 3.

III. Statistical Analysis

1. Z-Score

A. Establishment of the consensus value:

The consensus value was calculated according to The International Harmonized Protocol for the Proficiency Testing Of Analytical Chemistry Laboratories (IUPAC Technical Report) (IUPAC, 2006) recommendations.

B. Assignment of z-scores:

The IUPAC (2006) Harmonized Protocol recommended the conversion of participants' results into z-scores, and experience in the intervening years has demonstrated the wide applicability and acceptance of the z-score in proficiency testing. A participant's result x is converted into a z-score according to the equation

$$z = (x - xa)/\sigma p$$

where Xa is the "assigned" value, and σp is the fitness-for-purpose-based "standard deviation for proficiency assessment", that underline the importance of assigning a range appropriate to a particular purpose (ISO Guide 43; Statistical Guide ISO 13528).

In the equation the term (X – Xa) is the error in the measurement. The parameter σp describes the standard uncertainty that is most appropriate for the application area of the results of the analysis, assumed as "fitness-for-purpose". Measurement uncertainty can be thought of as the sum of the intra-laboratory reproducibility and the trueness. Trueness is difficult to assess as the true value in the case of counting is actually always unknown.

Uncertainty (u) of the assigned values was evaluated as follows: u = 1.25*srob/√n, in which srob = robust standard deviation and n = number of results. Criterion for the reliability of the assigned values was u/σp ≤0.3. The fulfillment of this criterion indicates that the z scores are reliable.

The uncertainty that is fit for purpose in a measurement result depends on the application. As described in the IUPAC guidelines, the choice of σ is dependent upon the data quality objective of a particular program. The most common approach is to specify the criterion as a relative standard deviation (RSD). Specific σp values are then obtained by multiplying the selected RSD by the assigned value. The standard deviation (σp) for the proficiency assessment is commonly set at 20%.

C. Definition of assigned value:

According to the IUPAC's technical report, an assigned value is an estimate of the value of the measurand that is used for the purpose of calculating scores. From the suggested methods for its determination in the technical report the only applicable for the macrozoobenthos test is the "consensus value" that is, a value derived directly from reported results. The consensus of the participants is currently the most widely used method for determining the assigned value. The idea of consensus is not that all of the participants agree within bounds determined by the repeatability precision, but that the results produced by the majority are unbiased and their dispersion has a readily identifiable mode.

For the establishment of the assigned consensus value we followed the next steps:

- Visualize the data
- Calculate mean and 90% confidence limit. Observations that were outside the 90% confidence limit were interpreted as outliers.
- Exclude the values which are not included in the 90% confidence limit
- Recalculate the mean which is assumed to be the assigned consensus value
- Recalculate the standard deviation which is assumed as srobust

For this test σp- fitness-for-purpose-based "standard deviation for proficiency assessment" was obtained by multiplying the selected RSD by the assigned consensus value.

D. Interpretation of the z-scores:

According to IUPAC, the interpretation of *z*-scores is *not* generally based on summary statistics that describe the observed participant results. Instead, it uses an assumed model based on the scheme provider's fitness-for-purpose criterion, which is represented by the standard deviation for proficiency assessment σp.

• A score of zero implies a perfect result. This will happen rarely even in the most competent laboratories.

• *z*-scores fall between –2 and +2. The sign (i.e., – or +) of the score indicates a negative or positive error respectively. Scores in this range are commonly designated "acceptable" or "satisfactory".

• A score outside the range from –3 to 3 indicate that the cause of the event should be investigated and remedied. Scores in this class are commonly designated

"unacceptable" or "unsatisfactory".

• Scores in the ranges –2 to –3 and 2 to 3 are designated as "questionable".

2. Similarity/Dissimilarity

Bray-Curtis Similarity Index was used to determine the similarity/dissimilarity in terms of species composition among replicates evaluated by each institute and among the biological data obtained by each institute. Since the number of individuals belonging to each species did not reveal a normal distribution, the data was transformed to Log10(X+1). A similarity matrix was obtained according to the Bray-Curtis index and the matrix results were shown in dendograms. Bray-Curtis Similarity Index is an index calculated based on the number of species and individuals and it is calculated by the help of the formula given as the Equation 1 (Magurran and McGill, 2011):

$$S_{BC} = \frac{2\sum_{i=1}^{S} min(M_{i1}, M_{i2})}{\sum_{i=1}^{S}(M_{i1} + M_{i2})} = 1 - \frac{\sum_{i=1}^{S}|M_{i1} - M_{i2}|}{\sum_{i=1}^{S}(M_{i1} + M_{i2})}$$

In this equation, M_{i1} represents the total number of individuals at the first area; M_{i2}: the total number of individuals at the second area; min(M_{i1},M_{i2}) means M_{i1} or smaller than M_{i2} (Magurran ve McGill, 2011).

Similarity Percentage Analysis-SIMPER was applied using the software package PRIMER 5.0 in order to find the species most contributed to the observed differences of species compositions among the replicates of the institutes. As a result of this analysis, the species with the highest contributions to the differences among the institutes and their percentage contributions were established.

IV. Evaluation of the Results

1. Z-Scores

1.1. Macrozoobenthos Total Abundance and Biomass

The raw data distribution is represented in the histogram,

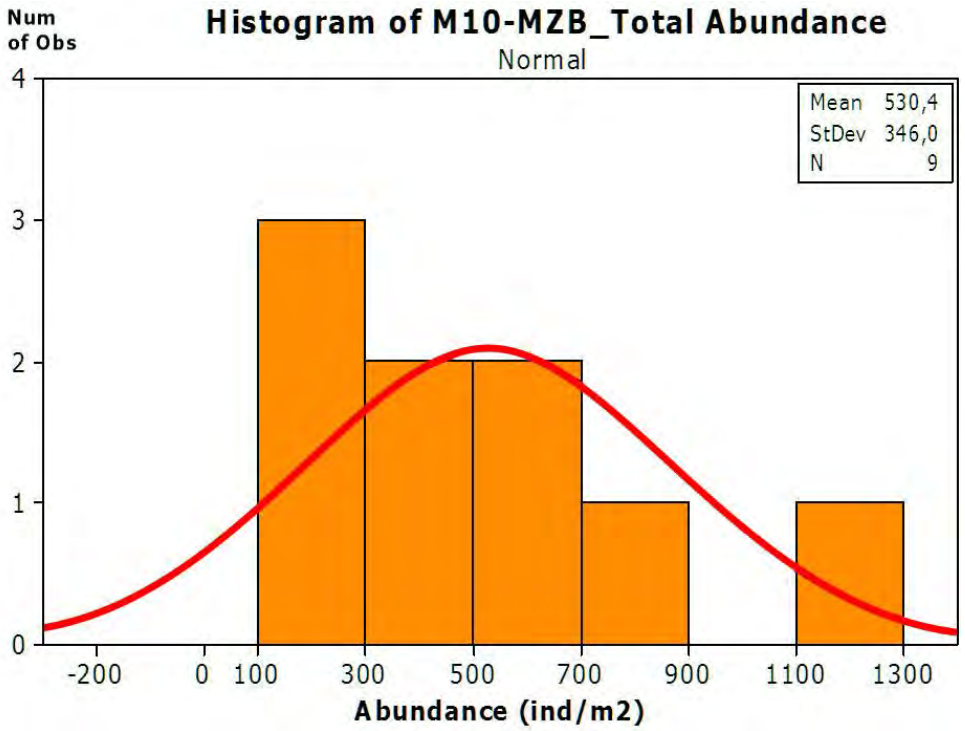

Figure 2. Raw data distribution – M10 Macrozoobenthos Total Abundance.

- Z-Scores; ZA: 0.99, ZB: 0.73, ZC: -0.81
- Assigned value: 442.63 ind/m^2
- Z-score (RSD= 0.65; σ=288.72)

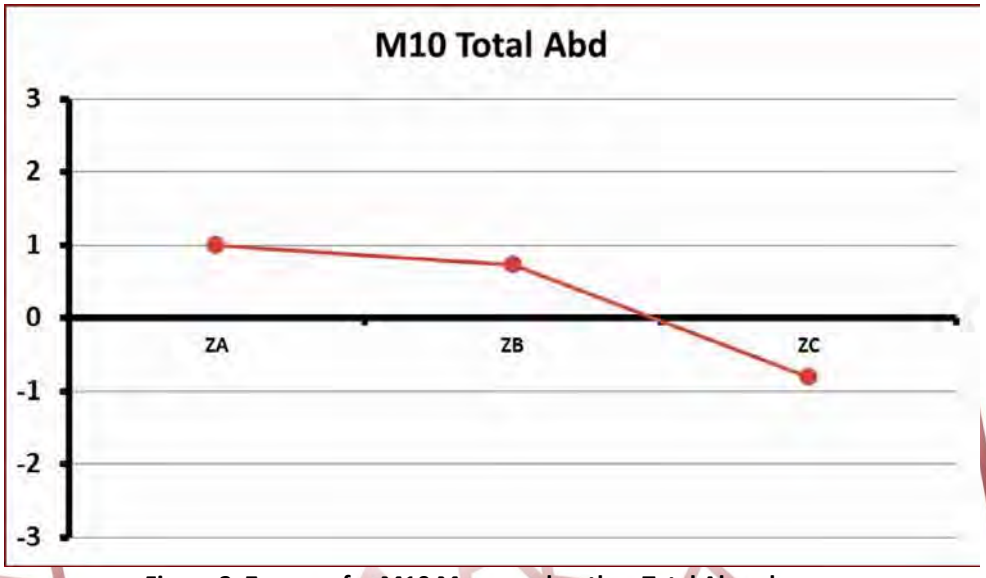

Figure 3. Z-scores for M10 Macrozoobenthos Total Abundance.

The raw data distribution is represented in the histogram,

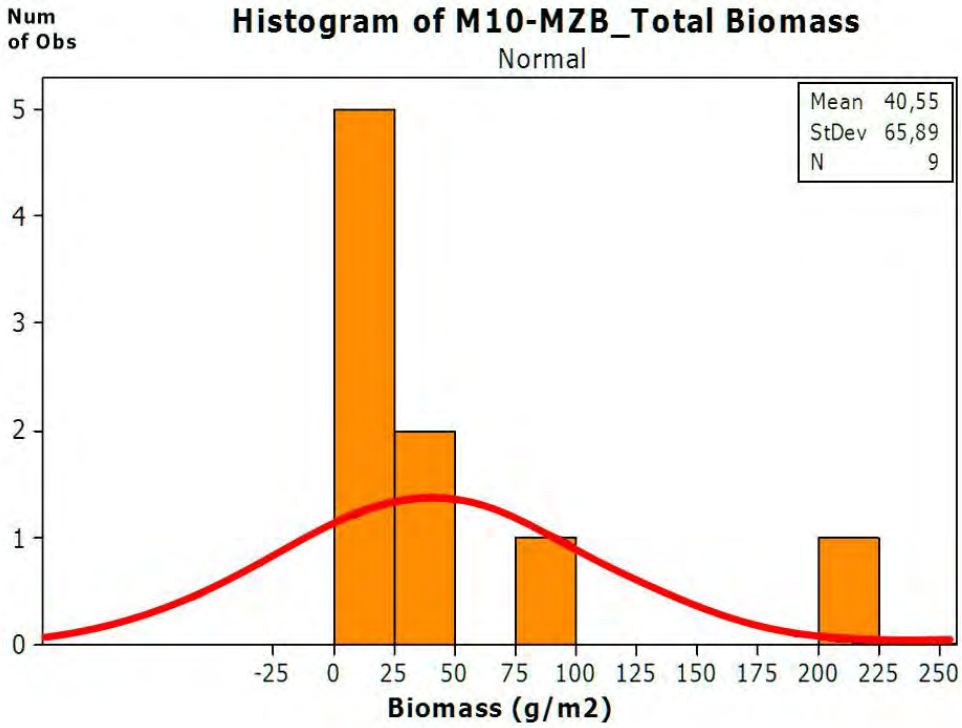

Figure 4. Raw data distribution – M10 Macrozoobenthos Total Biomass.

- Z-Scores; ZA: 2.61, ZB: 1.67, ZC: -0.45
- Assigned value: 20.37 g/m^2
- Z-score (RSD=1.63; σ=33.1)

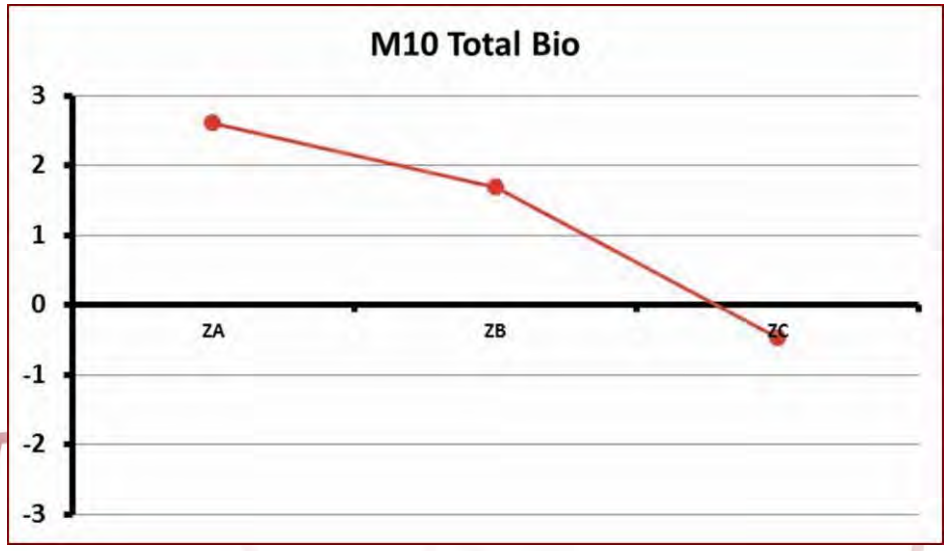

Figure 5. Z-scores for M10 Macrozoobenthos Total Biomass.

The raw data distribution is represented in the histogram,

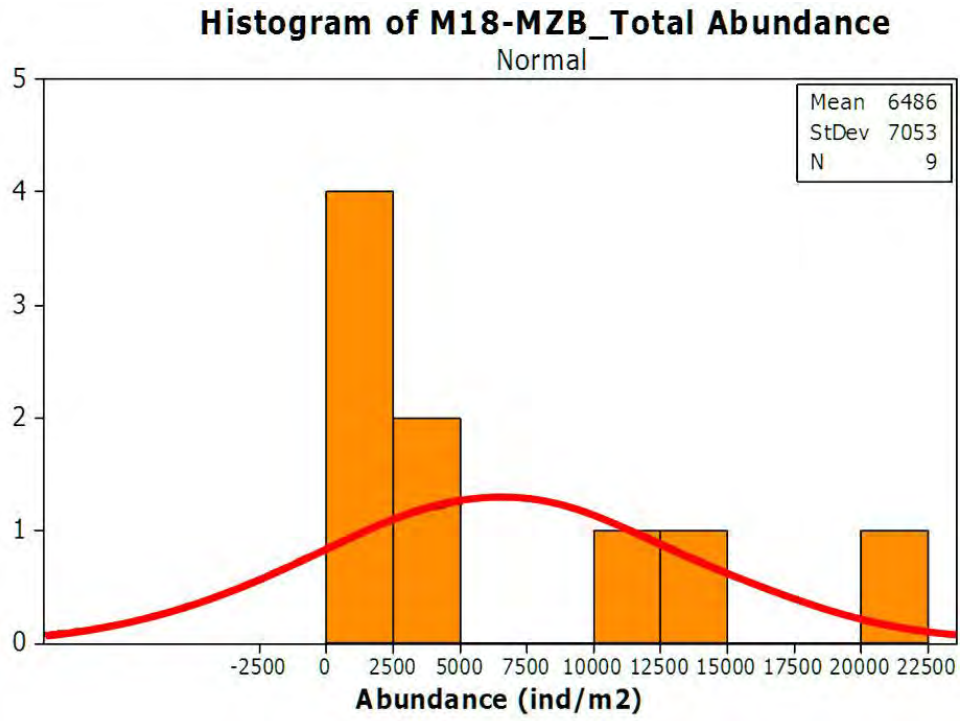

Figure 6. Raw data distribution – M18 Macrozoobenthos Total Abundance.

- Z-Scores; ZA: 2.06, ZB: -0.3, ZC: -0.69
- Assigned value: 4668.5 ind/m^2
- Z-score (RSD=1.09; σ=5076.6)

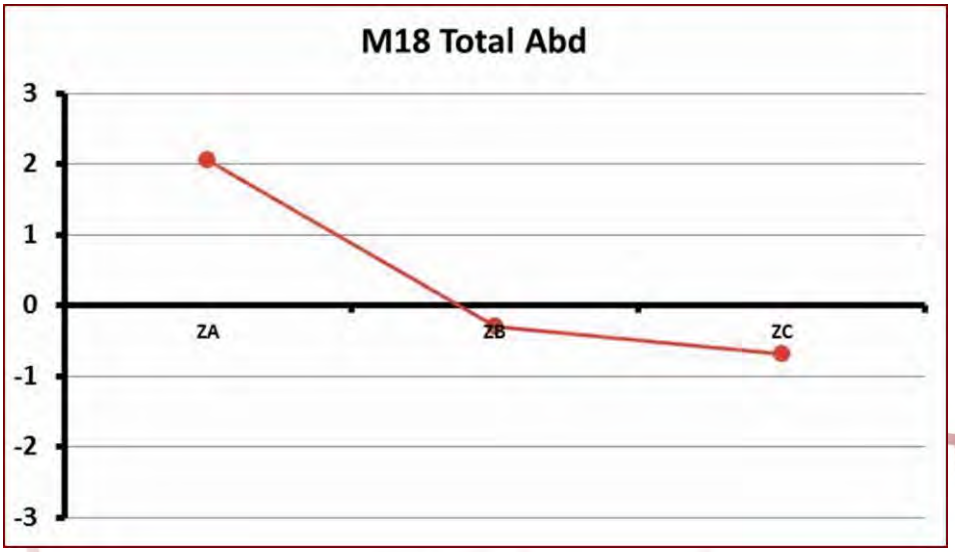

Figure 7. Z-scores for M18 Macrozoobenthos Total Abundance.

The raw data distribution is represented in the histogram,

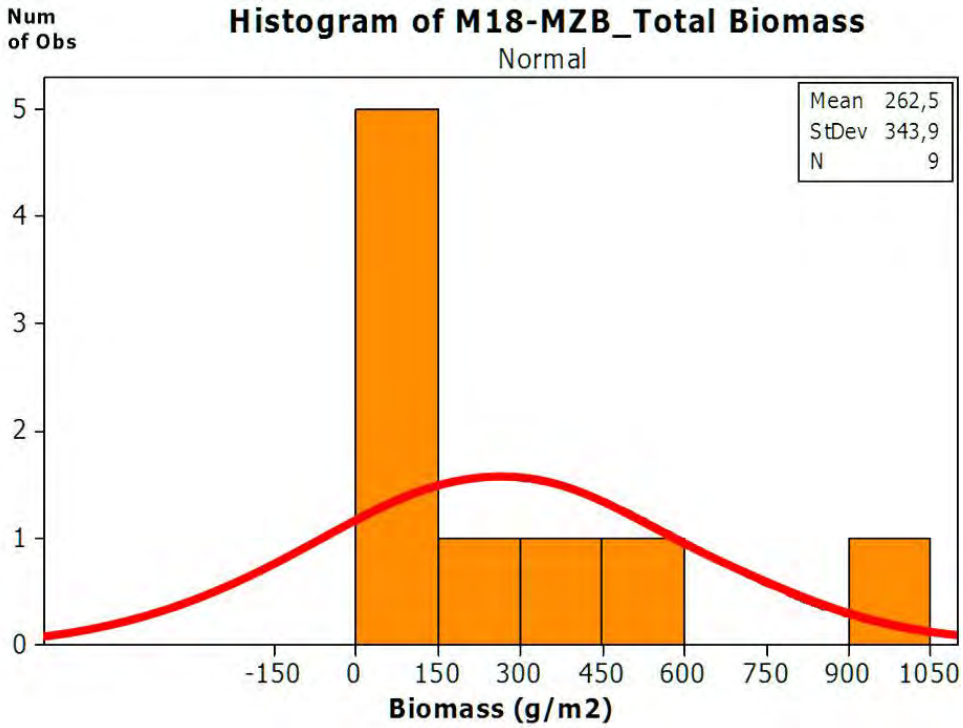

Figure 8. Raw data distribution – M18 Macrozoobenthos Total Biomass.

- Z-Scores; ZA: 2.28, ZB: -0.67, ZC: -0.26
- Assigned value: 165.32 g/m^2
- Z-score (RSD=1.31; σ=216.6)

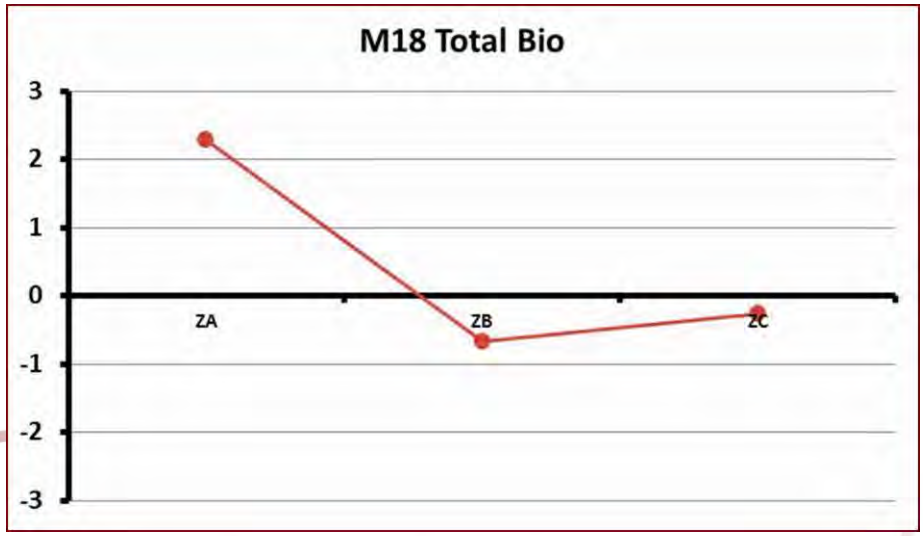

Figure 9. Z-scores for M18 Macrozoobenthos Total Biomass.

1.2. Polychaeta Total Abundance and Biomass

The raw data distribution is represented in the histogram,

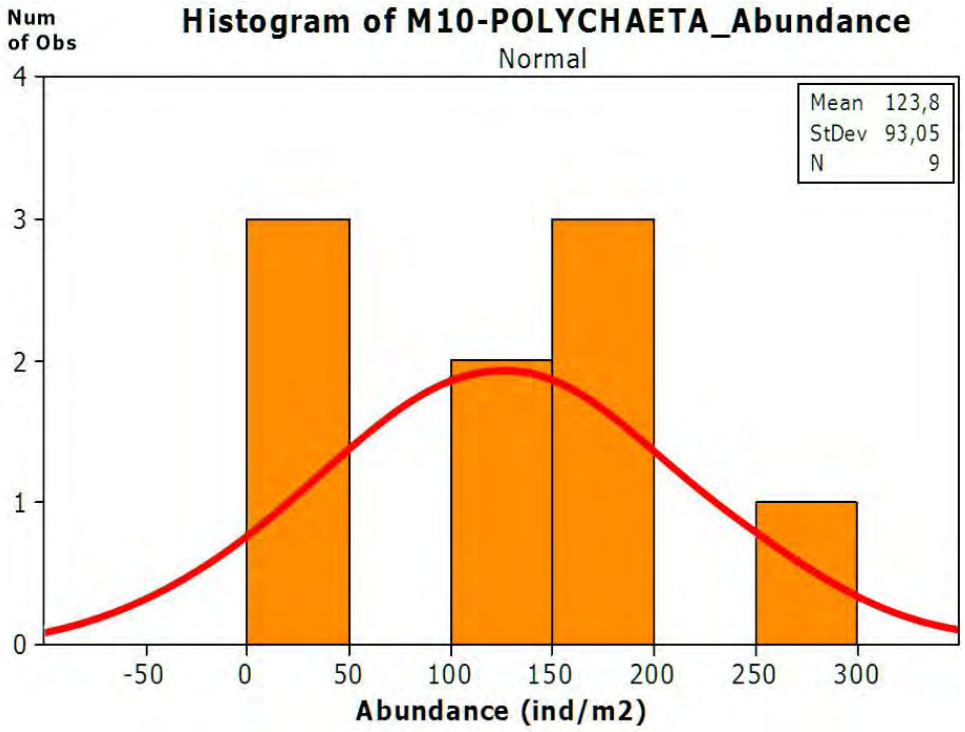

Figure 10. Raw data distribution – M10 Polychaeta Abundance.

- Z-Scores; ZA: -1.47, ZB: -0.86, ZC: -0.99
- Assigned value: 123.8 ind/m^2
- Z-score (RSD=0.75; σ=93.04)

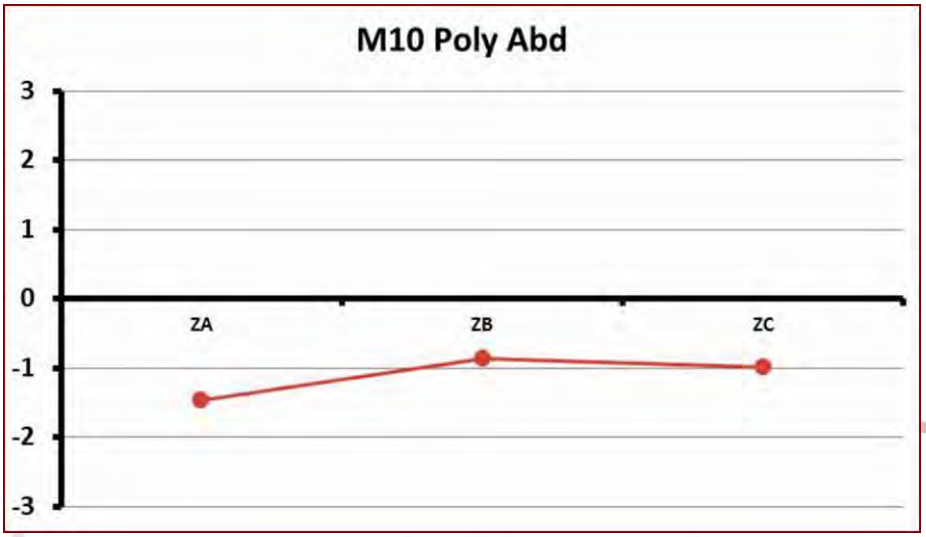

Figure 11. Z-scores for M10 Polychaeta Abundance.

The raw data distribution is represented in the histogram,

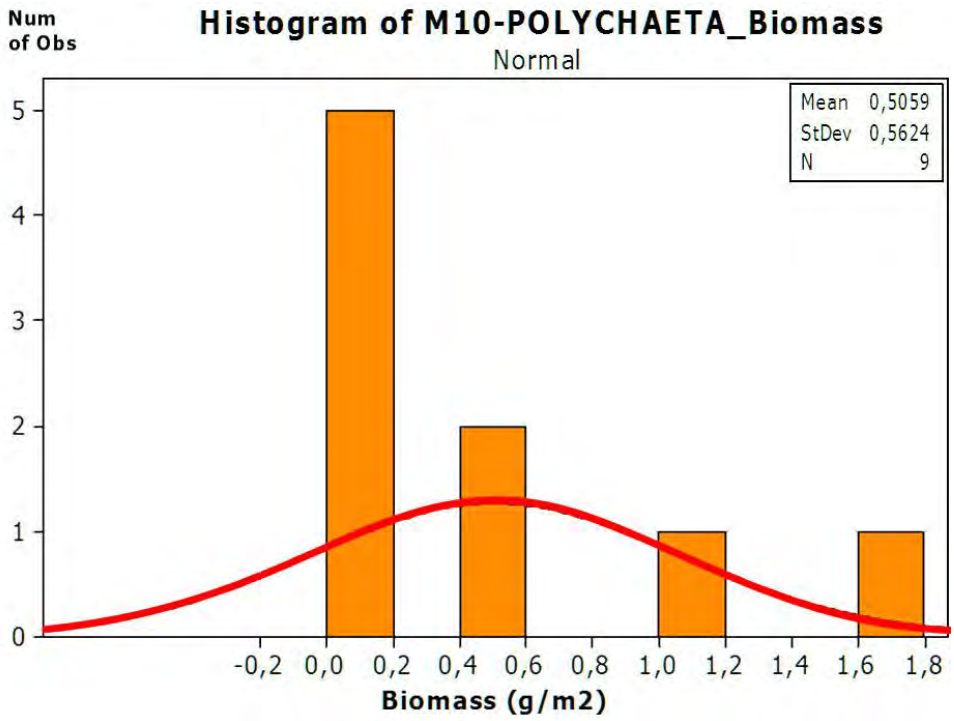

Figure 12. Raw data distribution – M10 Polychaeta Biomass .

- Z-Scores; ZA: -0.61, ZB: -0.58, ZC: -0.61
- Assigned value: 0.35 g/m^2
- Z-score (RSD=1.11; σ=0.39)

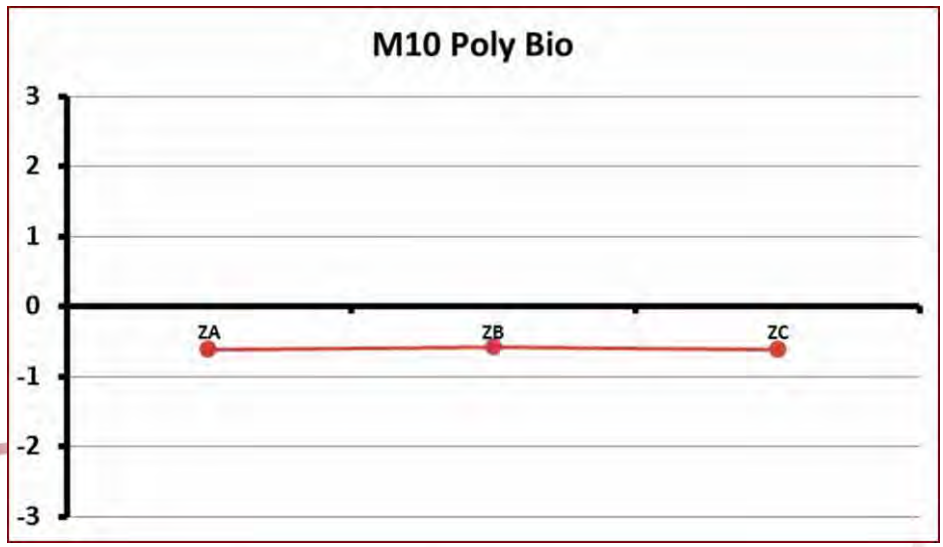

Figure 13. Z-scores for M10 Polychaeta Biomass.

The raw data distribution is represented in the histogram,

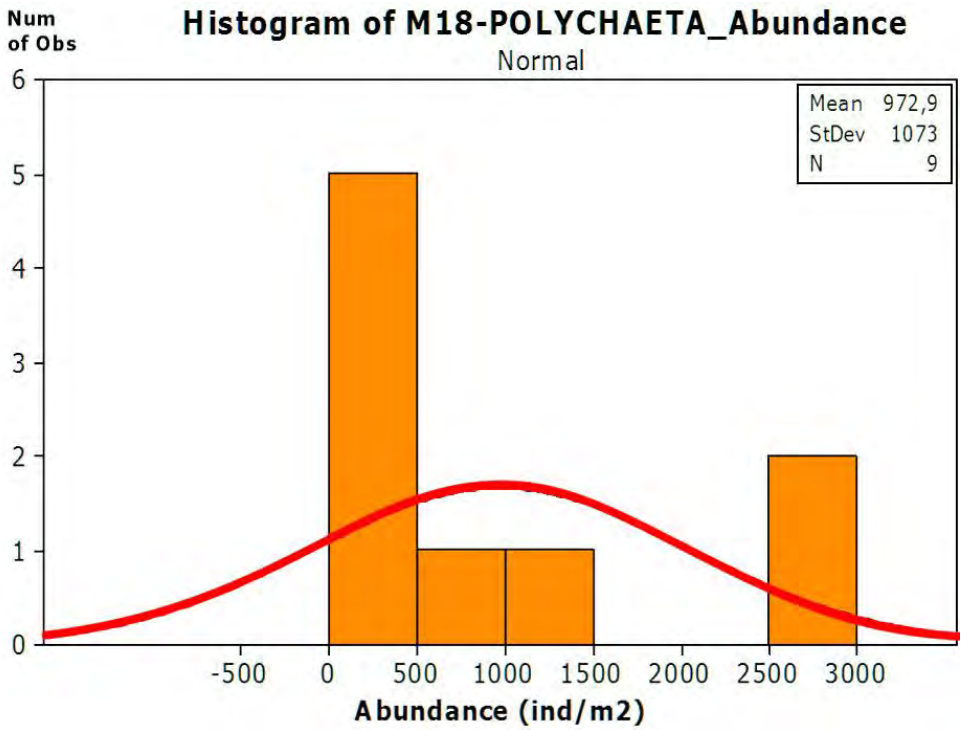

Figure 14. Raw data distribution – M18 Polychaeta Abundance .

- Z-Scores; ZA: -0.88, ZB: -0.47, ZC: -0.83
- Assigned value: 746.7 ind/m^2
- Z-score (RSD=1.1; σ=823.37)

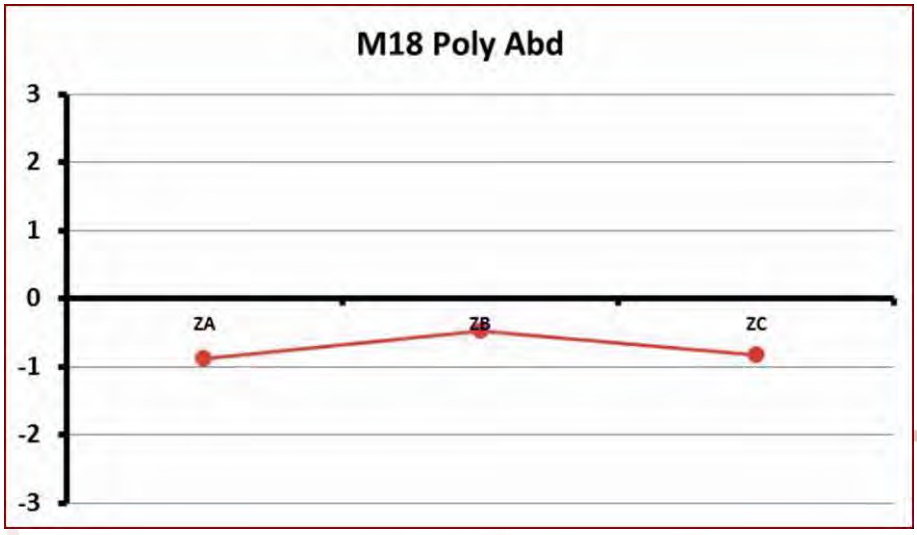

Figure 15. Z-scores for M18 Polychaeta Abundance.

The raw data distribution is represented in the histogram,

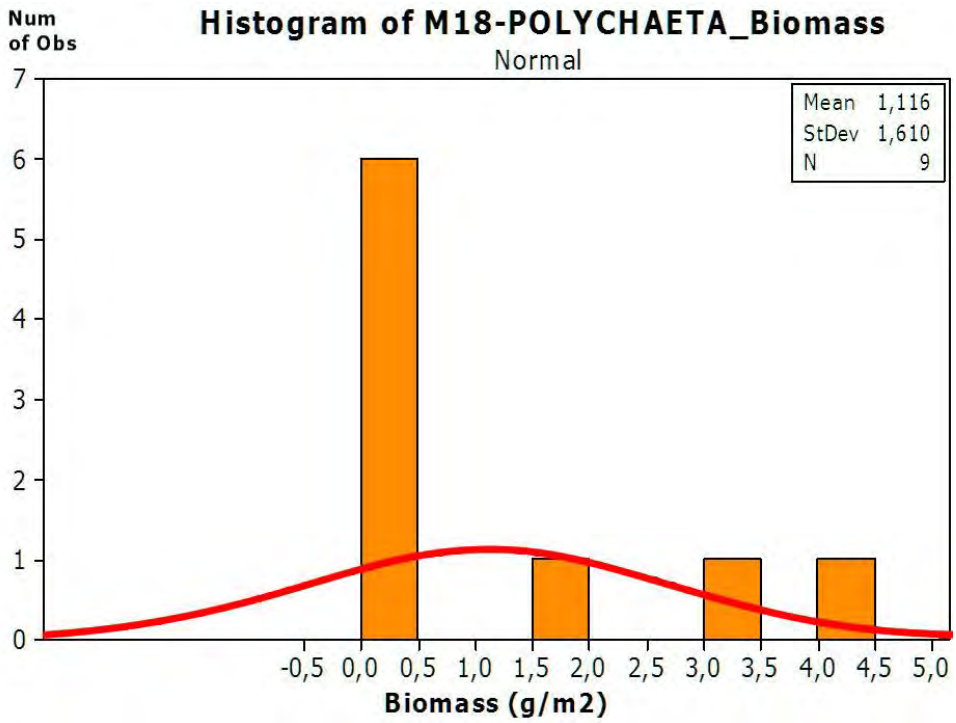

Figure 16. Raw data distribution – M18 Polychaeta Biomass.

- Z-Scores; ZA: -0.76, ZB: -0.75, ZC: -0.76
- Assigned value: 0.72 g/m^2
- Z-score (RSD=1.44; σ=1.04)

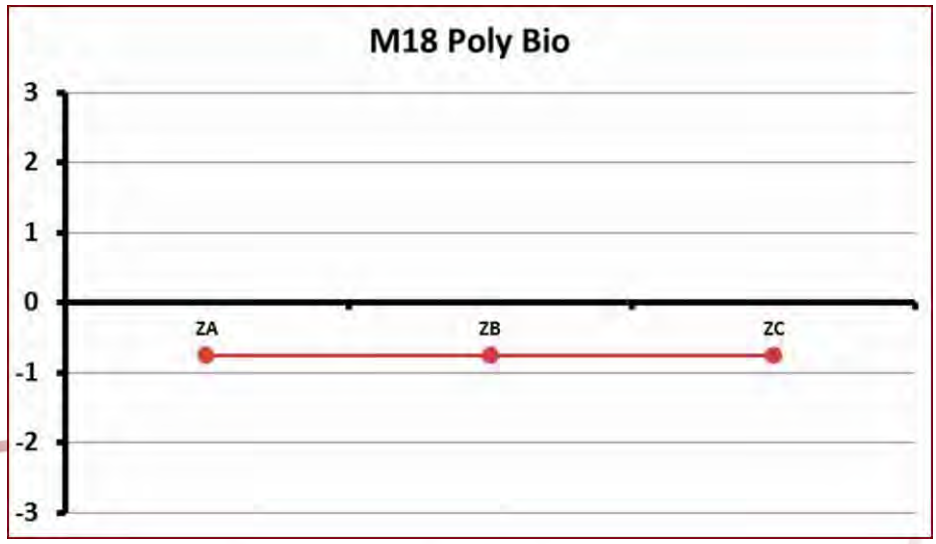

Figure 17. Z-scores for M18 Polychaeta Biomass.

1.3. Crustacea Total Abundance and Biomass

The raw data distribution is represented in the histogram,

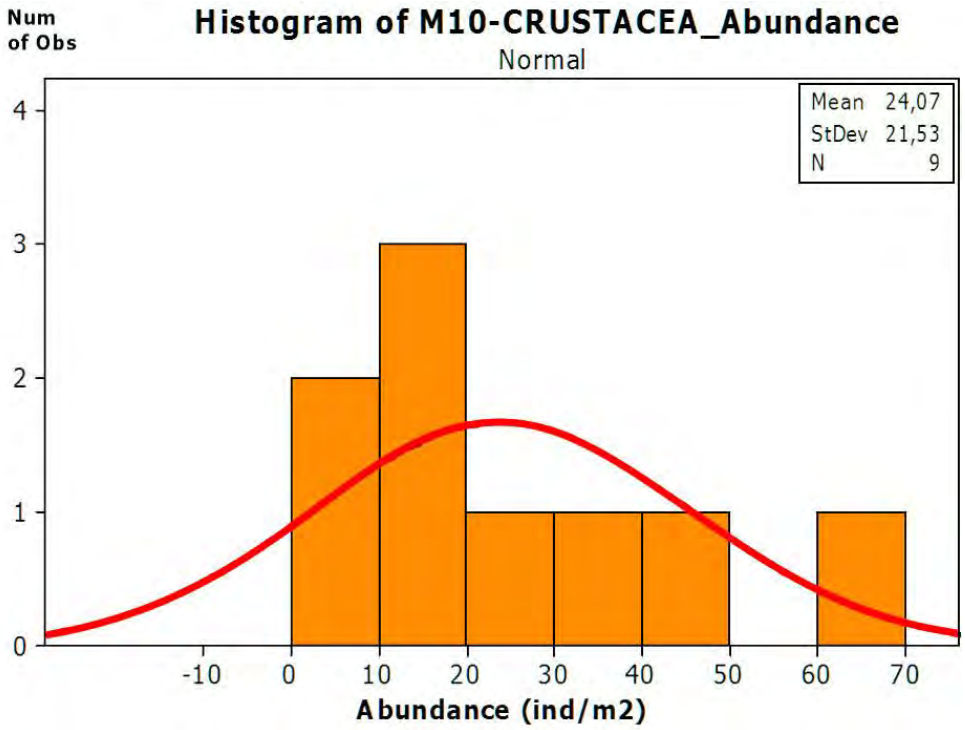

Figure 18. Raw data distribution – M10 Crustacea Abundance.

- Z-Scores; ZA: -1.39, ZB: -1.46, ZC: -1.5
- Assigned value: 24.06 ind/m^2
- Z-score (RSD=0.89; σ=21.53)

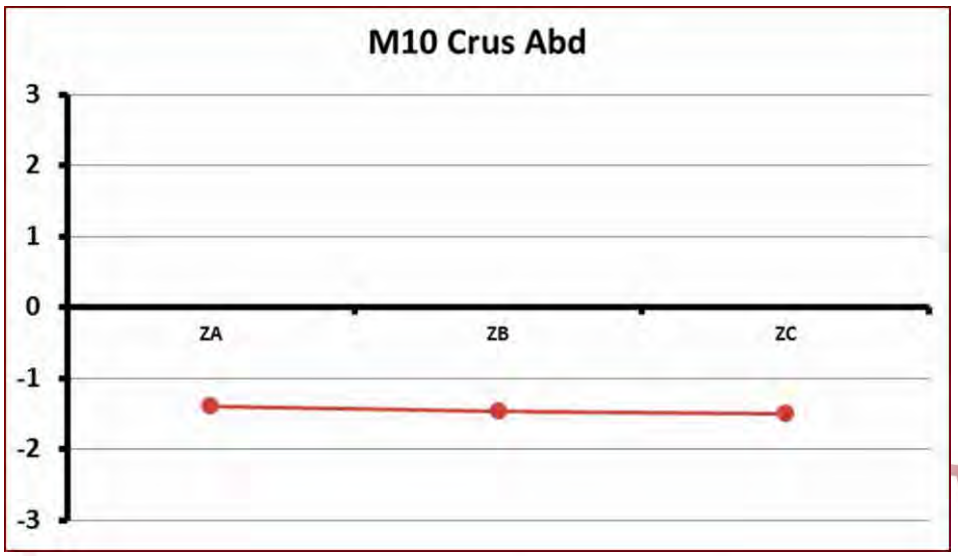

Figure 19. Z-scores for M10 Crustacea Abundance.

The raw data distribution is represented in the histogram,

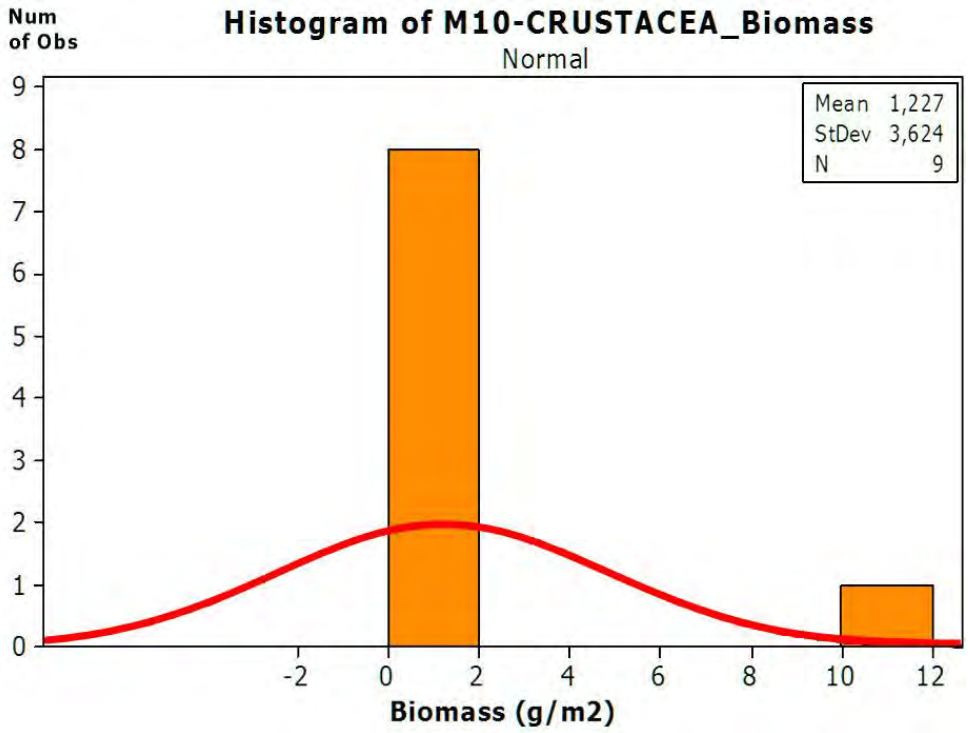

Figure 20. Raw data distribution – M10 Crustacea Biomass.

- Z-Scores; ZA: -0.61, ZB: -0.51, ZC: -0.61
- Assigned value: 0.02 g/m^2
- Z-score (RSD=2.95; σ=0.06)

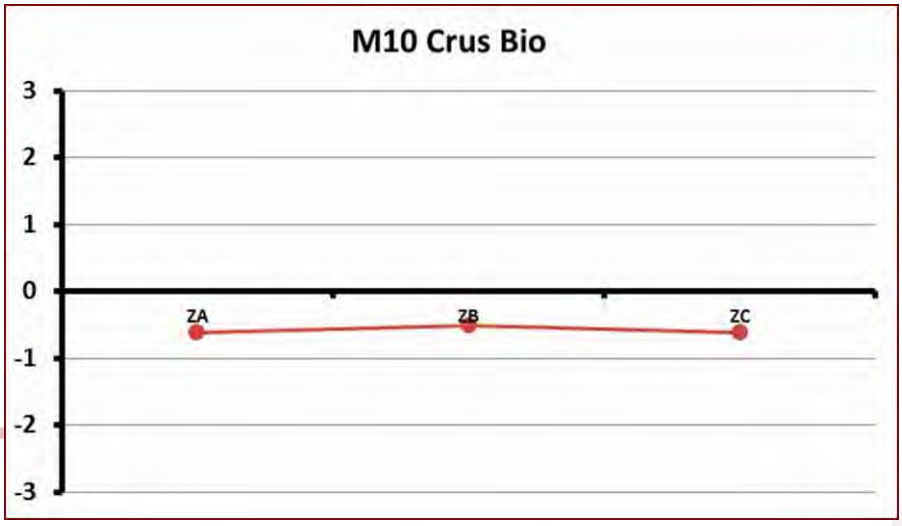

Figure 21. Z-scores for M10 Crustacea Biomass.

The raw data distribution is represented in the histogram,

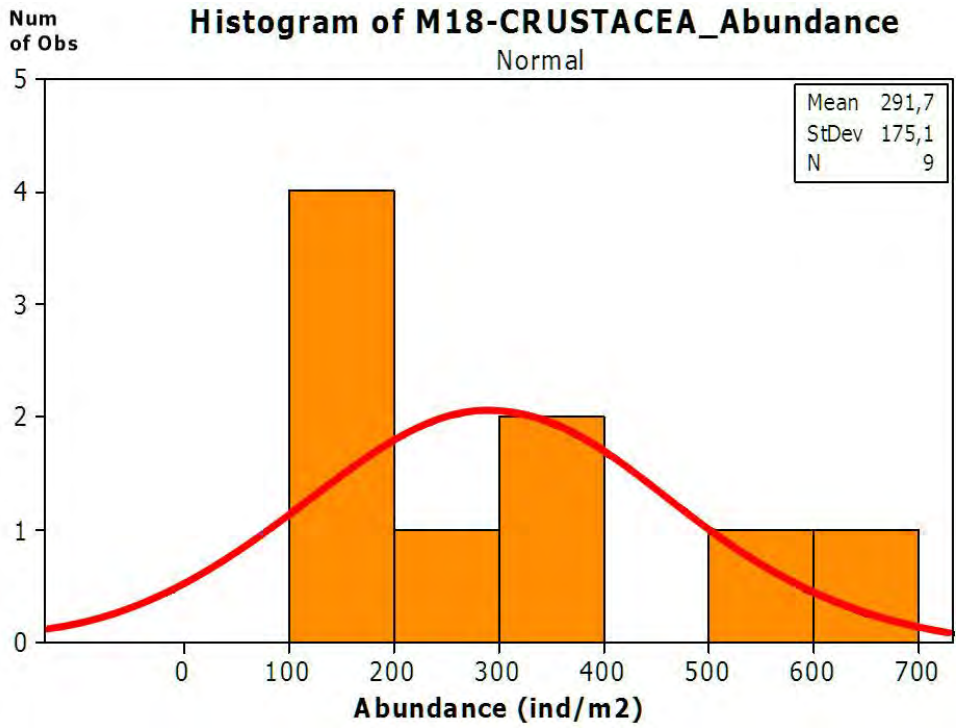

Figure 22. Raw data distribution – M18 Crustacea Abundance.

- Z-Scores; ZA: -0.88, ZB: -0.82, ZC: -0.89
- Assigned value: 249.6 ind/m^2
- Z-score (RSD=0.6; σ=149.8)

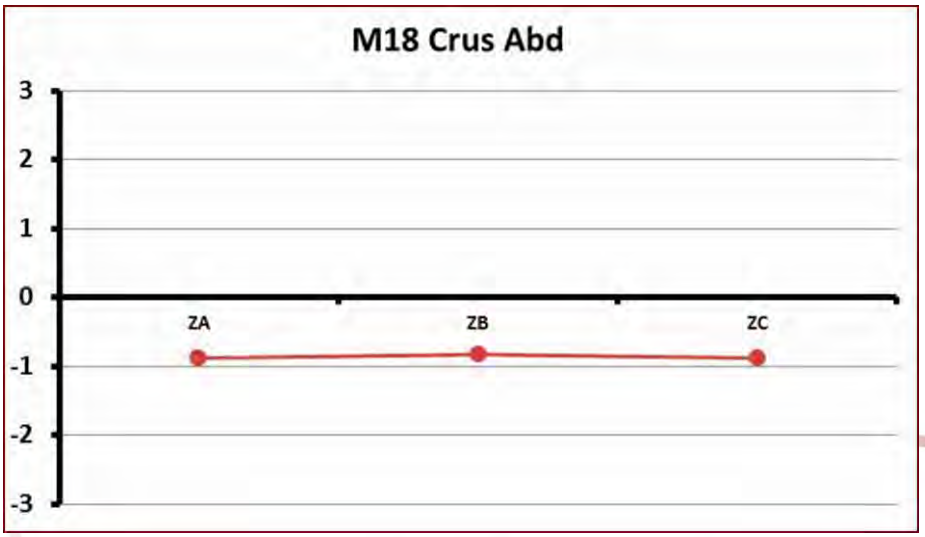

Figure 23. Z-scores for M18 Crustacea Abundance.

The raw data distribution is represented in the histogram,

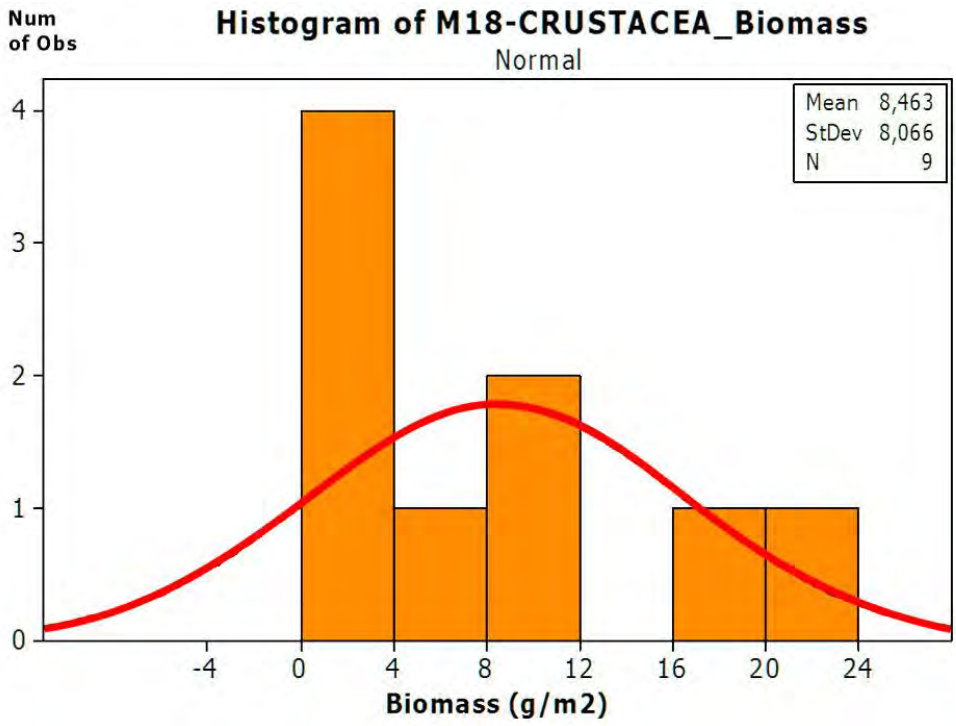

Figure 24. Raw data distribution – M18 Crustacea Biomass.

- Z-Scores; ZA: -0.73, ZB: -0.75, ZC: -0.7
- Assigned value: 6.6 g/m^2
- Z-score (RSD=0.95; σ=6.29)

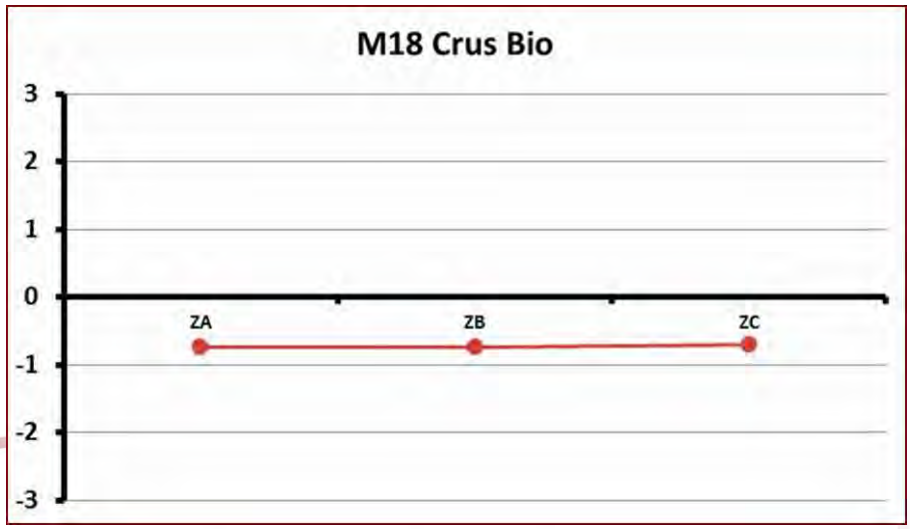

Figure 25. Z-scores for M18 Crustacea Biomass.

4.1.4. Mollusca Total Abundance and Biomass

The raw data distribution is represented in the histogram,

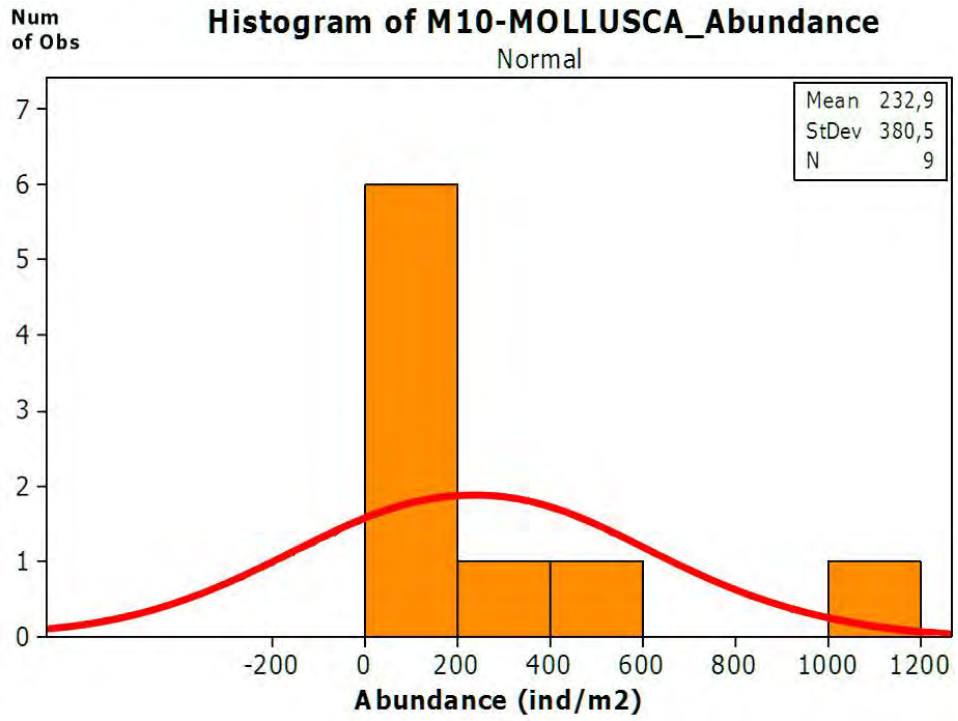

Figure 26. Raw data distribution – M10 Mollusca Abundance.

- Z-Scores; ZA: 0.66, ZB: -1.44, ZC: -1.4
- Assigned value: 116.4 ind/m^2
- Z-score (RSD=1.63; σ=190.2)

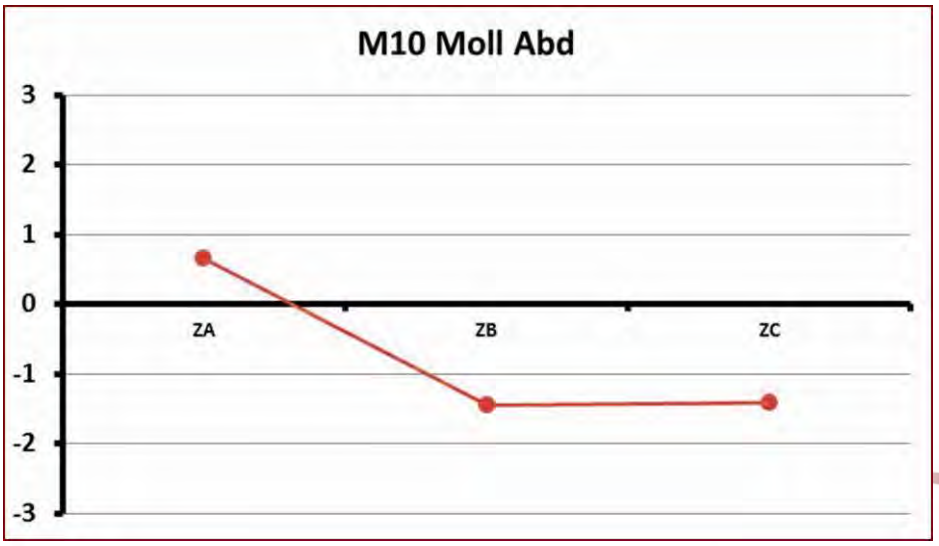

Figure 27. Z-scores for M10 Mollusca Abundance.

The raw data distribution is represented in the histogram,

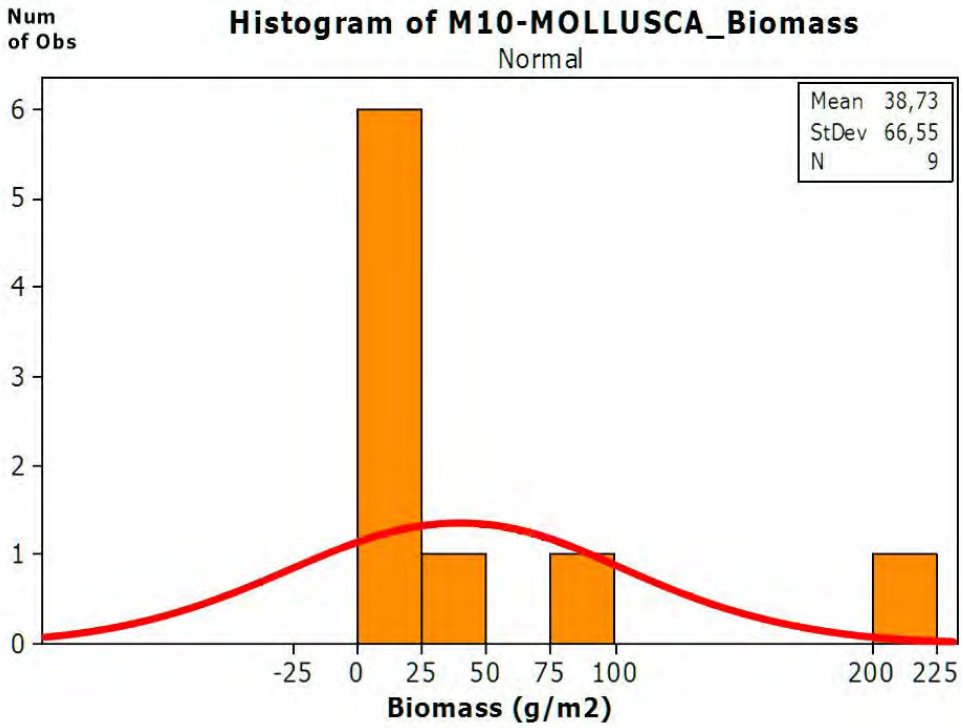

Figure 28. Raw data distribution – M10 Mollusca Biomass.

- Z-Scores; ZA: 2.66, ZB: -0.46, ZC: -0.48
- Assigned value: 18.3 g/m^2
- Z-score (RSD=1.72; σ=31.52)

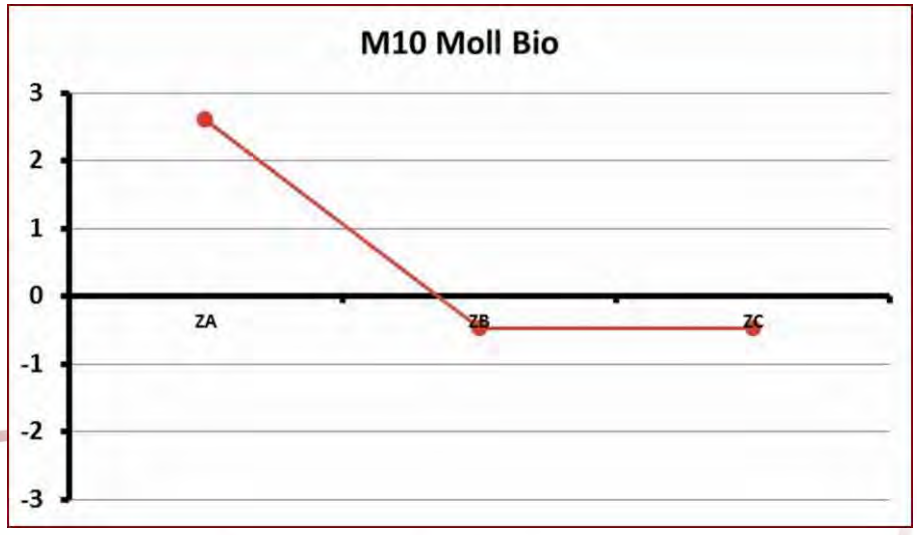

Figure 29. Z-scores for M10 Mollusca Biomass.

The raw data distribution is represented in the histogram,

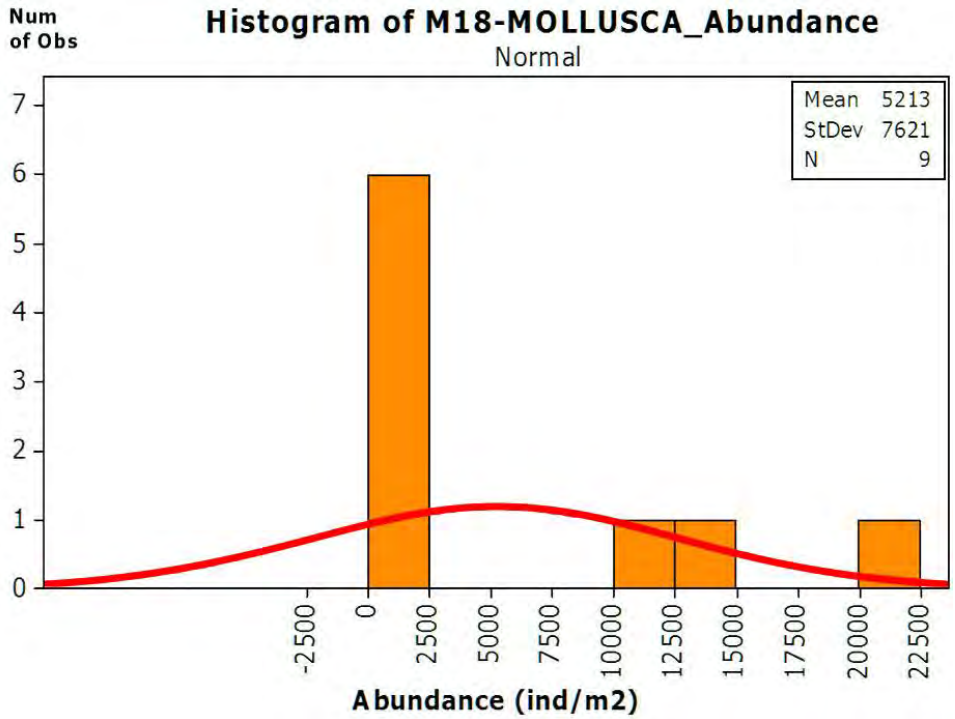

Figure 30. Raw data distribution – M18 Mollusca Abundance.

- Z-Scores; ZA: 1.98, ZB: -0.85, ZC: -0.81
- Assigned value: 3265.4 ind/m^2
- Z-score (RSD=1.46; σ=4773.2)

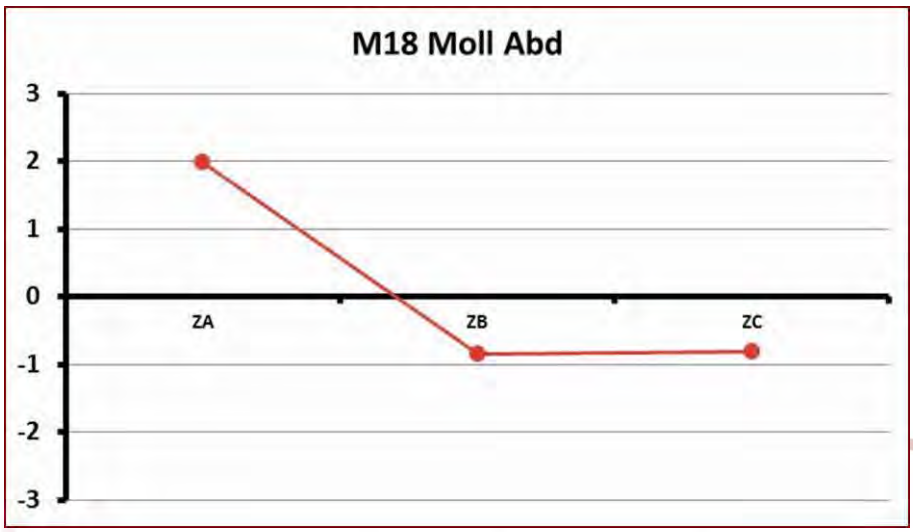

Figure 31. Z-scores for M18 Mollusca Abundance.

The raw data distribution is represented in the histogram,

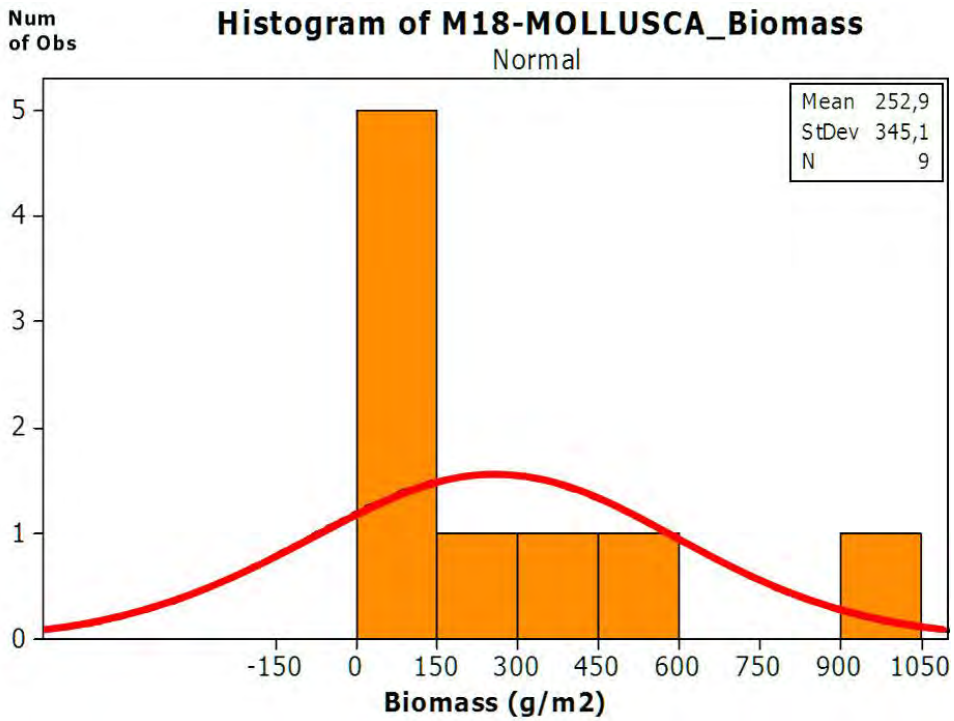

Figure 32. Raw data distribution – M18 Mollusca Biomass.

- Z-Scores; ZA: 2.24, ZB: -0.7, ZC: -0.33
- Assigned value: 155.73 g/m^2
- Z-score (RSD=1.36; σ=212.5)

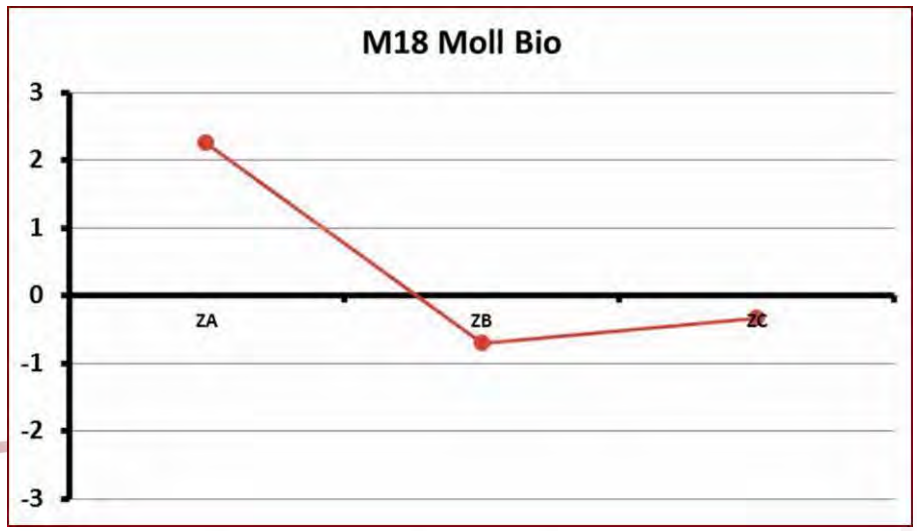

Figure 33. Z-scores for M18 Mollusca Biomass.

2. Species Richness

2.1. Station M10

2.1.1. Macrozoobenthos

As a result of the evaluations, a total of 45 taxa belonging to 8 taxonomical groups were idenified in general. The macrozoobenthos species list identified by 3 different institutes from the station M10 is given in Table 1.

Table 1. Macrozoobenthos species list at station M10 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Macrozoobenthos	A	B	C
CNIDARIA			
Amphinema dinema (Péron & Lesueur, 1810)		X	
Obelia longissima (Pallas, 1766)		X	
Actinothoe clavata (Ilmoni, 1830)		X	
ECHINODERMATA			
Amphiura stepanovi Chernyavskii, 1861		X	X
NEMERTEA			
Nemertea (sp.)	X	X	
OLIGOCHAETA			
Oligochaeta (sp.)	X	X	
POLYCHAETA			
Aricidea claudiae Laubier, 1967	X	X	
Aricidea sp.			X
Capitella capitata (Fabricius, 1780)			X
Heteromastus filiformis (Claparède, 1864)		X	X
Nephtys hombergii Savigny in Lamarck, 1818		X	X
Nephtys hystricis McIntosh, 1900	X		
Nephtys (cf.) *paradoxa* Malm, 1874		X	
Nephtys sp.			X
Oridia armandi (Claparède, 1864)			X
Oriopsis armandi (Claparède, 1864)		X	
Phyllodoce mucosa Örsted, 1843		X	
Polycirrus jubatus Bobretzky, 1869		X	
Prionospio cirrifera (Wirén, 1883)			X
Sphaerosyllis bulbosa Southern, 1914		X	
Spionidae varia			X
Terebellides stroemii Sars, 1835		X	X
PHORONIDA			
Phoronis euxinicola Selys-Longchamps, 1907		X	
Phoronida (sp.)	X		
CRUSTACEA			
Eudorella truncatula (Bate, 1856)			X
Iphinoe elisae Băcescu, 1950	X	X	X
Perioculodes longimanus (Bate & Westwood, 1868)	X	X	
Phtisica marina Slabber, 1769		X	
Upogebia pusilla (Petagna, 1792)		X	
MOLLUSCA			
Abra alba (W. Wood, 1802)	X	X	
Abra ovata (Philippi, 1836)			X
Abra prismatica (Montagu, 1808)		X	
Abra sp.			X
Acanthocardia paucicostata (G. B. Sowerby II, 1834)		X	X
Bittium reticulatum (da Costa,1778)	X		
Cerastoderma glaucum (Bruguière, 1789)	X		
Modiolula phaseolina (Philippi, 1844)			X
Mytilus galloprovincialis (Lamark,1819)		X	
Mytilus (Veliconce)			X
Nassarius reticulatus (Linnaeus,1758)	X		
Parvicardium simile (Milaschewisch, 1909)			X
Pitar rudis (Poli,1795)	X		
Retusa truncatula (Bruguiere, 1792)	X		
Spisula subtruncata (da Costa,1778)	X		X
Trophonopsis breviata (Jeffreys, 1882)	X		

The total number of species obtained by the three institutes from the station M10 are given in Table 2, and the detailed number of species achieved for the replicates are given in Table 3. Accordingly, institute A found 15, institute B found 24 and institute C found 19 taxa.

Table 2. The total number of species determined by the institutes in station M10 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Station: M10	Institutes		
Taxonomic Groups	**A**	**B**	**C**
CNIDARIA	-	3	-
ECHINODERMATA	-	1	1
NEMERTEA	1	1	-
OLIGOCHAETA	1	1	-
POLYCHAETA	2	9	9
PHORONIDA	1	1	-
CRUSTACEA	2	4	2
MOLLUSCA	8	4	7
Species Number_Total	**15**	**24**	**19**

Table 3. The total number of species determined by the institutes for each replicate (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Station: M10	A			B			C		
Taxonomic Groups	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
CNIDARIA	-	-	-	-	3	1	-	-	-
ECHINODERMATA	-	-	-	-	1	-	1	-	-
NEMERTEA	-	1	-	1	1	-	-	-	-
OLIGOCHAETA	1	1	1	1	1	1	-	-	-
POLYCHAETA	1	2	2	7	4	3	6	2	4
PHORONIDA	-	1	1	1	1	1	-	-	-
CRUSTACEA	1	1	2	2	2	1	1	2	-
MOLLUSCA	5	3	7	2	2	1	3	4	3
Species Number_Total	**8**	**9**	**13**	**14**	**15**	**8**	**11**	**8**	**7**

As the number of macrozoobenthic species found at station M10 are taken into consideration, the species identified just by one institute constituted 73% of the total number of species, these species identified by at least two institutes constituted 25% of the total number of species and the species identified by all three institutes accounted for 2% of the total number of species (Fig. 34).

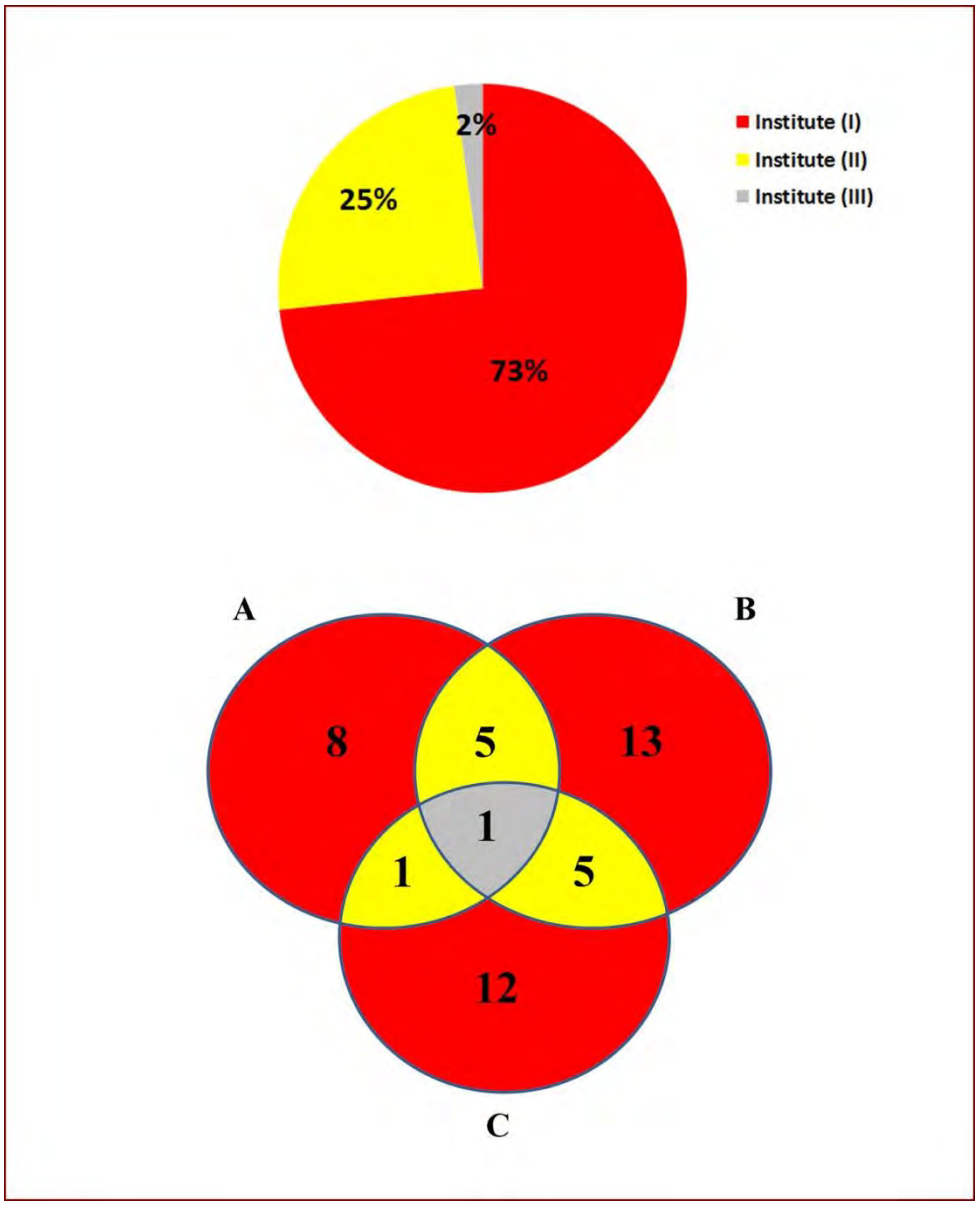

Figure 34. The sheme of the number of species found at station M10 by different institutes, the share of the number of species (%) and their distribution according to the institutes (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

2.1.2. Meiobenthos

Twelve group of organisms have been collected from the meiobenthos of the station M10. The list of major meiobenthic taxa identified by the two different institutes are given in Table 4.

Table 4. The major taxa identified from the meiobenthos of station M10 (A: SNU-FF, B: GeoEcoMar).

Meiobenthos	A	B
NEMATODA	X	X
HARPACTICOIDA	X	X
POLYCHAETA	X	X
FORAMINIFERA H.S.	X	X
FORAMINIFERA S.S.	X	
BIVALVIA	X	
GASTROPODA	X	
OSTRACODA	X	X
TURBELLARIA	X	
KINORHYNCHA	X	X
OLIGOCHAETA	X	X
OTHERS	X	

According to the Table 1, twelve group of organisms have been found by institute A and 7 group of organisms found by institute B at the station M10.

2.2. Station M18

2.2.1. Macrozoobenthos

As a result of the evaluations, 82 taxa belonging to 6 taxonomic groups were identified. The list of the macrozoobenthic groups identified from station M18 by three different institutes is given in Table 5.

Table 5. Macrozoobenthos species list at station M18 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Macrozoobenthos	A	B	C
NEMERTEA			
Amphiporus bioculatus (McIntosh, 1874)			X
Carinina heterosoma Müller, 1965		X	
Nemertea (sp.)	X	X	
PLATHELMINTHES			
Plathelminthes (sp.)	X		
POLYCHAETA			
Aonides (cf.) *paucibranchiata* Southern, 1914	X		
Aricia sp.		X	
Aricidea catherinae Laubier, 1967	X		
Aricidea claudiae Laubier, 1967		X	
Capitella capitata (Fabricius, 1780)		X	X
Caulleriella bioculata (Keferstein, 1862)	X	X	
Chaetozone caputesocis (Saint-Joseph, 1894)		X	
Eunice vittata (Delle Chiaje, 1829)	X		
Exogone (Exogone) *naidina* Örsted, 1845		X	
Glycera sp.	X		
Heteromastus filiformis (Claparède, 1864)	X	X	
Lagis koreni Malmgren, 1866	X		
Lagis sp.		X	
Leiochone leiopygos (Grube, 1860)		X	
Magelona mirabilis (Johnston, 1865)		X	
Melinna palmata Grube, 1870	X	X	
Microphthalmus similis Bobretzky, 1870		X	
Nephtys hombergii Savigny in Lamarck, 1818		X	X
Nephtys (cf) *paradoxa* Malm, 1874	X	X	
Nephtys sp.			X
Phylo sp.	X		
Phyllodoce mucosa Örsted, 1843		X	
Polydora cornuta Bosc, 1802		X	
Prionospio cirrifera Wirén, 1883		X	
Pygospio elegans (Claparede, 1863)			X
Spio decoratus Bobretzky, 1870	X	X	
Spionidae varia			X
PHORONIDA			
Phoronis euxinicola Selys-Longchamps, 1907		X	
CRUSTACEA			
Ampelisca diadema (A. Costa, 1853)			X
Ampelisca sarsi Chevreux, 1888	X	X	

Macrozoobenthos	A	B	C
Apseudopsis ostroumovi Bacescu & Carausu, 1947	X	X	X
Corophium sp.	X	X	
Diogenes pugilator (Roux, 1829)	X	X	X
Iphinoe elisae Băcescu, 1950		X	
Iphinoe maeotica Sowinskyi, 1893	X		
Iphinoe tenella Sars, 1878	X	X	
Leptinogaster histrio (Pelseneer, 1929)		X	
Megaluropus massiliensis Ledoyer, 1976		X	
Microdeutopus versiculatus (Bate, 1856)	X		
Perioculodes longimanus (Bate & Westwood, 1868)	X	X	
Pseudocuma longicorne (Bate, 1858)	X	X	X
Upogebia pusilla (Petagna, 1792)	X	X	X
MOLLUSCA			
Abra alba (W. Wood, 1802)		X	
Acanthocardia paucicostata (G. B. Sowerby II, 1834)		X	
Amphibalanus improvisus (Darwin, 1854)	X		X
Anadara transversa (Say, 1822)		X	
Angulus tenuis (da Costa, 1778)			X
Bela nebula (Montagu,1803)	X		
Bittium reticulatum (da Costa,1778)	X		
Calyptraea chinensis (Linnaeus, 1758)	X	X	
Caecum trachea (Montagu,1803)	X		
Cerastoderma glaucum (Bruguière, 1789)	X	X	
Chamelea gallina (Linnaeus, 1758)	X	X	X
Chrysallida interstincta (J.Adams,1797)	X		
Cyclope neritea (Linnaeus, 1758)	X	X	
Ecrobia ventrosa (Montagu,1803)	X		
Epitonium commune (Lamarck, 1822)	X		
Gibulla sp.			X
Gouldia minima (Montagu, 1803)	X	X	
Lucinella divaricata (Linnaeus, 1758)	X	X	X
Mangelia coarctata (Forbes,1840)	X		
Mytilaster lineatus (Gmelin, 1791)		X	
Mytilus galloprovincialis Lamarck, 1819		X	X
Mytillus (Veliconce)			X
Nassarius reticulatus (Linnaeus,1758)	X		
Parvicardium exiguum (Gmelin, 1791)			X
Papillicardium papillosum (Poli, 1791)		X	
Pitar rudis (Poli, 1795)	X	X	
Pusillina lineolata (Michaud,1830)	X		
Retusa truncatula (Bruguiere, 1792)	X		
Rissoa splendida (Eichwald,1830)	X		
Spisula sp.			X
Spisula solida (Linnaeus, 1758)			X
Spisula subtruncata (da Costa, 1778)	X	X	
Tellina tenuis da Costa, 1778	X	X	
Thracia phaseolina (Lamarck, 1818)		X	
Tricolia pullus (Linnaeus, 1758)	X	X	
*Turbonilla pusill*a (Philippi,1844)	X		

In the present study, the total number of species identified from the station M18 by three institutes in given n Table 6, the detailed number of species found at each replicate is given in Table 7. Accordingly, institute A found a total of 46, institute B found 49 and institute C found 21 taxa.

Table 6. The total number of species determined by the institutes in station M18 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Station: M18	Institutes		
Taxonomic Groups	**A**	**B**	**C**
NEMERTEA	1	2	1
PLATHELMINTHES	1	-	-
POLYCHAETA	11	18	5
PHORONIDA	-	1	-
CRUSTACEA	10	11	5
MOLLUSCA	23	17	10
Species Number Total	**46**	**49**	**21**

Table 7. The total number of species identified by the institutes for each replicate (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Station: M18	A			B			C		
Taxonomic Groups	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
NEMERTEA	1	1	1	1	1	1	-	1	-
PLATHELMINTHES	-	1	-	-	-	-	-	-	-
POLYCHAETA	5	7	9	14	16	11	3	4	4
PHORONIDA	-	-	-	-	-	1	-	-	-
CRUSTACEA	5	7	6	6	9	8	3	4	4
MOLLUSCA	12	19	20	5	12	12	8	6	7
Species Number Total	**23**	**35**	**36**	**26**	**38**	**33**	**14**	**15**	**15**

As the number of macrozoobenthic species found at station M18 are taken into consideration, the number of species identified just by one institute accounted for 66% of the total number of species, the species identified by at least two institutes constituted 27% of the total number of species and the species identified by all three institutes constituted 7% of the total number of species (Fig. 35).

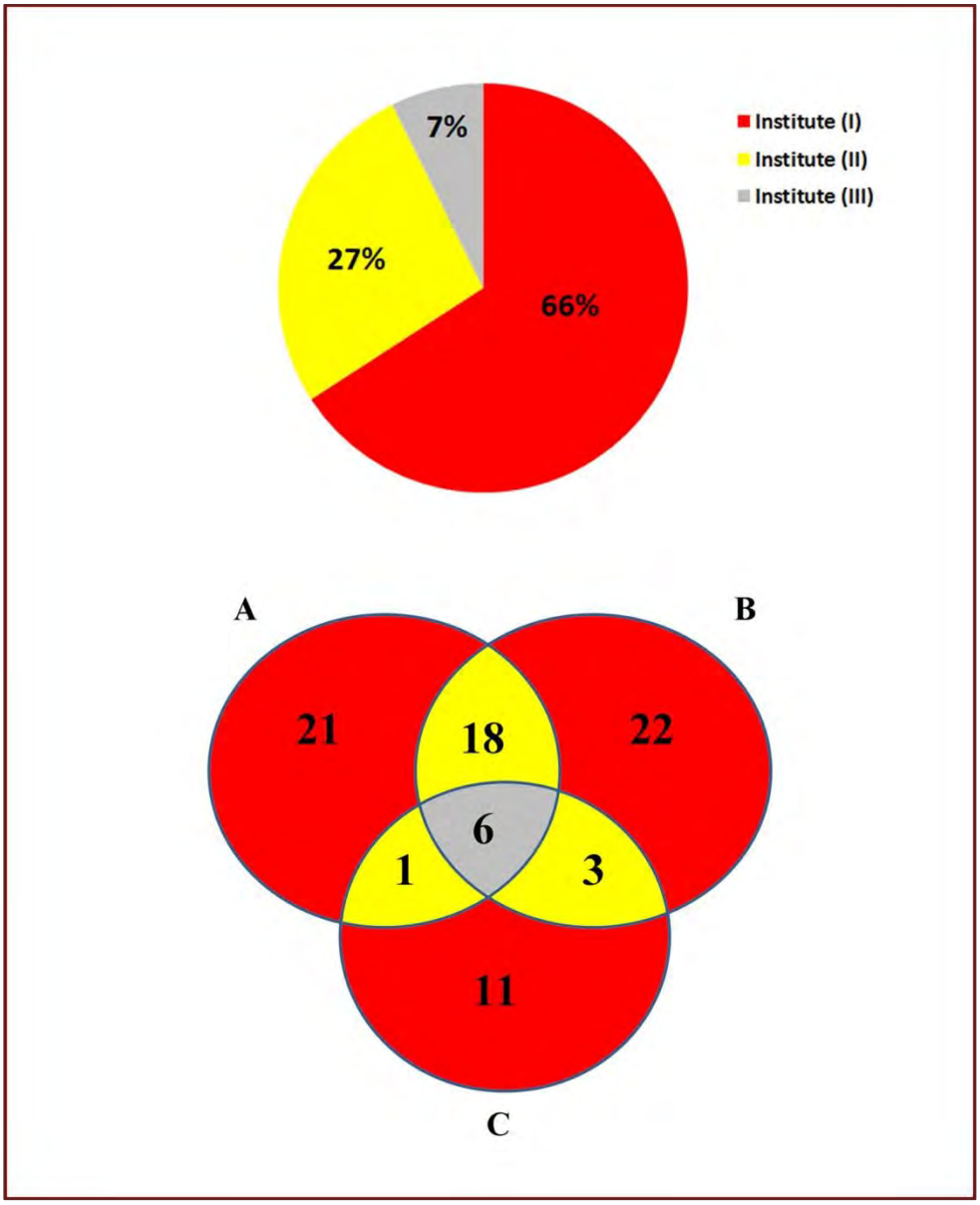

Figure 35. The scheme of the number of species identified at station M18 by the institutes, the share of the number of species (%) and their distribution according to the institutes (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

2.2.2. Meiobenthos

Ten group of organisms were collected from the meiobenthos of the station M18. The list of the major meiobenthic taxa identified by the two institutes are given in Table 8.

Table 8. The major taxa identified from the meiobenthos of station M10 (A: SNU-FF, B: GeoEcoMar).

Meiobenthos	A	B
NEMATODA	X	X
HARPACTICOIDA	X	
POLYCHAETA	X	
FORAMINIFERA H.S.	X	X
BIVALVIA	X	
OSTRACODA	X	X
GASTROTRICHA	X	
TURBELLARIA	X	
CILIOPHORA	X	
OTHERS	X	

According to Table 8, institute A found 10 major taxa and institute B found 3 major taxa of meiobenthic organisms at station M18.

3. Similarity/Dissimilarity

At the intercalibration stations, the evaluation of the results obtained by the institutes regarding the macrozoobenthic community were carried out on three data sets:

- Whether the species were found by the institutes or not (Presence/Absence Matrix)
- The abundance values of the species calculated by the institutes
- The biomass values of the species calculated by the institutes

The concerned species list, presence/absence values, abundance and biomass of this three data group are given in tables (Annex 2) and the data sets were analyzed.

In the analyzes, both the similarity indices for the replicates of each institute and also for all the replicates of the three institutes were calculated for the concerned station.

As a result, the sample groups were identified and cluster analysis was carried out for the replicates. SIMPER analysis was used to calculate the similarity and dissimilarities of the clustered samples. The species which cause the dissimilarities and their percentage contribution were also determined with the help of this analysis.

3.1. Station M10

3.1.1. Macrozoobenthos

3.1.1.1. Presence/Absence

The cluster dendogram based on the Presence/Absence matrix of the species at station M10 is given in Figure 36. As a result, three significant clusters have been identified. (Group I, Group II and Group III).

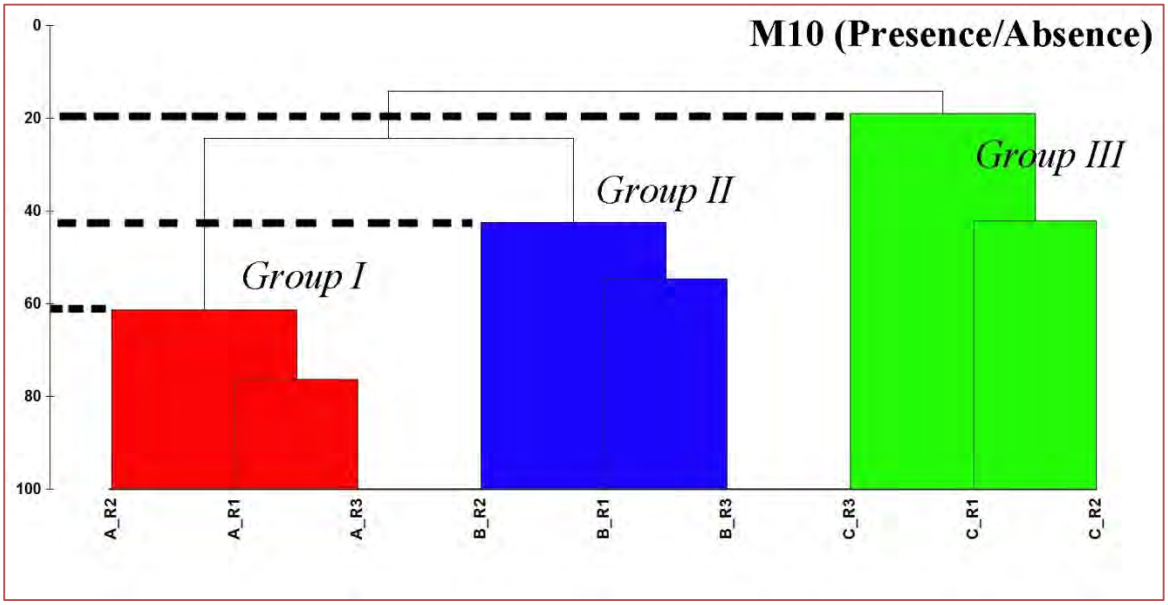

Figure 36. Qualitative cluster dendogram obtained by the samplings of the institutes for station M10 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Similarity percentages and percentage differences among these three important groups are given in Table 9. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of qualitative similarities. A difference of 75.72% was seen between group A and B. Similarly, a difference of 90.45% was found between group A and C. Group B and C revealed a difference of 81.44%.

Table 9. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	66.22	-
Group II	46.47	-
Group III	26.63	-
Group I&II	-	75.72
Group I&III	-	90.45
Group II&III	-	81.44

The species which have contributed to the dissimalirites among the groups and their percentage contribution to the dissimilarities are given in Table 10.

Table 10. The species which contribute to the dissimilarities and their percentage contributions to these dissimilarities (Av. Diss: Average Dissimilarity, Cont: Contribution).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Cerastoderma glaucum	4.62	6.1	5.47	6.05	-	-
Trophonopsis breviata	4.62	6.1	5.47	6.05	-	-
Nephtys hystricis	4.62	6.1	5.47	6.05	-	-
Phoronis euxinicola	4.62	6.1	-	-	4.91	6.03
Heteromastus filiformis	4.62	6.1	1.99	2.2	3.14	3.85
Nephtys hombergii	4.62	6.1	3.87	4.28	1.46	1.79
Amphinema dinema	3.22	4.25	-	-	3.44	4.22
Bittium reticulatum	3.02	3.99	3.57	3.94	-	-
Retusa truncatula	3.02	3.99	3.57	3.94	-	-
Spisula subtruncata	3.02	3.99	2.97	3.28	1.77	2.18
Phoronida sp.	2.94	3.88	3.45	3.82	-	-
Abra alba	2.46	3.25	-	-	2.89	3.55
Nemertea sp.	2.45	3.24	1.9	2.1	2.89	3.55
Aricidea claudiae	2.06	2.72	3.45	3.82	3.5	4.3
Perioculodes longimanus	1.91	2.53	-	-	-	-
Abra prismatica	1.88	2.48	-	-	2.02	2.48
Oligochaeta sp.	-	-	5.47	6.05	4.91	6.03
Capitella capitata	-	-	3.87	4.28	3.46	4.25
Aricidea sp.	-	-	3.59	3.97	3.23	3.97
Mytillus (Veliconce)	-	-	3.48	3.85	3.14	3.85
Parvicardium simile	-	-	3.48	3.85	3.14	3.85
Abra sp.	-	-	3.48	3.85	3.14	3.85
Modiolula phaseolina	-	-	1.99	2.2	1.77	2.18
Iphinoe elisae	1.34	1.77	1.99	2.2	2.18	2.68
Abra ovata	-	-	1.99	2.2	1.77	2.18
Nassarius reticulatus	-	-	1.9	2.1	-	-
Eudorella truncatula	-	-	1.88	2.08	1.68	2.07
Acanthocardia paucicostata	1.4	1.85	1.88	2.08	2.15	2.64
Oriopsis armandi	1.4	1.85	1.6	1.77	2.05	2.51
Terebellides stroemii	1.4	1.85	-	-	2.05	2.51
Amphiura stepanovi	-	-	-	-	2.02	2.48
TOTAL	**59.24**	**78.24**	**77.78**	**86.01**	**62.71**	**77**

3.1.1.2. Abundance

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species abundance values at station M10 is given in Figure 37. As a result, three important clusters were observed (Group I, Group II and Group III).

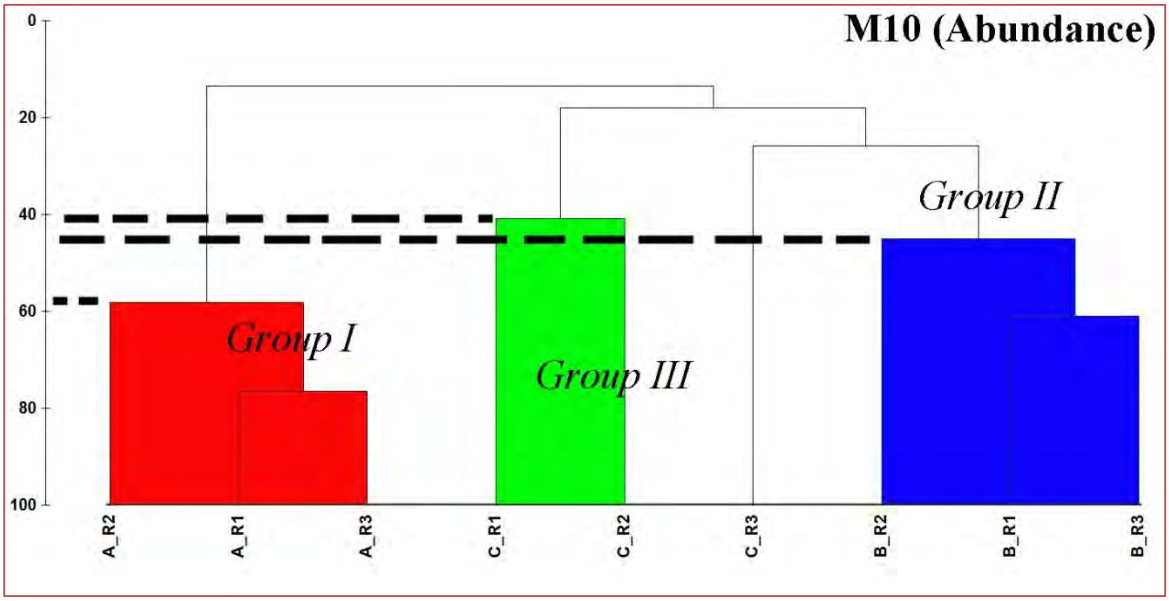

Figure 37. Quantitative cluster dendogram obtained by the samplings of the institutes for station M10 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

Similarity percentages and percentage differences among these three important groups are given in Table 11. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of quantitative similarities. A dissimilarity of 81.28% was observed between groups A and B. Similarly, a dissimilarity of 90.42% was found between the groups A and C. Groups B and C showed a dissimilarity of 82.79%.

Table 11. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	64.19	-
Group II	50.29	-
Group III	40.83	-
Group I&II	-	81.28
Group I&III	-	90.42
Group II&III	-	82.79

The species which contributed to the dissimilarities between the groups and their percentage contributions to these dissimilarities are given in Table 12.

Table 12. The species contributed to the dissimilarities and their percentage contribution to these dissimilarities (Av. Diss: Average Dissimilarity. Cont: Contrubition).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Cerastoderma glaucum	8.46	10.4	10.31	8.34	-	-
Nephtys hombergii	6.73	8.28	4.26	4.71	3.87	4.67
Heteromastus filiformis	4.88	6.01	-	-	5.45	6.59
Trophonopsis breviata	4.65	5.72	5.65	6.25	-	-
Nephtys hystricis	4.2	5.17	5.13	5.67	-	-
Spisula subtruncata	3.83	4.71	4.63	5.12	-	-
Bittium reticulatum	3.67	4.51	4.63	4.89	-	-
Oligochaeta sp.	3.56	4.38	6.02	6.66	9.47	11.44
Phoronis euxinicola	3.43	4.22	-	-	3.84	4.64
Retusa truncatula	3.35	4.12	4.05	4.48	-	-
Aricidea claudiae	3.07	3.78	-	-	3.85	4.65
Iphinoe elisae	2.61	3.21	-	-	2.16	2.6
Amphinema dinema	2.13	2.62	-	-	2.38	2.88
Nassarius reticulatus	2.12	2.61	2.64	2.92	-	-
Abra alba	2.07	2.54	-	-	2.41	2.92
Nemertea sp.	1.82	2.24	-	-	2.1	2.54
Obelia longissima	1.76	2.17	-	-	1.95	2.35
Abra primatica	1.74	2.15	-	-	1.98	2.39
Pitar rudis	1.65	2.03	1.95	2.16	-	-
Terebellides stroemii	1.63	2.01	2.25	2.49	2.6	3.14
Mytillus (Velicorne)	-	-	4.79	5.3	4.38	5.29
Abra sp.	-	-	4.79	5.3	4.38	5.29
Parvicardum simile	-	-	4.27	4.72	3.9	4.71
Nephtys sp.	-	-	4.21	4.65	3.87	4.67
Eudorella truncatula	-	-	1.95	2.16	1.77	2.14
Acanthocardia paucicostata	0.96	1.18	1.95	2.16	1.75	2.11
Capitella capitata	-	-	1.95	2.16	1.77	2.14
Nephtys (cf) *paradoxa*			-	-	1.79	2.16
Mytillus galloprovincialis	1.52	1.87	-	-	1.68	2.03
Oriopsis armandi	0.96	1.18	-	-	1.66	2.01
Amphiura stepanovi	-	-	1.73	1.91	1.66	2.01
TOTAL	**70.8**	**87.11**	**77.16**	**82.05**	**70.67**	**85.37**

3.1.1.3. Biomass

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species biomass values at station M10 is given in Figure 38. As a result, three important clusters were observed (Group I, Group II and Group III).

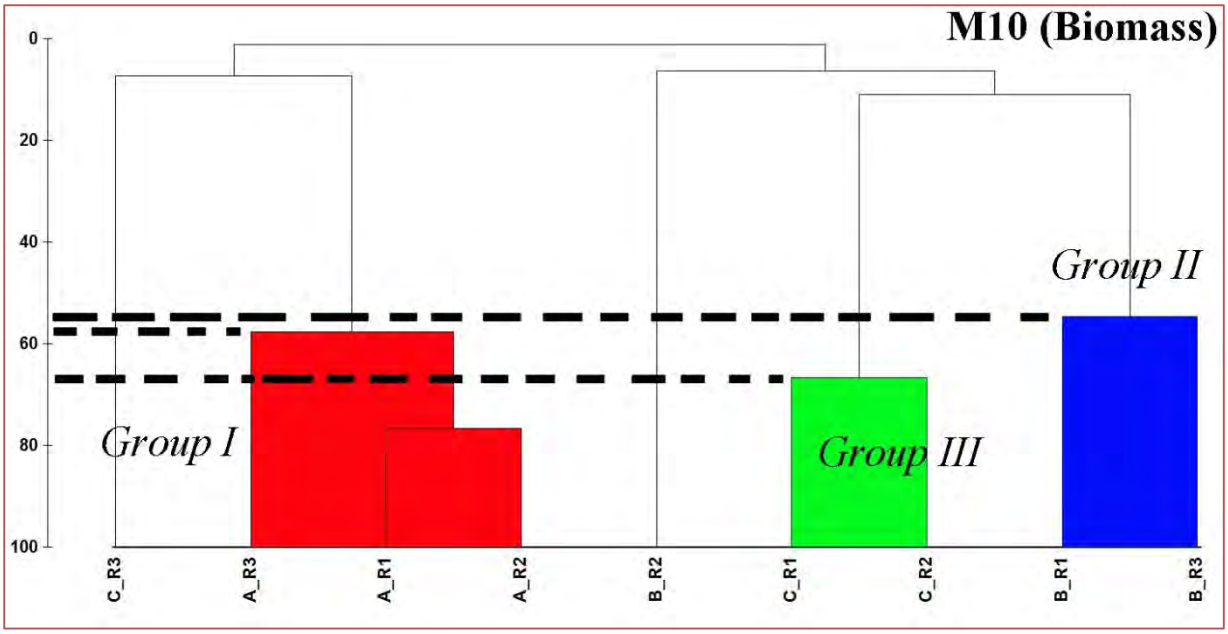

Figure 38. Quantitative cluster dendogram obtained by the samplings of the institutes for station M10 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

The similarity percentages of each group and the dissimilarities among the groups are given in Table 13.

Table 13. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	63.97	-
Group II	54.58	-
Group III	66.68	-
Group I&II	-	99.71
Group I&III	-	99.72
Group II&III	-	89.03

The species which contributed to the dissimilarities and their contributions to these dissimilarities are given in Table 14.

Table 14. The species contributed to the dissimilarities and their percentage contribution (Av. Diss: Average Dissimilarity. Cont: Contrubition).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Cerastoderma glaucum	46.96	47.1	39.09	39.2	-	-
Trophonopsis breviata	11.74	11.77	9.9	9.93	-	-
Nephtys hombergii	8.71	8.74	2.18	2.19	11.41	12.82
Bittium reticulatum	6.76	6.78	5.76	5.78	-	-
Spisula subtruncata	6.57	6.59	5.72	5.74	-	-
Pitar rudis	4.4	4.41	3.95	3.96	-	-
Abra prismatica	4.36	4.38	-	-	8.14	9.15
Abra alba	2.02	2.02	-	-	-	-
Parvicardium simile	-	-	13.7	13.74	31.1	34.93
Abra sp.	-	-	10.48	10.51	23.84	26.78
Acanthocardia paucicostata	-	-	-	-	4.2	4.71
Terebellides stroemii	-	-	-	-	3.12	3.5
TOTAL	**91.52**	**91.79**	**90.78**	**91.05**	**81.81**	**91.89**

3.1.2. Meiobenthos

3.1.2.1. Abundance

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species abundance values at station M10 is given in Figure 39. As a result, two clusters were observed (Group A and Group B).

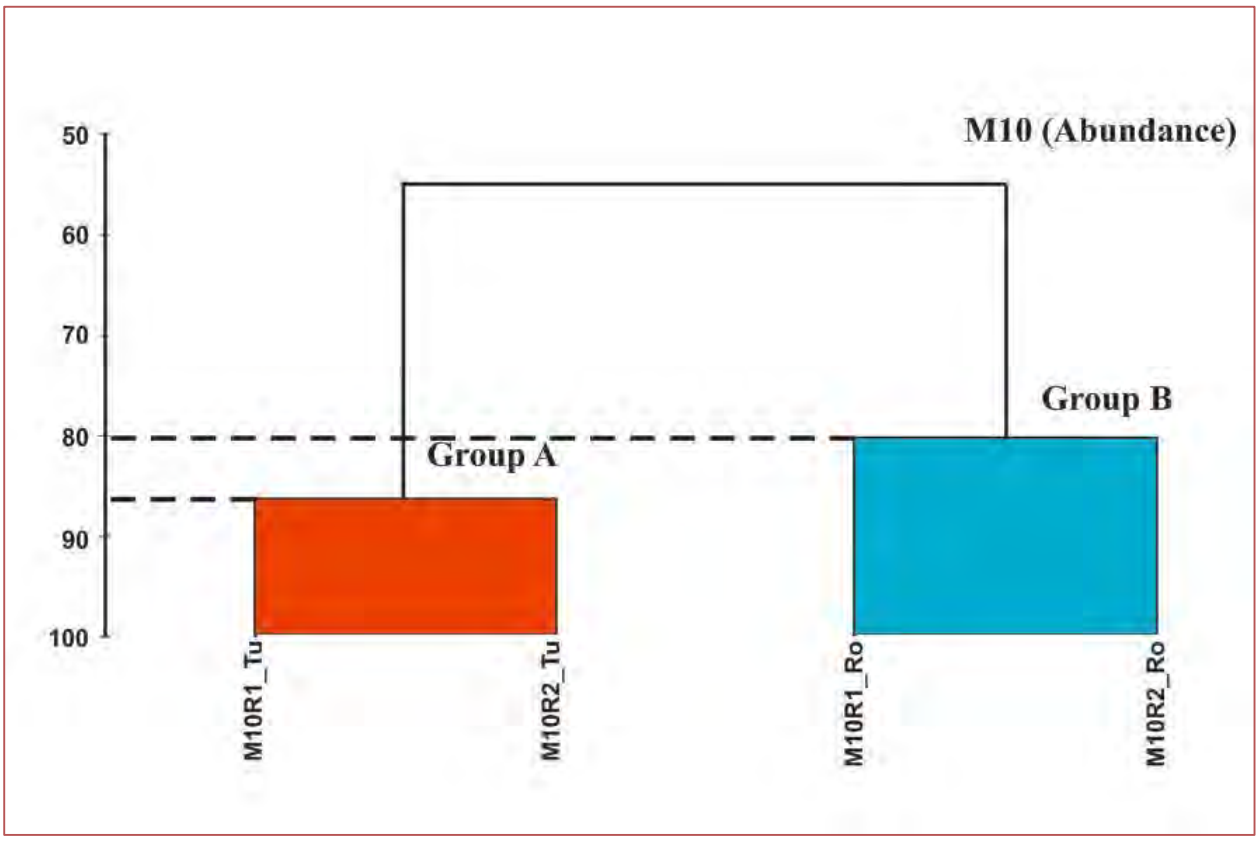

Figure 39. Quantitative cluster dendogram obtained by the meiobenthic samplings of the institutes for station M10 (Tu: SNU-FF, Ro: GeoEcoMar).

Similarity percentages and percentage differences among these two groups are given in Table 15. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of quantitative similarities. Average similarity of Group A was 85.23% and average similarity of Group B was 82.80%. Group A and B showed a low percentage of dissimilarity as 37.95%.

Table 15. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group A	85.23	-
Group B	82.80	-
Group A&B	-	37.95

The major taxa which contributed to the dissimilarities between the groups and their percentage contributions to these dissimilarities are given in Table 16.

Table 16. The major taxa contributed to the dissimilarities and their percentage contribution to these dissimilarities (Av. Diss: Average Dissimilarity, Cont: Contribution, H.S. :hard shelled, S.S. : soft shelled).

	Group (A-B)	
TAXA	Av.Diss	Cont. %
Bivalvia	6.16	16.22
Others	5.30	13.98
Foraminifera S.S.	5.15	13.56
Gastropoda	4.53	11.95
Foraminifera H.S.	3.47	9.14
Harpacticoida	2.72	7.18
Polychaeta	2.51	6.62
Turbellaria	2.41	6.34
Ostracoda	2.29	6.03
TOTAL	**34.54**	**91.02**

3.1.2.2. Biomass

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species biomass values at station M10 is given in Figure 40. As a result, two clusters were observed (Group A and Group B).

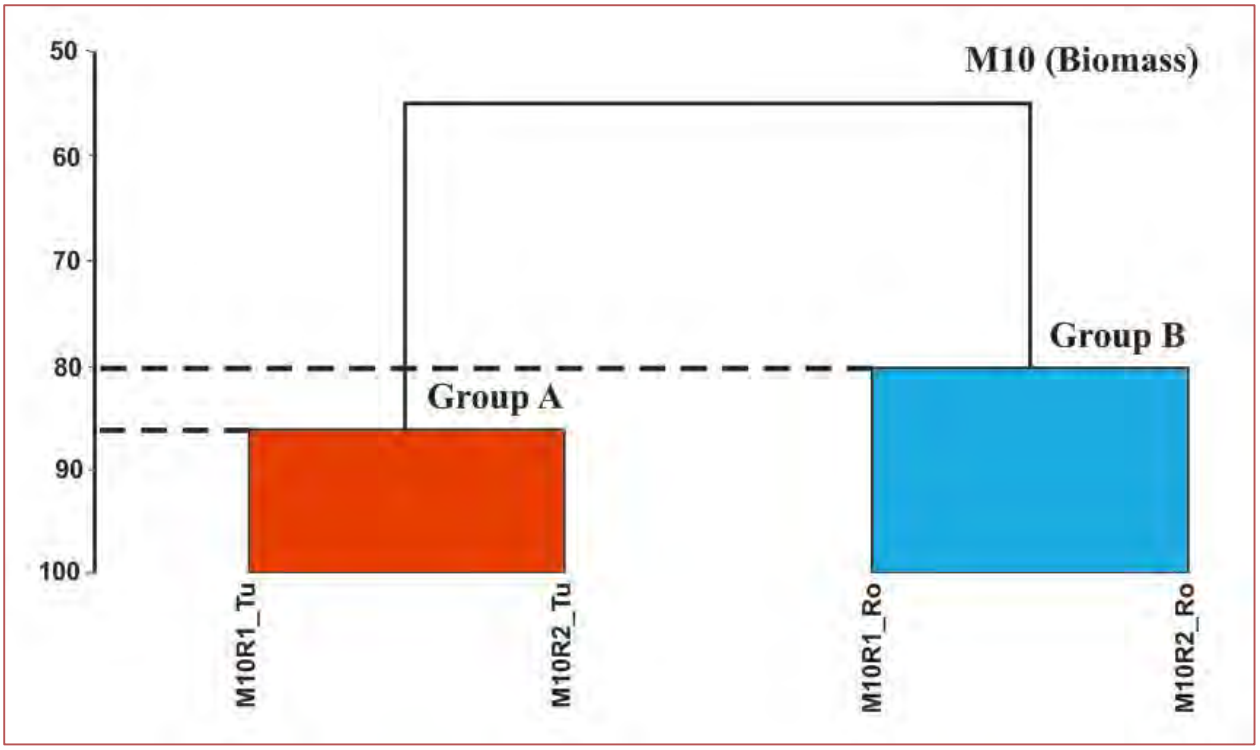

Figure 40. Quantitative cluster dendogram obtained by the meiobenthic samplings of the institutes for station M10 (Tu: SNU-FF, Ro: GeoEcoMar).

Similarity percentages and percentage differences among these two groups are given in Table 17. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of quantitative similarities. Average similarity of Group A was 86.35% and average similarity of Group B was 80.37%. Group A and B showed a low percentage of dissimilarity as 45.09%.

Table 17. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group A	86.35	-
Group B	80.37	-
Group A&B	-	45.09

The major taxa which contributed to the dissimilarities between the groups and their percentage contributions to these dissimilarities are given in Table 18.

Table 18. The major taxa contributed to the dissimilarities and their percentage contribution to these dissimilarities (Av. Diss: Average Dissimilarity, Cont: Contribution, H.S. :hard shelled, S.S. : soft shelled).

	Group (A-B)	
TAXA	Av.Diss	Cont. %
Bivalvia	9.25	20.52
Foraminifera H.S.	7.34	16.28
Gastropoda	5.68	12.59
Ostracoda	4.86	10.78
Nematoda	3.14	6.97
Others	3.10	6.87
Polychaeta	2.62	5.81
Kinorhyncha	2.58	5.71
Foraminifera S.S.	2.54	5.64
TOTAL	**41.11**	**91.17**

3.2. Station M18

3.2.1. Macrozoobenthos

3.2.1.1. Presence/Absence

The dendogram obtained as a result of the CLUSTER analysis based on the Presence/Absence matrix of the species at station M18 is given in Figure 41. As a result, three important clusters were observed (Group I, Group II and Group III).

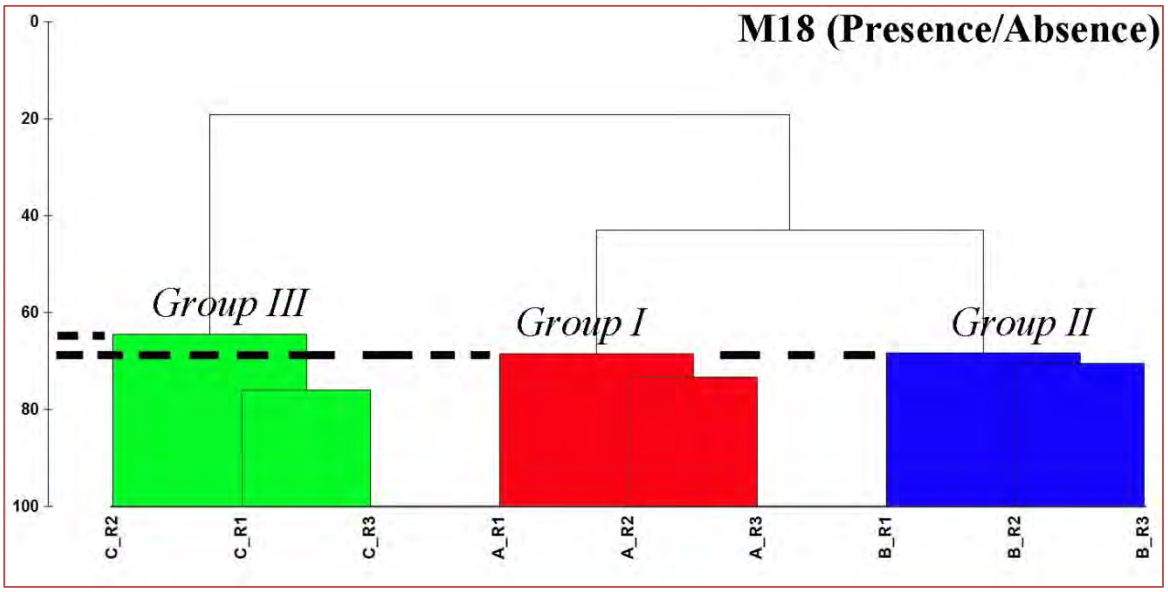

Figure 41. Qualitative cluster dendogram obtained by the samplings of the institutes for station M18 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

The species which contributed to the dissimilarities and their contributions to these dissimilarities are given in Table 19.

Table 19. Similarity and dissimilarities calculated based on the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	69.68	-
Group II	68.99	-
Group III	68.2	-
Group I&II	-	56.97
Group I&III	-	83.04
Group II&III	-	78.69

The species which contributed to the dissimilarities and their contributions to these dissimilarities are given in Table 20.

Table 20. The species contributed to the dissimilarities and their percentage contribution (Av. Diss: Average Dissimilarity, Cont: Contribution).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Mytilaster lineatus	1.6	2.8	-	-	2.15	2.73
Mytillus galloprovincialis	1.6	2.8	-	-	1.44	1.83
Retusa truncatula	1.6	2.8	2.21	2.67	-	-
Bittum reticulatum	1.6	2.8	2.21	2.67	-	-
Caecum trachea	1.6	2.8	2.21	2.67	-	-
Ecrobia ventrosa	1.6	2.8	2.21	2.67	-	-
Nephtys hombergii	1.6	2.8	0.73	0.88	1.44	1.83
Prionospio cirrifera	1.6	2.8	-	-	2.15	2.73
Leiochone leiopygos	1.6	2.8	-	-	2.15	2.73
Aricidea catherinae	1.6	2.8	2.21	2.67	-	-
Aricidea claudiae	1.6	2.8	-	-	2.15	2.73
Capitella capitata	1.6	2.8	2.21	2.67	-	-
Mytillus (Veliconce)	-	-	2.21	2.67	2.15	2.73
Spisula subtruncata	-	-	2.21	2.67	2.15	2.73
Tricolia pullus	1.11	1.95	2.21	2.67	-	-
Calyptraea chinensis	1.11	1.95	2.21	2.67	-	-
Cyclope neritea	1.11	1.95	2.21	2.67	-	-
Perioculodes longimanus	0.67	0.92	2.21	2.67	1.45	1.85
Angulus tenuis	-	-	2.21	2.67	2.15	2.73
Nephtys (cf) *paradoxa*	-	-	2.21	2.67	2.15	2.73
Spio decoratus	-	-	2.21	2.67	2.15	2.73
Spionidae varia	-	-	2.21	2.67	2.15	2.73
Ampelisca diadema	-	-	2.21	2.67	2.15	2.73
Ampelisca sarsi	-	-	2.21	2.67	2.15	2.73
Heteromastus filiformis	-	-	2.21	2.67	2.15	2.73
Nemertea sp.	-	-	2.21	2.67	-	-
Tellina tenuis	0.61	1.07	1.33	1.6	2.15	2.73
Iphinoe tenella	0.99	1.73	0.89	1.07	2.15	2.73
Melinna palmata	0.61	1.07	1.33	1.6	2.15	2.73
Caulleriella bioculata	1.1	1.93	-	-	2.15	2.73
TOTAL	**26.51**	**46.17**	**48.48**	**58.55**	**38.73**	**51.92**

3.2.1.2. Abundance

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species abundance values at station M18 is given in Figure 42. As a result, three important clusters were observed (Group I, Group II and Group III).

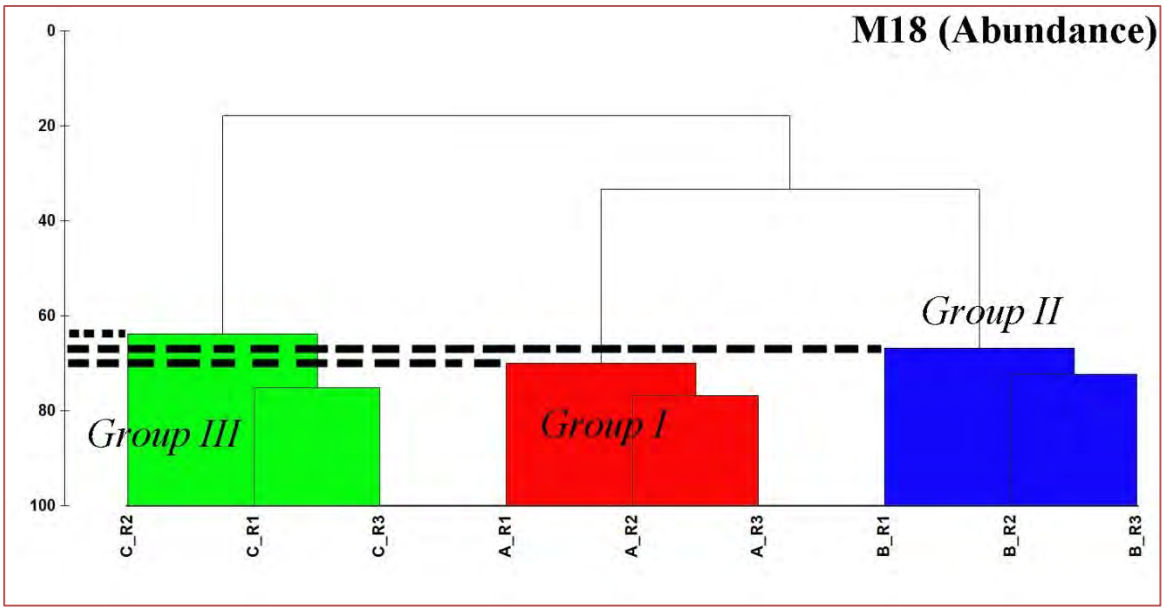

Figure 42. Quantitative cluster dendogram obtained by the samplings of the institutes for station M18 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

The similarity percentages in each group and the dissimilarities among the groups are given Table 21.

Table 21. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	72.22	-
Group II	68.66	-
Group III	67.5	-
Group I&II	-	66.64
Group I&III	-	84.03
Group II&III	-	80.5

The species which contributed to the dissimilarities and their percentage contribution are given in Table 22.

Table 22. Species contributed to the dissimilarities and their percentage contribution (Av. Diss: Average Dissimilarity, Cont: Contrubition).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Bittum reticulatum	3.74	9.55	4.95	5.9	-	-
Caecum trachea	3.61	5.41	4.78	5.69	-	-
Aricidea claudiae	2.99	4.49	-	-	4.13	5.13
Tricolia pullus	2.49	3.74	3.67	4.37	-	-
Calyptraea chinensis	2.27	3.41	3.38	4.02	-	-
Aricidea catherinae	2.06	3.09	2.73	3.25	-	-
Capitella capitata	2.03	3.05	2.42	2.88	-	-
Ecrobia ventrosa	2.03	3.04	2.68	3.19	-	-
Prionospio cirrifera	1.92	2.88	-	-	2.64	3.28
Lucinella divaricata	1.78	2.68	0.88	1.05	2.06	2.56
Retusa truncatula	1.77	2.65	2.34	2.79	-	-
Mytilaster lineatus	1.75	2.63	-	-	2.41	2.99
Mytillus galloprovincialis	1.67	2.5	-	-	1.75	2.18
Pusillina lineolata	1.66	2.49	2.15	2.55	-	-
Leiochone leiopygos	1.56	2.33	-	-	2.13	2.64
Cyclope neritea	1.35	2.03	2.25	2.68	-	-
Spionidae varia	-	-	3.22	3.83	3.34	4.15
Spisula subtruncata	0.57	0.86	2.93	3.48	2.25	2.79
Ampelisca diadema	-	-	2.59	3.08	2.69	3.34
Ampelisca sarsi	-	-	2.56	3.05	2.91	3.61
Angulus tenuis	-	-	2.31	2.75	2.4	2.99
Mytillus (Velicone)	-	-	2.17	2.58	2.25	2.8
Nephtys (cf) paradoxa	0.56	0.84	1.8	2.14	2.64	3.27
Spio decoratus	-	-	1.57	1.87	3.33	4.14
Heteromastus filiformis	1.09	1.64	1.47	1.76	3.02	3.75
Melinna palmata	1.13	1.69	-	-	2.01	2.49
Caulleriella bioculata	1.22	1.83	-	-	1.87	2.32
Tellina tenuis	0.72	1.08	1.33	1.59	1.82	2.26
Pseudocuma longicorne	0.57	0.85	0.96	1.14	1.71	2.13
TOTAL	**40.54**	**64.76**	**55.14**	**65.64**	**47.36**	**58.82**

3.2.1.3. Biomass

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species biomass values at station M18 is given in Figure 43. As a result, three important clusters were observed (Group I, Group II and Group III).

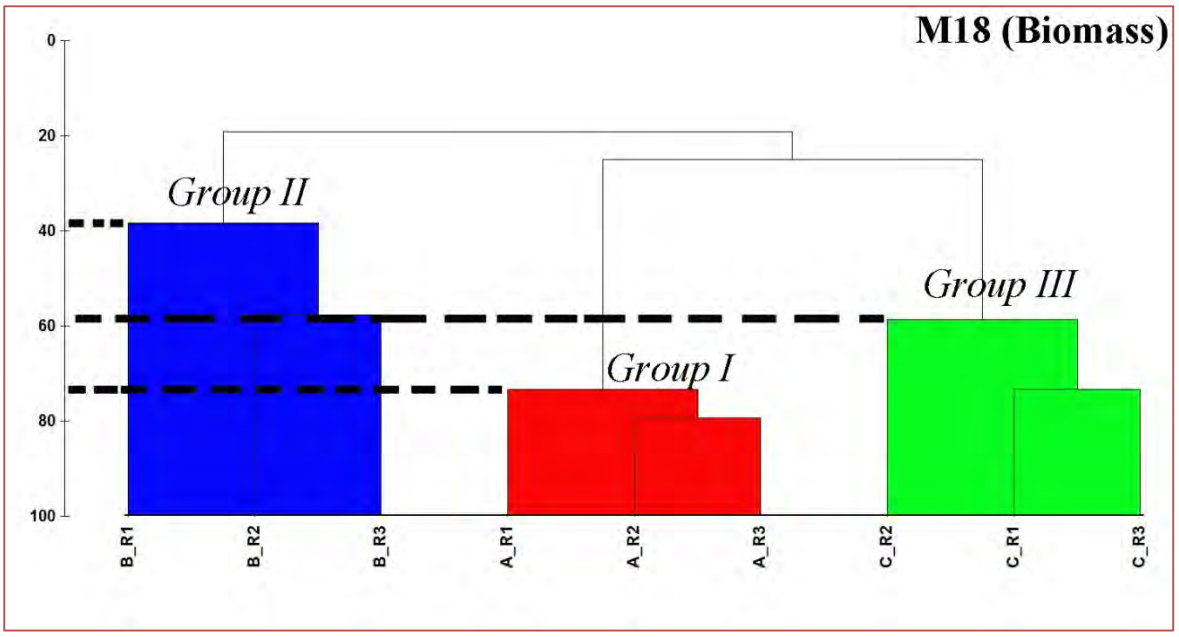

Figure 43. Quantitative cluster dendogram obtained by the samplings of the institutes for station M18 (A: SNU-FF, B: GeoEcoMar, C: NIMRD).

The similarities within each group and the percentage of dissimilarities among the groups are given in Table 23.

Table 23. Similarity and dissimilarities calculated based on the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	75.33	-
Group II	44.73	-
Group III	63.52	-
Group I&II	-	79.54
Group I&III	-	74.97
Group II&III	-	82.02

The species which contributed to the differences and their percentage contribution to the dissimilarities are given in Table 24.

Table 24. The species contributed to the dissimilarities and their percentage contribution (Av. Diss: Average Dissimilarity, Cont: Contrubition).

	Group (I-II)		Group (I-III)		Group (II-III)	
SPECIES	Av.Diss	Cont. %	Av.Diss	Cont. %	Av.Diss	Cont. %
Bittum reticulatum	12.92	16.25	10.75	14.34	-	-
Chamelea gallina	9.42	11.84	3.81	5.09	8.77	10.69
Calyptraea chinensis	7.18	9.03	5.96	7.95	-	-
Tricolia pullus	5.76	7.25	4.8	6.41	-	-
Pitar rudis	5.62	7.06	4.79	6.39	-	-
Cyclope neritea	4.79	6.02	4.49	5.98	-	-
Spisula subtruncata	4.57	5.74	5.08	6.77	2.53	3.08
Lucinella divaricata	4.49	5.64	2.84	3.78	10.95	13.35
Caecum trachea	3.39	4.26	2.81	3.75	-	-
Upogebia pusilla	2.96	3.72	2.63	3.51	6.1	7.44
Ecrobia ventrosa	2.7	3.4	2.25	3.01	-	-
Tellina tenuis	2.23	2.8	2	2.66	3.82	4.65
Nephtys hombergii	1.79	2.25	-	-	3.09	3.76
Angulus tenuis	-	-	5.6	7.47	11.34	13.83
Spisula sp.	-	-	2.42	3.23	4.78	5.82
Diogenes pugilator	-	-	2.23	2.97	4.56	5.56
Parvicardium exiguum	-	-	2.06	2.75	4.1	5
Ampelisca diadema	-	-	1.59	2.12	3.23	3.94
Gibulla sp.	-	-	1.44	1.92	2.74	3.34
Ampelisca sarsi	-	-	-	-	2.56	3.13
Spisula solida	-	-	-	-	1.24	2.82
Aricidea claudiae	1.17	1.47	-	-	2.01	2.45
TOTAL	**68.99**	**86.73**	**67.55**	**90.1**	**71.82**	**88.86**

3.2.2. Meiobenthos

3.2.2.1. Abundance

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species abundance values at station M18 is given in Figure 44. As a result, two clusters were observed (Group A and Group B).

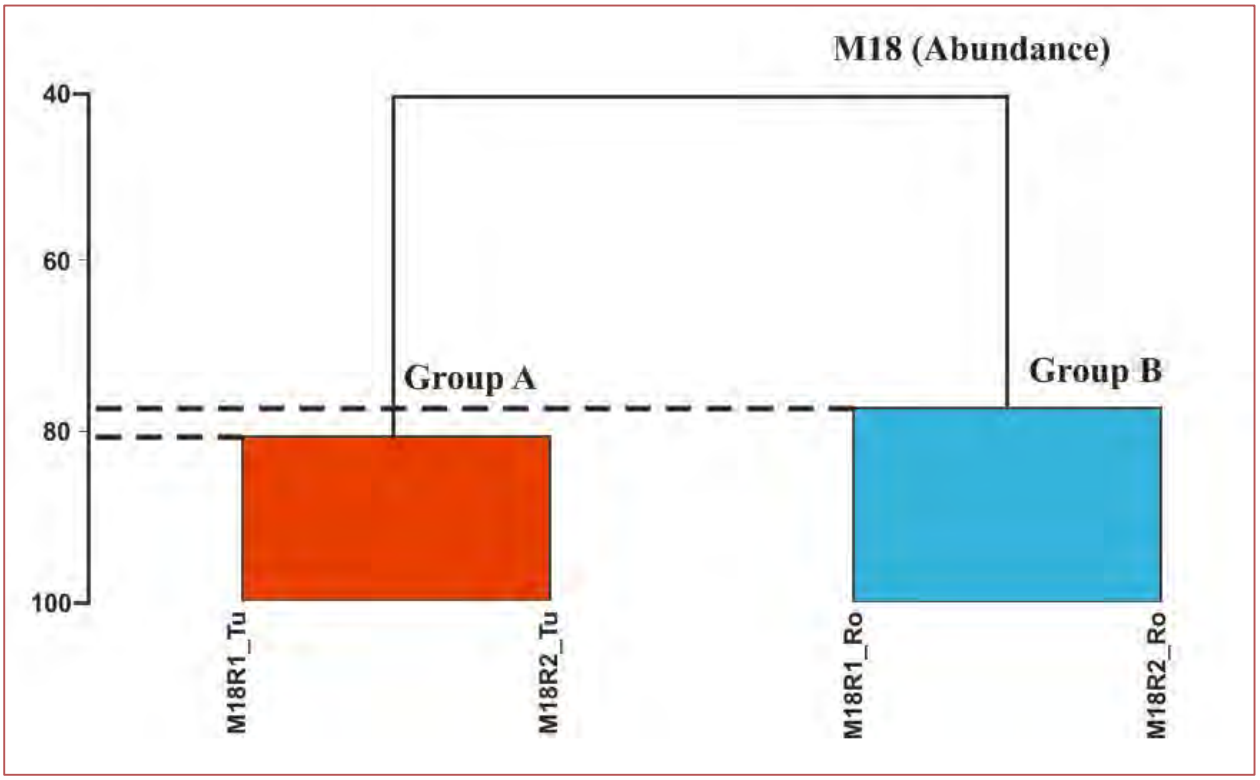

Figure 44. Quantitative cluster dendogram obtained by the meiobenthic samplings of the institutes for station M18 (Tu: SNU-FF, Ro: GeoEcoMar).

Similarity percentages and percentage differences among these two groups are given in Table 25. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of quantitative similarities. Average similarity of Group A was 80.46% and average similarity of Group B was 77.37%. Group A and B showed a percentage of dissimilarity as 59.35%.

Table 25. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group A	80.46	-
Group B	77.37	-
Group A&B	-	59.35

The major taxa which contributed to the dissimilarities between the groups and their percentage contributions to these dissimilarities are given in Table 26.

Table 26. The major taxa contributed to the dissimilarities and their percentage contribution to these dissimilarities (Av. Diss: Average Dissimilarity, Cont: Contribution).

	Group (A-B)	
TAXA	Av.Diss	Cont. %
Polychaeta	10.21	17.21
Others	9.35	15.75
Bivalvia	8.74	14.72
Harpacticoida	8.41	14.17
Turbellaria	8.24	13.88
Ostracoda	4.33	7.29
Ciliophora	4.12	6.94
Gastrotricha	3.41	5.75
TOTAL	**56.81**	**95.71**

3.2.2.3. Biomass

The dendogram obtained as a result of the CLUSTER analysis based on the Log(x+1) matrix of species biomass values at station M18 is given in Figure 45. As a result, two clusters were observed. First cluster was assigned as Group A and the other as Group B.

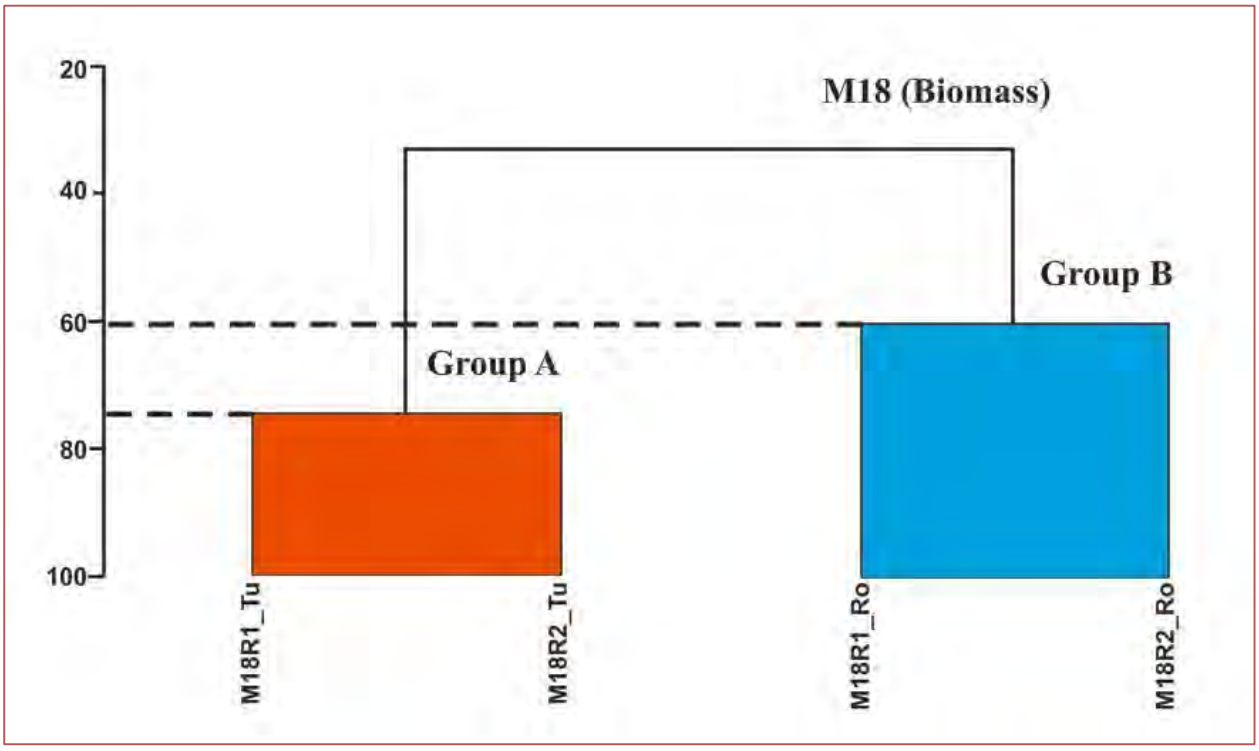

Figure 45. Quantitative cluster dendogram obtained by the meiobenthic samplings of the institutes for station M18 (Tu: SNU-FF, Ro: GeoEcoMar).

Similarity percentages and percentage differences among these two groups are given in Table 27. Accordingly, each institute showed their own clusters. However, differences were observed among the institutes in terms of quantitative similarities. Average similarity of Group A was 74.70% and average similarity of Group B was 60.38%. Group A and B showed a percentage of dissimilarity as 67.24%.

Table 27. Similarity and dissimilarities calculated as a result of the SIMPER analysis.

Analysis Groups	Average Similarity	Average Dissimilarity
Group A	74.70	-
Group B	60.38	-
Group A&B	-	67.24

The major taxa which contributed to the dissimilarities between the groups and their percentage contributions to these dissimilarities are given in Table 28.

Table 28. The major taxa contributed to the dissimilarities and their percentage contribution to these dissimilarities (Av. Diss: Average Dissimilarity, Cont: Contribution, H.S. :hard shelled).

	Group (A-B)	
TAXA	Av.Diss	Cont. %
Polychaeta	15.00	22.31
Bivalvia	14.20	21.11
Others	8.00	11.89
Harpacticoida	7.44	11.07
Ostracoda	6.21	9.23
Gastrotricha	5.39	8.02
Foraminifera H.S.	3.99	5.94
Turbellaria	3.40	5.05
TOTAL	**63.63**	**94.62**

V. Conclusions

Dissimilarities observed between results obtained by the teams who analyzed the samples can be explained through:

- The natural variability of species distribution in their habitats;
- The sampling design (the repetitive cast of Van Veen in the same place affected the species composition, so that each sample collected had different number of species (different qualitative composition) and number of individuals (quantitative composition) from each species (especially for those species that have small populations);
- Samples' processing on board (washing, sieving, preserving and staining), but these aspects can be in very small measure claimed for the differences observed);
- The samples' lab processing (taxonomic experts work).

The results could be considered only satisfactory from the point of comparability since in both stations analyzed (M10 and M18) there were found significant dissimilarities (> 50%) between the results provided by the three teams (SNUFF, GeoEcoMar, NIMRD G.Antipa), two teams in case of meiobenthos (SNUFF and GeoEcoMar) respectively who participated at intercalibration exercise.

The SIMPER analysis of similarities and dissimilarities within the groups (replicates) and between groups (institutes) concerning the abundance, presence/absence and biomass parameters of benthic populations coupled with Bray – Curtis cluster analysis have been proved an appropriate statistical method to evince the gaps and plusses regarding the intercalibration exercise, that could be useful for Black Sea regional monitoring programme design.

VI. Recommendations

1. Intercalibration exercises should follow the international and regional benthos sampling and processing guidelines. These should be referring both to ISO technical guidance for sampling and analysis of benthos samples (e.g., ISO 16665:2014, ISO 19493:2007) and to regional (Black Sea) (e.g., Todorova V. and Konsulova T., 2005) and international guidelines (e.g., ICES. 2004).

2. Elaboration of SOPs Standard Operating Procedure within each laboratory either for their own in-house purposes or in relation to specific regional intercalibration projects.

3. Identification skills of taxonomists should be periodically trained in national and international intercalibration exercises and dedicated workshops and events. In the same purpose, application of QA schemes during intercalibration exercises (exchange of material between laboratories or creation of one administrative laboratory that is responsible for circulation of test material and the analysis and reporting of results) should be promoted. The exercise performed during MISIS project highlighted the imperious necessity of taxonomic revision and producing of updated key identification guidelines for all benthic groups in the Black Sea.

4. Creation of National Marine Biological Analytical Quality Control Scheme (NMBAQC)/Biological Effects Quality Assurance Monitoring (BEQUALM) in each country.

5. In order to allign the Black Sea surveillance monitoring programme to European Directives requirements (Water Framework Directive, Marine Strategy Directive), the guidelines elaborated by international expert technical groups should be followed (Carletti and Heiskanen., 2009; Cochrane et al, 2010).

Annex 1.

List of the participating institutes.

Institution	Country	Responsible person	Parameters
A-Sinop University Fisheries Faculty (SNU-FF)	TURKEY	Murat Sezgin Derya Ürkmez	Macrozoobenthos Meiobenthos
B-National Research and Development Institute for Marine Geology and Geoecology (GeoEcoMar)	ROMANIA	Adrian Teaca Mihalea Muresan	Macrozoobenthos Meiobenthos
C-National Institute for Marine Research and Development "Grigore Antipa" (NIMRD)	ROMANIA	Adrian Filimon	Macrozoobenthos

Annex 2.

Raw data reported

A. Z-Scores:

Table 29. M10-M18_Macrozoobenthos Total Abundance (ind/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 MZB-Total Abundance	**R1**	360.00	858.40	255.00
	R2	592.00	481.00	170.00
	R3	1233.00	621.60	203.00
	Mean	**728.33**	**653.67**	**209.33**
	St.dev	**452.19**	**190.73**	**42.85**
	CV (%)	**62.1**	**29.2**	**20.5**
M18 MZB-Total Abundance	**R1**	11228.00	3359.60	1370.00
	R2	13151.00	3840.60	869.00
	R3	21029.00	2271.80	1258.00
	Mean	**15136.00**	**3157.33**	**1165.67**
	St.dev	**5193.27**	**803.72**	**262.95**
	CV (%)	**34.3**	**25.5**	**22.6**

Table 30. M10-M18_Polychaeta Abundance (ind/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Polychaeta Abundance	**R1**	15.00	273.80	199.00
	R2	19.00	118.40	100.00
	R3	22.00	192.40	175.00
	Mean	**18.67**	**194.87**	**158.00**
	St.dev	**3.51**	**77.73**	**51.64**
	CV (%)	**18.8**	**39.9**	**32.7**
M18 Polychaeta Abundance	**R1**	218.00	2715.80	336.00
	R2	190.00	2782.40	377.00
	R3	127.00	1346.80	663.00
	Mean	**178.33**	**2281.67**	**458.67**
	St.dev	**46.61**	**810.30**	**178.14**
	CV (%)	**26.1**	**35.5**	**38.8**

Table 31. M10-M18_Crustacea Abundance (ind/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Crustacea Abundance	**R1**	30.00	44.40	14.00
	R2	70.00	14.80	14.00
	R3	22.00	7.40	0.00
	Mean	**40.67**	**22.20**	**9.33**
	St.dev	**25.72**	**19.58**	**8.08**
	CV (%)	**63.2**	**88.2**	**86.6**
M18 Crustacea Abundance	**R1**	258.00	503.20	155.00
	R2	317.00	629.00	149.00
	R3	104.00	318.20	192.00
	Mean	**226.33**	**483.47**	**165.33**
	St.dev	**109.97**	**156.34**	**23.29**
	CV (%)	**48.6**	**32.3**	**14.1**

Table 32. M10-M18_Mollusca Abundance (ind/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Mollusca Abundance	**R1**	298.00	14.80	35.00
	R2	440.00	44.40	49.00
	R3	1165.00	22.20	28.00
	Mean	**634.33**	**27.13**	**37.33**
	St.dev	**465.02**	**15.40**	**10.69**
	CV (%)	**73.3**	**56.8**	**28.6**
M18 Mollusca Abundance	**R1**	10747.00	125.80	879.00
	R2	12634.00	414.40	336.00
	R3	20797.00	584.60	403.00
	Mean	**14726.00**	**374.93**	**539.33**
	St.dev	**5341.63**	**231.93**	**296.06**
	CV (%)	**36.3**	**61.9**	**54.9**

Table 33. M10-M18_Macrozoobenthos Total Biomass (g/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 MZB-Total Biomass	**R1**	36.9405	1.913196	8.1129
	R2	81.3059	25.446528	4.9873
	R3	202.0059	2.39834	1.8514
	Mean	**106.75**	**9.92**	**4.98**
	St.dev	**85.42**	**13.45**	**3.13**
	CV (%)	**80.0**	**135.6**	**62.8**
M18 MZB-Total Biomass	**R1**	445.112	7.35486	166.0989
	R2	492.4011	36.141008	52.8101
	R3	1040.3267	14.28274	108.3349
	Mean	**659.28**	**19.26**	**109.08**
	St.dev	**330.84**	**15.02**	**56.65**
	CV (%)	**50.2**	**78.0**	**51.9**

Table 34. M10-M18_Polychaeta Biomass (g/m2) (Raw data. Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Polychaeta Biomass	**R1**	0.1871	1.737446	0.125
	R2	0.1575	0.408628	0.5914
	R3	0.1852	1.087874	0.0734
	Mean	**0.18**	**1.08**	**0.26**
	St.dev	**0.02**	**0.66**	**0.29**
	CV (%)	**9.4**	**61.6**	**108.4**
M18 Polychaeta Biomass	**R1**	0.2282	4.283194	0.1844
	R2	0.1184	3.29004	0.182
	R3	0.0547	1.624966	0.0808
	Mean	**0.13**	**3.07**	**0.15**
	St.dev	**0.09**	**1.34**	**0.06**
	CV (%)	**65.6**	**43.8**	**39.7**

Table 35. M10-M18_Crustacea Biomass (g/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Crustacea Biomass	**R1**	0.016	0.01961	0.006
	R2	0.04	10.89058	0.056
	R3	0.01	0.003626	0
	Mean	**0.02**	**3.64**	**0.02**
	St.dev	**0.02**	**6.28**	**0.03**
	CV (%)	**72.2**	**172.7**	**148.8**
M18 Crustacea Biomass	**R1**	10.883	1.721166	1.0165
	R2	1.045	3.495168	23.3521
	R3	9.609	6.275274	18.772
	Mean	**7.18**	**3.83**	**14.38**
	St.dev	**5.35**	**2.30**	**11.80**
	CV (%)	**74.5**	**59.9**	**82.0**

Table 36. M10-M18_Mollusca Biomass (g/m^2) (Raw data, Mean, St. dev: Standard Deviation and CV: Coefficient of Variation).

INSTITUTE		A	B	C
M10 Mollusca Biomass	**R1**	36.736	0.0333	7.7999
	R2	81.103	13.75512	4.3299
	R3	201.809	1.2136	1.778
	Mean	**106.55**	**5.00**	**4.64**
	St.dev	**85.43**	**7.60**	**3.02**
	CV (%)	**80.2**	**152.1**	**65.2**
M18 Mollusca Biomass	**R1**	433.966	1.3209	164.898
	R2	491.2272	29.3262	29.252
	R3	1030.651	6.34698	89.4821
	Mean	**651.95**	**12.33**	**94.54**
	St.dev	**329.21**	**14.93**	**67.96**
	CV (%)	**50.5**	**121.1**	**71.9**

Table 37. Station M10 Abundance (ind/m^2) values by 3 institutes (A: SNU-FF, B-GeoEcoMar, C:NIMRD).

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
CNIDARIA									
Amphinema dinema (Péron & Lesueur, 1810)					7.4	7.4			
Obelia longissima (Pallas, 1766)					51.8				
Actinothoe clavata (Ilmoni, 1830)					7.4				
ECHINODERMATA									
Amphiura stepanovi Chernyavskii, 1861					7.4		7		
NEMERTEA									
Nemertea (sp.)		1		7.4	7.4				
OLIGOCHAETA									
Oligochaeta (sp.)	17	61	21	510.6	214.6	377.4			
POLYCHAETA									
Aricidea claudiae Laubier, 1967		1	3	22.2		37			
Aricidea sp.							7		7
Capitella capitata (Fabricius, 1780)								7	54
Heteromastus filiformis (Claparède, 1864)				29.6	14.8	44.4			21
Nephtys hombergii Savigny in Lamarck, 1818				162.8	59.2	111		93	93
Nephtys hystricis McIntosh, 1900	15	18	19						
Nephtys (cf.) *paradoxa* Malm, 1874					37				
Nephtys sp.							157		
Oriopsis armandi (Claparède, 1864)				7.4			7		
Phyllodoce mucosa Örsted, 1843					7.4				
Polycirrus jubatus Bobretzky, 1869				7.4					
Prionospio cirrifera (Wirén, 1883)							7		
Sphaerosyllis bulbosa Southern, 1914				7.4					
POLYCHAETA									
Spionidae varia							7		
Terebellides stroemii Sars, 1835				37			14		

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
PHORONIDA									
Phoronis euxinicola Selys-Longchamps, 1907				7.4	7.4	14.8			
Phoronida (sp.)		1	3						
CRUSTACEA									
Eudorella truncatula (Bate, 1856)								7	
Iphinoe elisae Băcescu, 1950	30	70	15	37		7.4	14	14	
Perioculodes longimanus (Bate & Westwood, 1868)			7	7.4					
Phtisica marina Slabber, 1769					7.4				
Upogebia pusilla (Petagna, 1792)					7.4				
MOLLUSCA									
Abra alba (W. Wood, 1802)			15	7.4	14.8				
Abra ovata (Philippi, 1836)									7
Abra prismatica (Montagu, 1808)						22.2			
Abra sp.							14	14	
Acanthocardia paucicostata (G. B. Sowerby II, 1834)				7.4				7	
Bittium reticulatum (da Costa,1778)	37		81						
Cerastoderma glaucum (Bruguière, 1789)	154	370	829						
Modiolula phaseolina (Philippi, 1844)									14
Mytilus galloprovincialis (Lamark,1819)					29.6				
Mytillus (Veliconce)							14	14	
Nassarius reticulatus (Linnaeus,1758)		55							
Parvicardium simile (Milaschewisch, 1909)							7	14	
Pitar rudis (Poli,1795)			55						
Retusa truncatula (Bruguiere, 1792)	37		37						
Spisula subtruncata (da Costa,1778)	55		74						7
MOLLUSCA									
Trophonopsis breviata (Jeffreys, 1882)	15	15	74						

Table 38. Station M10 Biomass (g/m^2) values by 3 institutes (A: SNU-FF, B-GeoEcoMar, C:NIMRD).

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
CNIDARIA									
Amphinema dinema (Péron & Lesueur, 1810)					0.006	0.006			
Obelia longissima (Pallas, 1766)					0.041				
Actinothoe clavata (Ilmoni, 1830)					0.059				
ECHINODERMATA									
Amphiura stepanovi Chernyavskii, 1861					0.222		0.182		
NEMERTEA									
Nemertea (sp.)		0.0004		0.015	0.015				
OLIGOCHAETA									
Oligochaeta (sp.)	0.0014	0.0048	0.0015	0.102	0.043	0.075			
POLYCHAETA									
Aricidea claudiae Laubier, 1967		0.0001	0.0002	0.008		0.014			
Aricidea sp.							0.0042		0.0042
Capitella capitata (Fabricius, 1780)								0.0014	0.01
Heteromastus filiformis (Claparède, 1864)				0.025	0.013	0.038			0.0042
Nephtys hombergii Savigny in Lamarck, 1818				1.332	0.296	1.036		0.59	0.055
Nephtys hystricis McIntosh, 1900	0.1871	0.1574	0.1850						
Nephtys (cf.) *paradoxa* Malm, 1874					0.074				
Nephtys sp.							0.094		
Oriopsis armandi (Claparède, 1864)				0.003			0.01		
Phyllodoce mucosa Örsted, 1843					0.026				
Polycirrus jubatus Bobretzky, 1869				0.035					
Prionospio cirrifera (Wirén, 1883)							0.0042		
Sphaerosyllis bulbosa Southern, 1914				0.001					
Spionidae varia							0.0042		
Terebellides stroemii Sars, 1835				0.333			0.0084		

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
PHORONIDA									
Phoronis euxinicola Selys-Longchamps, 1907				0.006	0.006	0.012			
Phoronida (sp.)		0.0002	0.0002						
CRUSTACEA									
Eudorella truncatula (Bate, 1856)								0.01	
Iphinoe elisae Băcescu, 1950	0.016	0.040	0.009	0.018		0.004	0.006	0.056	
Perioculodes longimanus (Bate & Westwood, 1868)			0.001	0.001					
Phtisica marina Slabber, 1769					0.013				
Upogebia pusilla (Petagna, 1792)					10.878				
MOLLUSCA									
Abra alba (W. Wood, 1802)			1.528	0.001	0.805				
Abra ovata (Philippi, 1836)									0.84
Abra prismatica (Montagu, 1808)						1.214			
Abra sp.							2.57	1.71	
Acanthocardia paucicostata (G. B. Sowerby II, 1834)				0.033				0.47	
Bittium reticulatum (da Costa,1778)	1.346		2.962						
Cerastoderma glaucum (Bruguière, 1789)	33.333	79.365	177.777						
Modiolula phaseolina (Philippi, 1844)									0.025
Mytilus galloprovincialis (Lamark,1819)					12.950				
Mytillus (Veliconce)							0.0099	0.0099	
Nassarius reticulatus (Linnaeus,1758)		0.463							
Parvicardium simile (Milaschewisch, 1909)							5.22	2.14	
Pitar rudis (Poli,1795)			6.568						
Retusa truncatula (Bruguiere, 1792)	0.136		0.136						
Spisula subtruncata (da Costa,1778)	0.646		6.46						0.913
Trophonopsis breviata (Jeffreys, 1882)	1.275	1.275	6.378						

Table 39. Station M18 Abundance (ind/m^2) values by 3 institutes (A: SNU-FF, B-GeoEcoMar, C:NIMRD).

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
NEMERTEA									
Amphiporus bioculatus (McIntosh, 1874)								7	
Carinina heterosoma Müller, 1965					14.8				
Nemertea (sp.)	5	3	1	14.8		14.8			
PLATHELMINTHES									
Plathelminthes (sp.)		7							
POLYCHAETA									
Aonides (cf.) *paucibranchiata* Southern, 1914			1						
Aricia sp.				7.4					
Aricidea catherinae Laubier, 1967	141	142	84						
Aricidea claudiae Laubier, 1967				1894.4	1028.6	577.2			
Capitella capitata (Fabricius, 1780)				44.4	222	170.2	43	64	121
Caulleriella bioculata (Keferstein, 1862)		2		7.4	44.4	44.4			
Chaetozone caputesocis (Saint-Joseph, 1894)				7.4					
Eunice vittata (Delle Chiaje, 1829)			1						
Exogone (Exogone) *naidina* Örsted, 1845				7.4	22.2				
Glycera sp.	1	1							
Heteromastus filiformis (Claparède, 1864)	11	16	11	66.6	355.2	244.2			
Lagis koreni Malmgren, 1866			1						
Lagis sp.					7.4				
Leiochone leiopygos (Grube, 1860)				14.8	74	51.8			
Magelona mirabilis (Johnston, 1865)				7.4	7.4				
Melinna palmata Grube, 1870		2	3	22.2	81.4	14.8			
Microphthalmus similis Bobretzky, 1870					7.4	14.8			
Nephtys hombergii Savigny in Lamarck, 1818				7.4	7.4	14.8			21

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Nephtys (cf) *paradoxa* Malm, 1874	38	16	16	155.4	37	88.8			
Nephtys sp.							107	21	
POLYCHAETA									
Phylo sp.			1						
Phyllodoce mucosa Örsted, 1843					7.4				
Polydora cornuta Bosc, 1802					7.4				
Prionospio cirrifera Wirén, 1883				81.4	192.4	44.4			
Pygospio elegans (Claparede, 1863)								29	43
Spio decoratus Bobretzky, 1870	27	11	9	392.2	680.8	81.4			
Spionidae varia							186	263	478
PHORONIDA									
Phoronis euxinicola Selys-Longchamps, 1907						7.4			
CRUSTACEA									
Ampelisca diadema (A. Costa, 1853)							77	100	107
Ampelisca sarsi Chevreux, 1888	215	148	16	273.8	103.6	74			
Apseudopsis ostroumovi Bacescu & Carausu, 1947		15	30	14.8	214.6	44.4	43		71
Corophium sp.		7			7.4	7.4			
Diogenes pugilator (Roux, 1829)			7			22.2		21	7
Iphinoe elisae Băcescu, 1950					14.8	7.4			
Iphinoe maeotica Sowinskyi, 1893		7							
Iphinoe tenella Sars, 1878	7			7.4	22.2	14.8			
Leptinogaster histrio (Pelseneer, 1929)				7.4					
Megaluropus massiliensis Ledoyer, 1976					7.4				
Microdeutopus versiculatus (Bate, 1856)		15							
Perioculodes longimanus (Bate & Westwood, 1868)	7	7	7	29.6	22.2				
Pseudocuma longicorne (Bate, 1858)	22	118	37	170.2	214.6	133.2	35	21	

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Upogebia pusilla (Petagna, 1792)	7		7		22.2	14.8		7	7
MOLLUSCA									
Abra alba (W. Wood, 1802)					51.8	37			
Acanthocardia paucicostata (G. B. Sowerby II, 1834)					7.4				
MOLLUSCA									
Amphibalanus improvisus (Darwin, 1854)		7					7		
Anadara transversa (Say, 1822)						7.4			
Angulus tenuis (da Costa, 1778)							79	36	67
Bela nebula (Montagu,1803)		55							
Bittium reticulatum (da Costa,1778)	3848	7134	9265						
Calyptraea chinensis (Linnaeus, 1758)	348	459	348		7.4				
Caecum trachea (Montagu,1803)	5195	3071	5417						
Cerastoderma glaucum (Bruguière, 1789)			52			29.6			
Chamelea gallina (Linnaeus, 1758)	266	111	548	14.8	59.2	44.4	286	64	114
Chrysallida interstincta (J.Adams,1797)		126	55						
Cyclope neritea (Linnaeus, 1758)	22	96	81		14.8				
Ecrobia ventrosa (Montagu,1803)	96	81	185						
Epitonium commune (Lamarck, 1822)	55		15						
Gibulla sp.							14		29
Gouldia minima (Montagu, 1803)		22				14.8			
Lucinella divaricata (Linnaeus, 1758)	37	215	1813			66.6	350	50	93
Mangelia coarctata (Forbes,1840)			55						
Mytilaster lineatus (Gmelin, 1791)				37	37	148			
Mytilus galloprovincialis Lamarck, 1819				51.8	29.6	66.6		14	

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Mytillus (Veliconce)							29	136	21
Nassarius reticulatus (Linnaeus,1758)		15	67						
Parvicardium exiguum (Gmelin, 1791)							79		29
Papillicardium papillosum (Poli, 1791)						14.8			
Pitar rudis (Poli, 1795)		59	52		59.2	37			
Pusillina lineolata (Michaud,1830)		148	1643						
Retusa truncatula (Bruguiere, 1792)	81	15	170						
Rissoa splendida (Eichwald,1830)		55	37						
MOLLUSCA									
Spisula sp.							35		50
Spisula solida (Linnaeus, 1758)								36	
Spisula subtruncata (da Costa, 1778)	96	148	414	14.8	81.4	88.8			
Tellina tenuis da Costa, 1778		55	37	7.4	51.8	29.6			
Thracia phaseolina (Lamarck, 1818)					7.4				
Tricolia pullus (Linnaeus, 1758)	681	762	484		7.4				
*Turbonilla pusill*a (Philippi,1844)	22		59						

Table 40. Station M18 Biomass (g/m^2) values by 3 institutes (A: SNU-FF, B-GeoEcoMar, C:NIMRD).

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
NEMERTEA									
Amphiporus bioculatus (McIntosh, 1874)								0.024	
Carinina heterosoma Müller, 1965					0.030				
Nemertea (sp.)	0.0348	0.0035	0.0120	0.030		0.030			
PLATHELMINTHES									
Plathelminthes (sp.)		0.007							
POLYCHAETA									
Aonides (cf.) *paucibranchiata* Southern, 1914			0.0002						
Aricia sp.				0.003					
Aricidea catherinae Laubier, 1967	0.0718	0.0678	0.0213						
Aricidea claudiae Laubier, 1967				1.184	0.592	0.214			
Capitella capitata (Fabricius, 1780)				0.007	0.033	0.026	0.0086	0.013	0.024
Caulleriella bioculata (Keferstein, 1862)		0.0001		0.007	0.044	0.044			
Chaetozone caputesocis (Saint-Joseph, 1894)				0.030					
Eunice vittata (Delle Chiaje, 1829)			0.0011						
Exogone (Exogone) *naidina* Örsted, 1845				0.001	0.002				
Glycera sp.	0.0970	0.0091							
Heteromastus filiformis (Claparède, 1864)	0.0021	0.0129	0.0054	0.057	0.148	0.210			
Lagis koreni Malmgren, 1866			0.0009						
Lagis sp.					0.037				
Leiochone leiopygos (Grube, 1860)				0.074	0.814	0.118			
Magelona mirabilis (Johnston, 1865)				0.059	0.059				

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Melinna palmata Grube, 1870		0.0032	0.0041	0.067	0.244	0.044			
Microphthalmus similis Bobretzky, 1870					0.001	0.001			
Nephtys hombergii Savigny in Lamarck, 1818				2.442	0.444	0.740			0.012
Nephtys (cf) *paradoxa* Malm, 1874	0.0439	0.0223	0.0139	0.222	0.333	0.074			
Nephtys sp.							0.0642	0.012	
POLYCHAETA									
Phylo sp.			0.0046						
Phyllodoce mucosa Örsted, 1843					0.026				
Polydora cornuta Bosc, 1802					0.007				
Prionospio cirrifera Wirén, 1883				0.057	0.135	0.031			
Pygospio elegans (Claparede, 1863)								0.017	0.0258
Spio decoratus Bobretzky, 1870	0.0134	0.0030	0.0032	0.074	0.370	0.122			
Spionidae varia							0.1116	0.14	0.019
PHORONIDA									
Phoronis euxinicola Selys-Longchamps, 1907						0.006			
CRUSTACEA									
Ampelisca diadema (A. Costa, 1853)							1.001	1.3	1.39
Ampelisca sarsi Chevreux, 1888	1.220	0.890	0.095	1.643	0.622	0.444			
Apseudopsis ostroumovi Bacescu & Carausu, 1947		0.035	0.073	0.030	0.429	0.089	0.012		0.142
Corophium sp.		0.005			0.003	0.003			
Diogenes pugilator (Roux, 1829)			0.242			0.222		7.35	2.54
Iphinoe elisae Băcescu, 1950					0.007	0.004			
Iphinoe maeotica Sowinskyi, 1893		0.004							
Iphinoe tenella Sars, 1878	0.004			0.004	0.011	0.007			
Leptinogaster histrio (Pelseneer, 1929)				0.000					

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Megaluropus massiliensis Ledoyer, 1976					0.001				
Microdeutopus versiculatus (Bate, 1856)		0.083							
Perioculodes longimanus (Bate & Westwood, 1868)	0.001	0.001	0.001	0.006	0.004				
Pseudocuma longicorne (Bate, 1858)	0.005	0.027	0.008	0.039	0.049	0.031	0.0035	0.0021	
Upogebia pusilla (Petagna, 1792)	9.653		9.19		2.368	5.476		14.7	14.7
MOLLUSCA									
Abra alba (W. Wood, 1802)					1.184	0.083			
Acanthocardia paucicostata (G. B. Sowerby II, 1834)					0.007				
MOLLUSCA									
Amphibalanus improvisus (Darwin, 1854)		0.021					0.0001		
Anadara transversa (Say, 1822)						0.059			
Angulus tenuis (da Costa, 1778)							23.56	8.56	19.27
Bela nebula (Montagu,1803)		0.026							
Bittium reticulatum (da Costa,1778)	140.067	259.663	337.239						
Calyptraea chinensis (Linnaeus, 1758)	17.251	22.756	17.251		0.001				
Caecum trachea (Montagu,1803)	3.636	2.15	3.792						
Cerastoderma glaucum (Bruguière, 1789)			11.111			0.030			
Chamelea gallina (Linnaeus, 1758)	247.086	102.952	507.9	0.433	18.870	2.908	79.59	10.41	40.72
Chrysallida interstincta (J.Adams,1797)		0.277	0.016						
Cyclope neritea (Linnaeus, 1758)	3.523	15.267	12.918		1.258				
Ecrobia ventrosa (Montagu,1803)	1.828	1.547	3.515						

	A			B			C		
TAXA/ID Stations	**A-R1**	**A-R2**	**A-R3**	**B-R1**	**B-R2**	**B-R3**	**C-R1**	**C-R2**	**C-R3**
Epitonium commune (Lamarck, 1822)	0.123		0.247						
Gibulla sp.							0.035		8.85
Gouldia minima (Montagu, 1803)		0.098				0.135			
Lucinella divaricata (Linnaeus, 1758)	1.036	6.009	50.764			0.394	52.6	6.44	10.71
Mangelia coarctata (Forbes,1840)			0.069						
Mytilaster lineatus (Gmelin, 1791)				0.037	0.037	0.041			
Mytilus galloprovincialis Lamarck, 1819				0.052	0.030	0.067		0.025	
Mytillus (Veliconce)							0.0029	0.097	0.0021
Nassarius reticulatus (Linnaeus,1758)		0.928	4.176						
Parvicardium exiguum (Gmelin, 1791)							4.46		3.41
Papillicardium papillosum (Poli, 1791)						0.077			
Pitar rudis (Poli, 1795)		52.546	45.978		0.164	0.202			
Pusillina lineolata (Michaud,1830)		0.044	0.492						
Retusa truncatula (Bruguiere, 1792)	0.301	0.0548	0.63						
Rissoa splendida (Eichwald,1830)		0.112	0.559						
MOLLUSCA									
Spisula sp.							4.65		6.52
Spisula solida (Linnaeus, 1758)								3.72	
Spisula subtruncata (da Costa, 1778)	8.398	12.92	16.796	0.474	1.820	0.740			
Tellina tenuis da Costa, 1778		1.89	9.453	0.326	5.275	1.612			
Thracia phaseolina (Lamarck, 1818)					0.636				
Tricolia pullus (Linnaeus, 1758)	10.688	11.966	7.668		0.044				
*Turbonilla pusill*a (Philippi,1844)	0.029		0.077						

Annex 3.

Sampling Methodology for Macrozoo-Meio Benthos

A-Sinop University Fisheries Faculty (SNU-FF):

Macrobenthic samples were taken with a Van Veen grab sampling ca. 0.14 m^2 area, at two intercalibration stations (M10 - BG sector and M18 - TR sector) in the Black Sea. Three replicates were taken at each station. On board, soft bottom samples were sieved through a sieve with 0.5 mm mesh size and fixed in a 5% formalin solution. In the laboratory, samples were washed in fresh water, sorted under a stereomicroscope and preserved in 70% ethanol. Specimens of each group were identified and counted and wet weighed (total individuals belonging to each species).

Meiobenthic samples were collected as two replicates at the same stations with a metal sediment corer of 4 cm diameter (sampling area is 12.56 cm^2) from the sample coming on ship deck after Van Veen retrieval. Fixation was done using 75% ethanol. Material was washed through sieves of 1 mm, 500 µm and 64 µm mesh sizes. Bengal rose solution was added to the samples prior to sorting. Specimens of each group were counted and approximate constants are used to calculate the biomass (total individuals belonging to each groups).

B-National Research and Development Institute for Marine Geology and Geoecology (GeoEcoMar):

Benthic samples were taken with a Van Veen grab of 0.14 m2 area at two intercalibration stations in the Black Sea (M10 - BG sector and M18 - TR sector). Three replicates were taken at each station. In the intercalibration station M10 -BG, the samples collected were cut from the top layer (about 20 cm) of the entire sample coming on ship deck after Van Veen retrieval. This is due to the nature of the substrate (mud) and the type of habitat present at 74.7 m depth. At 25.9 m depth of Turkish intercalibration station the samples were collected entirely due to sandy substrate. The samples were sieved through 0.5 mm mesh size and fixed in 5% formalin solution on board. In laboratory, the samples were washed in fresh water, sorted under a stereomicroscope and preserved in 70% ethanol. Specimens of each group were identified, counted and wet weighed (total individuals belonging to each species).

C-National Institute for Marine Research and Development (NIMRD):

Benthic samples were taken with a Van Veen grab of 0.14 m2 area at two intercalibration stations in the Black Sea (M10 - BG sector and M18 - TR sector). Three replicates were taken at each station. In the intercalibration station M10 -BG, the samples collected were cut from the top layer (about 20 cm) of the entire sample coming on ship deck after Van Veen retrieval. This is due to the nature of the substrate (mud) and the type of habitat present at 74.7 m depth. At 25.9 m depth of Turkish intercalibration station the samples were collected entirely due to sandy substrate. The samples were sieved through 0.5 mm mesh size and fixed in 5% formalin solution on board. In laboratory, the samples were washed in fresh water, sorted under a stereomicroscope and preserved in 70% ethanol. Specimens of each group were identified, counted and wet weighed (total individuals belonging to each species).

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Black Sea
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