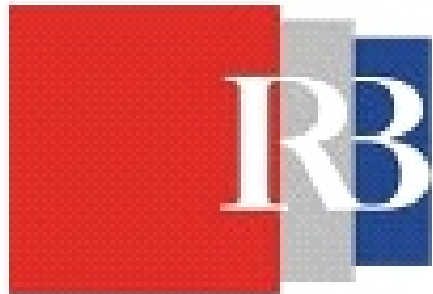


LONG-TERM CHANGES IN THE TRANSITIONAL COMMUNITY OF DETRITIC BOTTOMS OF THE NORTHERN ADRIATIC SEA: DYNAMICS OF THE BIVALVE ASSEMBLAGES

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Benthic fauna is an important component in marine ecosystems. Some benthic species are able to integrate water and sediment quality conditions over time, and thus indicate stress in the benthic zone. Due to their relatively sessile habit, benthic macrofauna served as indicators of changes in the marine environment caused by natural or anthropogenic disturbances. This study is focused on the long-term natural variability of the diversity, biotic and multimetric indices, through the use of long-term bivalve data in the transitional community of detritic bottoms (DL) in the northern Adriatic Sea (1989-1991 and 2003-2005). (Fig. 1). High abundance of some indicator species such as *Corbula gibba*, *Modiolarca subpicta* and *Timoclea ovata* were recorded during the post-anoxic period (1989-1991). The faunistic composition, Cluster and Abundance Comparison analyses were used to assess the recruitment in the quality of bivalve assemblages during a period of relatively stable ecological conditions: in 2003, 2004 and 2005 (1). The results of univariate and multivariate analyses clearly separated the two aforementioned periods (1989-1991 and 2003-2005) during which the investigations were conducted. Furthermore, the temporal variability in bivalve diversity, due to ecological status in the investigated area in the northern Adriatic Sea, is also discussed.

INVESTIGATED AREA

NORTHERN ADRIATIC SEA: depth (< 50m), semi-enclosed water body, water column stratification, high riverine input (the Po river), high primary production sensitive marine ecosystem (2, 3).

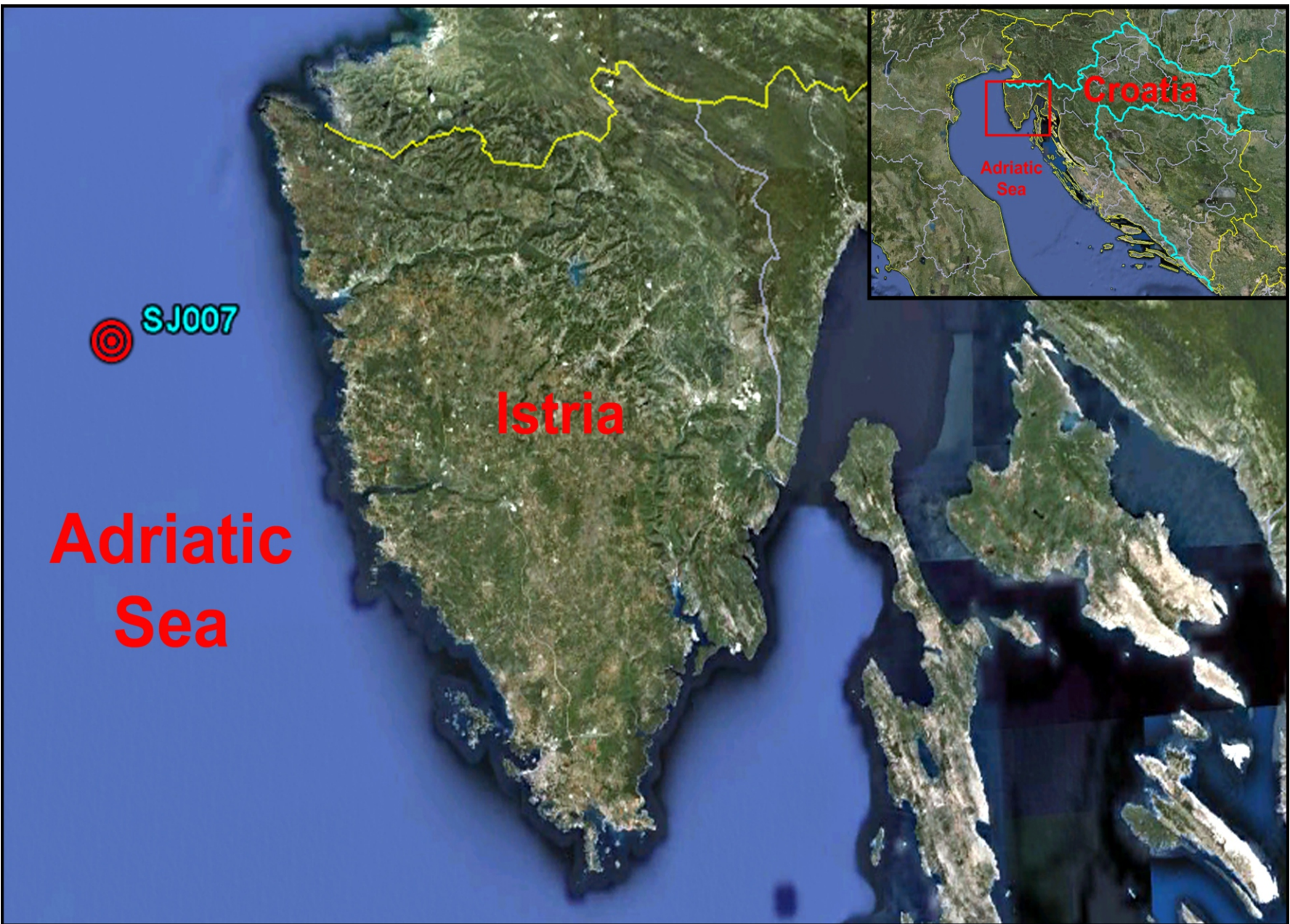


Fig. 1. Study area with sampling sites.

MATERIAL AND METHODS

sampling: December 1989-1991 and 2003-2005  
Van Veen grab (0,1m²) - 4 replicates  
sieving: 2 mm mesh size  
fixation: neutralized 4% formalin, 70% ethanol  
- counting and classification of macrofauna  
- taxonomic determination of bivalves  
STATICAL ANALYSIS: multivariate, univariate



RESULTS AND DISCUSSION

A total of 62 species, belonging to 44 genera and 30 families were identified. Bivalve assemblages were represented by 8159 specimens among which the most abundant were *Corbula gibba* (40,52%), *Modiolarca subpicta* (21,65%) during the post-anoxic period (1989-1991). After September 1990, increase was determined with respect to the number of species and diversity as well. Dominant bivalves species from 1989 to 2005 in the investigated area are presented in Fig. 2 and Fig. 3.

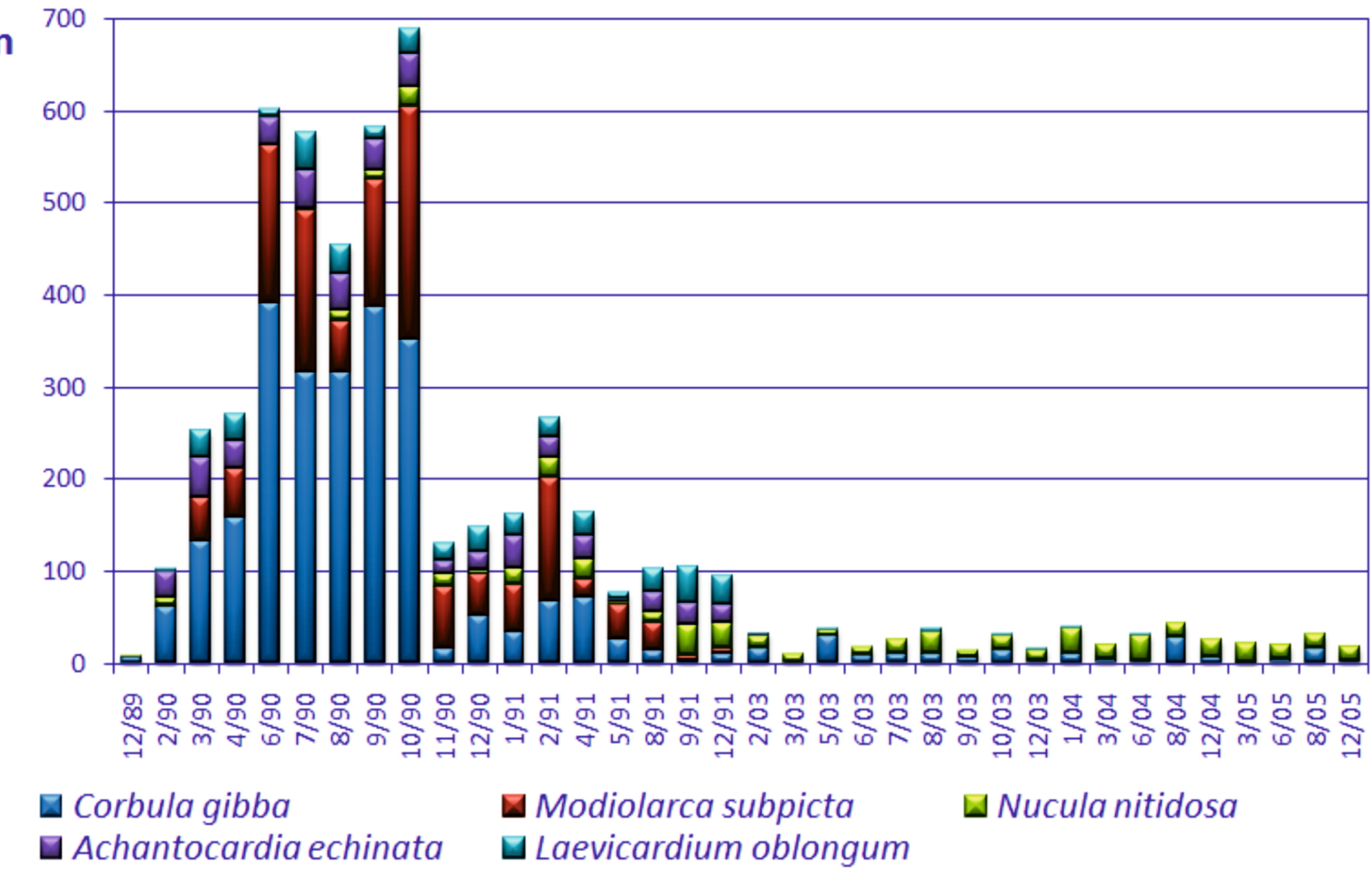


Fig. 2. Absolute abundance of dominant bivalves species from 1989 to 2005 in the investigated area

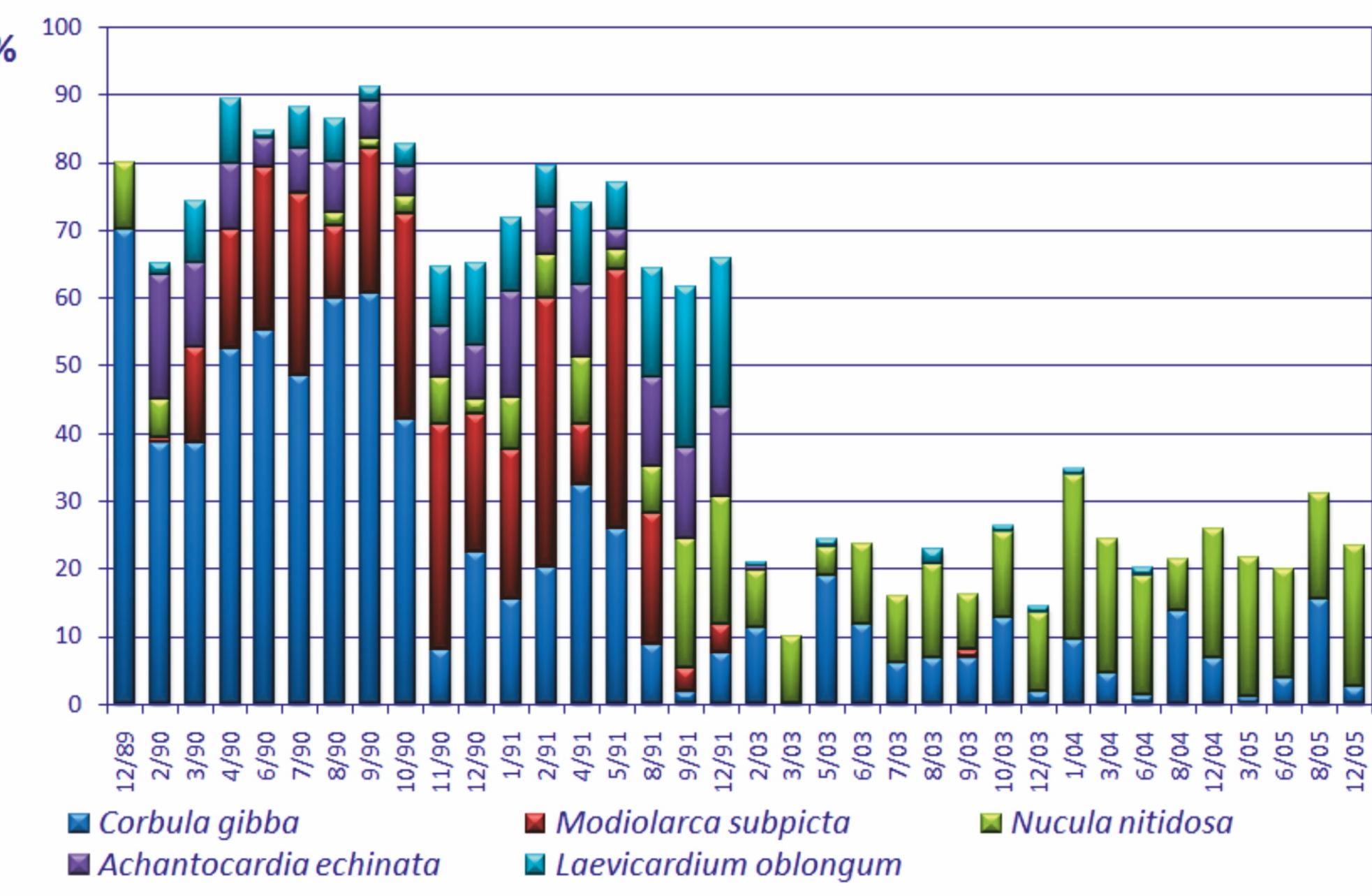


Fig. 3. Relative abundance of dominant bivalves species from 1989 to 2005 in the investigated area



The number of species during the post-anoxic period ranged from 3 to 20 and the number of specimens from 10 to 834. With consideration to the period from December 1989 to December 1991, Pielou's Index (species evenness) ranged from 0.49 to 0.84, and Shannon-Wiener's index 1.16-3.50. From February 2003 to December 2005, in the period of relatively stable ecological conditions the number of species increased and ranged from 16 to 29, while number of specimens decreased with a range from 76 to 210. Pielou's Index ranged from 0.76 to 0.93, and Shannon-Wiener's index from 3.02 to 4.04.

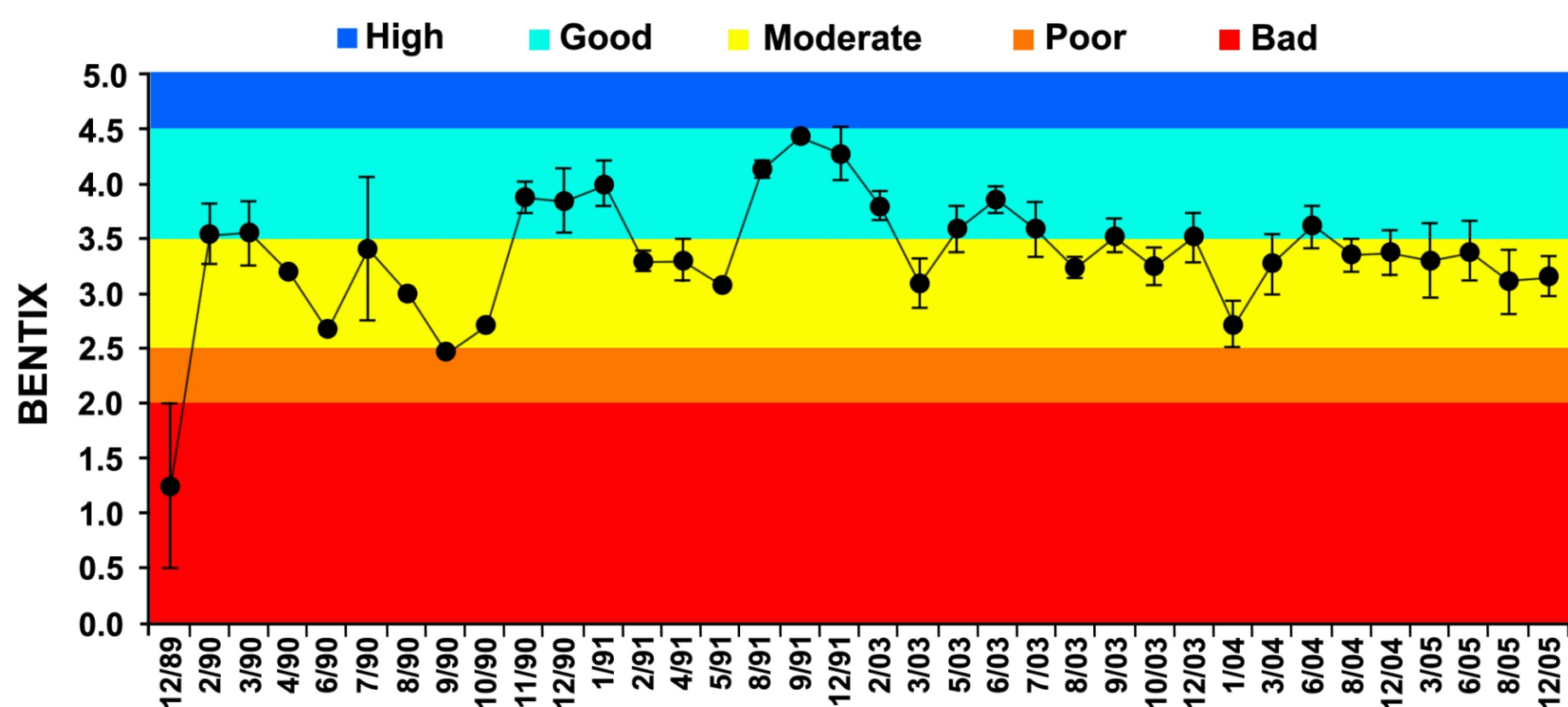


Fig. 4. Mean BENTIX values of the sampling site with standard deviation.

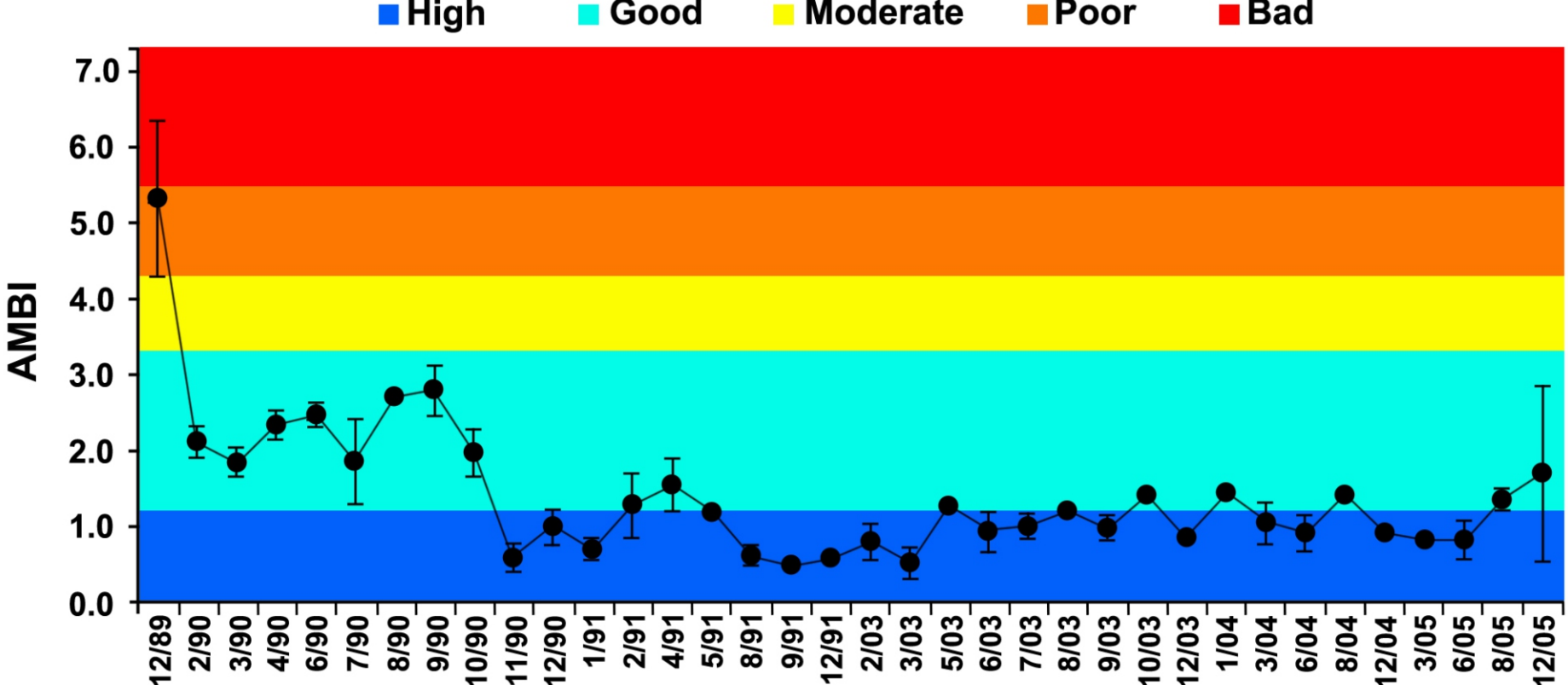


Fig. 5. Mean AMBI values of the sampling site with standard deviation.

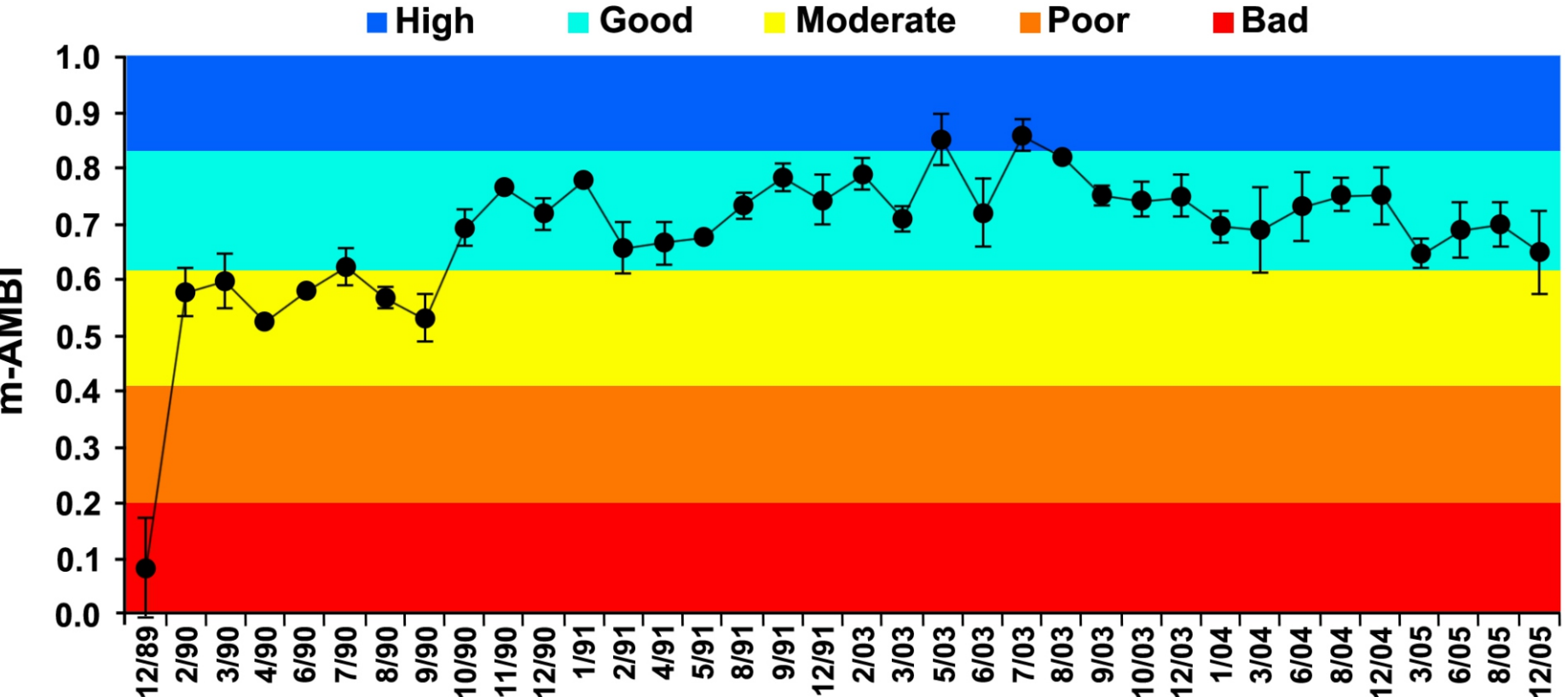


Fig. 6. Mean AMBI values of the sampling site with standard deviation.

The mean BENTIX values calculated during the study ranged between 1.25 and 4.44 (Fig. 4). The lowest BENTIX (1.25) value was determined in December 1989 which was the first sampling period of the study. The highest mean AMBI value (5.32) which was in the range of poor condition determined in December 1989 (Fig 5). Good ecological conditions prevailed in the sampling site between February and October 1990 according to the mean AMBI values calculated. From November 1990 till the end of the sampling periods, mean AMBI values were mostly in the range of high ecological conditions. The mean m-AMBI values determined in the sampling area ranged between 0.08 (December 1989) and 0.86 (July 2003) (Fig 6). The period between February and September 1990 mostly represented with m-AMBI values which were in the range of moderate ecological condition.

The nMDS plots of Bivalve species in the transitional community of detritic bottoms (DL) clearly separated two sampling period (Fig. 7). The ANOSIM test was performed in order to test hypothesis that structural changes in the community were primarily influenced by oxygen deficient bottom waters. . The results of ANOSIM (global R=0,933; T=999, p<0,001) confirmed that bivalve assemblages in the post-anoxic period (1989-1991) significantly differed from a period of relatively stable ecological conditions (2003-2005).

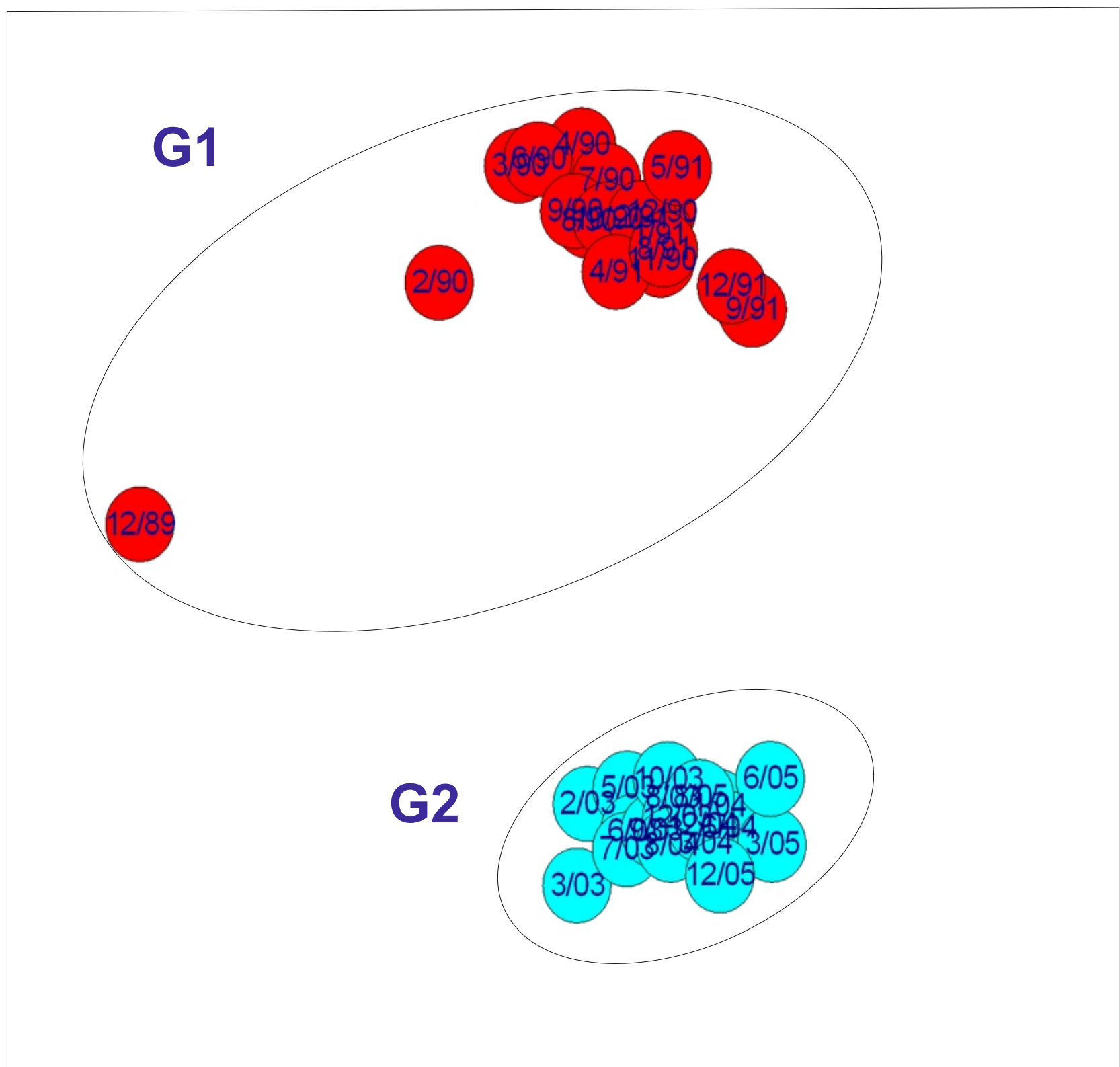


Fig. 7. nMDS diagram of the biological matrix: G1 = group 1 (12/89-12/91) and G2 = group 2 (2/03-12/05). Stress values = 0.08.

CONCLUSION

The results of the post-anoxic monitoring (1989-1991) in the northern Adriatic Sea indicate a degradation of macrofauna recovery of benthic communities (4). Bivalvia assemblages in the first sampling period (1989-1991) were represented with high abundance of indicator species. Recruitment in the sampling site was proved by the ecologic and biotic indexes became evident by October 1990. The indices values were in the range of good and moderate conditions in the all periods of the research except December 1989 and September 1990. Long-term changes in the transitional community of detritic bottoms (DL) by using bivalve assemblages as an indicator of ecosystem disturbance has to be considered within ecological quality assessment pattern.

ACKNOWLEDGEMENT

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