Notes on the Ecological Significance of the Fish Fauna Associated to Artificial Reefs in the Southern Tyrrhenian

D'ANNA G.* , BADALAMENTI F*. , PIPITONE C.* & RIGGIO S.**

* I.T.P.P - C.N.R., MAZARA DEL VALLO (Italy)
** Istituto di Zoologia dell'Universita di PALERMO (Italy)

An artificial reef is to some extent a "memory" of the environment, where the benthic community is an effective storer of information and converter of energy (BOMBACE,1989). Data from the fishing yields obtained in proximity of artificial substrata have been taken into account mainly from the economic or applicative point of view, whereas their utilization as a reliable descriptor of the reef system has been neglected. In this note data, obtained from the monitoring of the fishing yields of 3 artificial reefs, are analysed in order to verify the possibility to utilize informations from catch data to asses the degree of maturity and efficiency of a manmade reef.

Methods

Three artificial reefs **(AM, TR, TE)** were deployed in the Gulf of Castellammare on a sandy bottom at distance of ca. 6 Km from each other. Further details and descriptions are reported in RIGGIO, 1990. Fishing samples were performed monthly for a year using a trammel net (height 3 m, inner mesh size 54 mm) at 6 stations (depth 18-20 m) : 3 over the reefs and 3 **(CAM, CTR, CTE)** in a nearby control site. **CAM and CTR** were located on sandy bottom at a distance of about 1 Km far from the respective artificial reefs, whereas CTE was situed at a distance of ca. 0.5Km close to *P. oceanica* meadows on a mixed bottom of hard and soft substrata. Samplings, carried out during the night for a mean fishing time of 12h, were started in each reef after 4 years from their deployment. Data from the catches were standardized to a fishnet 500 m long and the average values of the numbers and weights of the individuals in each stations were calculated in order to compare data of a site to the others. The following indexes referring to each station for both total and benthic-nektobenthic taxa were calculated: species richness of Margalef (d'), Shannon-Weaver diversity index (H'), and Pielou's evenness index (J'). Factorial Correspondence Analysis (FCA) was performed on a quantitative 6x60 station/species correlation matrix (BENZECRI, 1982) not inclusive of rare species. Axes significance was evaluated using the tables of LEBART (1975). Taxa were included in four groups according to their higher or lower affinity for the substratum and/or biocoenosis (Fig. 1).

Results

Eighty-eight taxa were identified. The highest values of d' and H' were recorded in close proximity of the reefs, whereas the values in the control sites were lower (Tab. 1). On the contrary, the evenness (J') of the control sites was nearly equal to those calculated on the reefs.

The first three axes of the FCA are significant ($P < 0.001$), accounting for as much as 90% of the total variance. The model puts into evidence a parabolic distribution of the stations along a steep gradient from soft (left side of Fig. 1) to natural hard substrata (right side of Fig. 1).

Table 1 - Community structure indexes (d' richness, H' diversity, J' evenness) calculated separately for total and benthic-nektobenthic species at each site.

AREA	AM	CAM	TR	CTR	TE	CTE
No. catch operations	16	17	19	22	11	11
d' TOTAL SPECIES	7.30	4.44	5.88	5.51	5.44	4.36
H' " "	2.44	2.14	2.91	2.72	2.76	2.44
J' " "	0.60	0.60	0.77	0.75	0.72	0.68
BENT.+NEK-BENT. SPECIES						
d' " "	6.23	3.84	5.22	4.31	5.16	3.70
H' " "	2.95	2.72	2.82	2.59	2.59	2.25
J' " "	0.77	0.82	0.77	0.77	0.68	0.65

AM,TR,TE = artificial reefs; CAM,CTR,CTE = control sites

This pattern is typical of those environmental situations heavily conditioned by a polarizing factor represented in our case by the first axis. The second axis is related to the first one by a squared relationship and represents an intensity factor. No sensible differences can be shown between each artificial reef and its control site.

Discussion

Although the trammel net is highly selective, the fauna sampled with this gear is well representative of the species composition of the nektonic community (D'ANNA *et al.*, in press).

One might expect the artificial reefs to develop a peculiar community of nektonic species, related to the nature, the shape and orientation of the artificial substrata, and more or less independent on a recruitment from neigh-bouring areas.

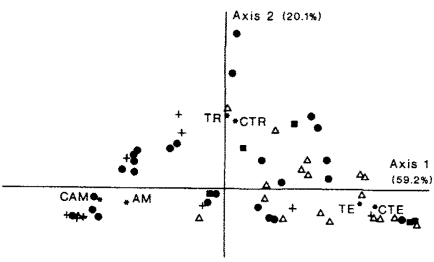

Fig. 1 - Ordination of stations and species derived from FCA

● Sandy bottom species △ Rocky bottom species
+ Pelagic species ■ Seagrass species

neighbouring areas.

On the contrary careful examination of the catch composition focuses on the reefs as individual units whose fish communities are strictly related to the natural populations living in the area. In fact, although the higher values of d' and H' in the reef areas highlight a greater variety and complexity of the environment from the point of view of biotic diversity, no valuable change in the structure of the natural population living in the area is evident.

Conclusions

Manmade reefs -as far as a critical volume is attained- should be viewed as breakups in the environmental *continuum*, that locally increase the biotic diversity by recruitment of few new taxa (D' ANNA *et al.*, in press ; BADALAMENTI *et al.*, in press), which do not alter the overall community structure. Their ultimate result is a magnification of the dominant features of the surrounding seabed, that is the major source of biological information. Detailed knowledge of preexisting communities in natural areas, often neglected in the reef plans, is the necessary prerequisite to a rational deployment of reefs. This view can give a new insight and practical directions in the promotion and future planning of artificial marine habitats.

REFERENCES

BADALAMENTI F. *et al.*, in press - *5th Int. Conf. Artif. Hab. Fish.*, November 2-8 1991.
BOMBACE G., 1989. - *Bull. Mar. Sci.*,44 (2) : 1023-1032.
BENZECRI J.P., 1982. - *Dunoud Paris*, third edition : 632 pp.
D'ANNA G. *et al.*, in press - *5th Int. Conf. Artif. Hab. Fish.*, November 2-8 1991.
LEBART L., 1975. - *Centre de Reach. et de Docum. sur le Consom.* Paris. L.L/cd. No. 4465 : 1-157.
RIGGIO S., 1990. - *FAO Fish. Rep.*, 428 : 128-137.

X