Preliminary results on recolonization in a small brackish basin on the island of Elba (western Mediterranean)

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ABSTRACT

The recolonization of polychaetes in a small brackish basin of Elba Island has been studied to determine how the abundant species respond to artificial disturbance. Results have shown that recolonization in this small brackish basin was characterized by two species *(Capitella* cf. *capitata* and *Brania oculata)*, that colonized the substrate in every months.

RÉSUMÉ

Résultats préliminaires sur la recolonisation d'un petit bassin saumâtre de l'île d'Elbe (Méditerranée occidentale)

La recolonisation d'un peuplement de Polychètes d'un petit bassin saumâtre de l'île d'Elbe a été étudiée pour mettre en évidence les réponses des espèces les plus abondantes à une défaunation artificielle. Les résultats ont mis en évidence que la recolonisation est caractérisée par *C.* cf. *capitata* et *B. oculata.* Ces espèces sont capables de coloniser le substrat défauné pendant tous les mois étudiés et d'être dominantes au cours des premières phases de la succession.

INTRODUCTION

The recolonization of polychaete assemblage (we defined as assemblage the ensemble of the most abundant species which characterized the community) in a small brackish basin of Elba Island was the purpose of this study. This assemblage has shown high persistence in time, due to the characteristics adaptive strategies of its species (LARDICCI, 1991). The successional sequences in zoobenthos have been studied extensively in recent years through the use of experimental boxes (GUÉRIN, 1970; MASSÉ & GUÉRIN, 1978; MCCALL 1978; ARNTZ & RUMOHR, 1982; ZAJAC & WHITLATCH, 1982a, b; LEVIN, 1984; WHITLATCH & ZAJAC, 1985; DIAZ-CASTANEDA, 1987; DIAZ-CASTANEDA & SAFRAN, 1988; DIAZ-CASTANEDA *et al.*, 1989; FRID, 1989; BERGE, 1990). However, concerning the successional dynamics and the response of polychaete assemblage along the Mediterranean coasts to artificial disturbances, few data exist (DIAZ-CASTANEDA & SAFRAN, 1988; LARDICCI 1992).

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MATERIAL AND METHODS

The studied area (called Salina) is located in Portoferraio Bay, Elba Island (Fig. 1). It is a shallow intertidal basin, surrounded by a series of barriers which permit water exchange only during high tide. A small drainage channel is a major input of fresh water into the basin. The dynamics and the general feature of recruitment in this basin have been previously described (LARDICCI, 1991, 1992).

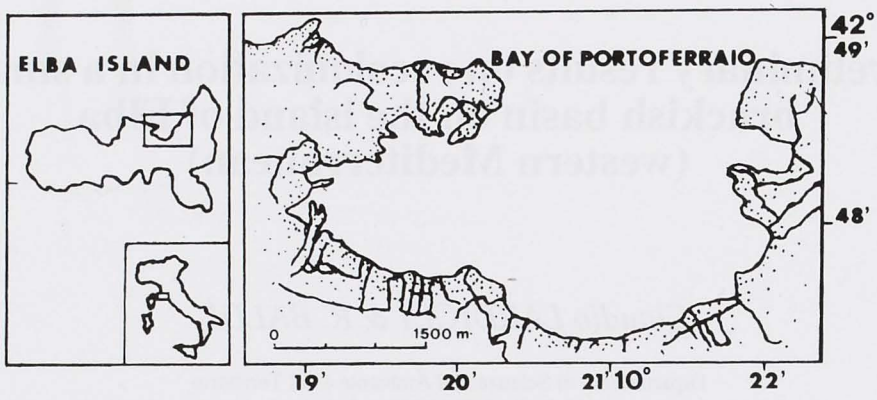

FIG.1. — Study area and sampling station.

Recolonization was studied by deploying experimental boxes (50 x 50 x 20 cm) containing defaunated air dried sediment in a silty-sand area which measures 5 x 5 m. All boxes were dug into sediment with the top of the box flush with the surface of the sediment.

Two series of experiments were performed: the first consisted of boxes that were sampled, removed and replaced monthly to determine monthly settlement from July 1990 to November 1991. These boxes were referred to as the monthly boxes. The second experiment consisted of seven boxes which were deployed at the start of the study on July 9, 1990 and sampled after 7, 14, 30, 60, 120, 240 and 477 days to follow recolonization. These boxes were referred to as the successional boxes.

Samples were collected using corers with a 6 cm inside diameter and pushed 20 cm into the sediment during low tide. Four cores per month were taken from the monthly boxes, four from the successional boxes for each sampling date and four from the natural sediment. We wish to emphasize that the observations concerning the experimental boxes and natural sediment are to be considered as comparisons of physical locations, rather than treatment *per se* (HURLBERT, 1984) and a great deal of caution must be employed in the interpretation of the results. Samples were washed through a 250 µm sieve. Sample residues were fixed in 4 % formalin. All samples were sorted under a dissecting microscope and all animals, where it was possible, identified to species. Polychaetes were the most important group collected (68.7 %) while molluscs and crustacean constituted respectively the 25 % and 6.3 % of the total species. Twenty-two species of polychaetes belonging to 10 families were collected during the course of this study (Table 1).

The temperature in the water ranged from 11.9 °C in January 1991 to a high value of 35.4 °C in July 1991. Salinity ranged from 30.6 P.S.U. in May 1991 to 38.3 P.S.U. in September 1991 in the study period.

RESULTS

Monthly sampled boxes: polychaetes were the only species of macrozoobenthos with many unidentified turbellarians and nematods collected in experimental boxes. These species were *Capitella* cf. *capitata*, *Brania oculata*, *Streblospio shrubsolii*, *Perinereis rullieri*, *Syllides edentata* and *Cirrophorus furcatus*. *Capitella* cf. *capitata* was the most abundant species collected from the boxes with a pattern that seemed to follow its fluctuations in the ambient. *B. oculata* and *S. shrubsolii* were present nearly every month but their distribution in the boxes was quite different from that of their ambient numerical levels. *S. shrubsolii* showed large fluctuations in the natural sediment, whereas, there were fewer specimens within the box. *B. oculata* was abundant in the ambient but showed a low level of abundance nearly all the months. *P. rullieri* appeared to colonize the

defaunated sediment only from March through July 1991, *S. edentata* was present in the last four months of 1990, and June and July 1991, *C. furcatus* was only collected in September 1990.

Successional trends: polychaetes were the only species of macrozoobenthos with many unidentified turbellarians and nematods collected up to 120 days in these boxes. The amphipod *Melita palmata* and the tanaidacean *Leptochelia savigny* were also present after 120 days with few specimens while the bivalve *Abra ovata* began to appear at 477 days in this box. Only *C.* cf. *capitata* and *B. oculata* were collected at the first phase of succession. *C.* cf. *capitata* showed a relatively constant numerical increase from 30 to 240 days after which it declined. Fewer *B. oculata* occurred for the first 60 days then it continued to increase until 240 days after which the number of specimens remained at the same level to the end of the experiment. Three additional species appeared at 120 days; these were *S. shrubsolii* which reached its highest level at 477 days, *M. fuliginosus* decreased after its appearance and continued to decline in number to the end of the experiment and *S. edentata* fluctuated in its occurrence during the remainder of the experiment. *P. rullieri* was only present at 240 days, *D. ornata* appeared at 240 days and decreased and *C. furcatus* colonized the defaunated sediment at 477 days (Fig. 2).

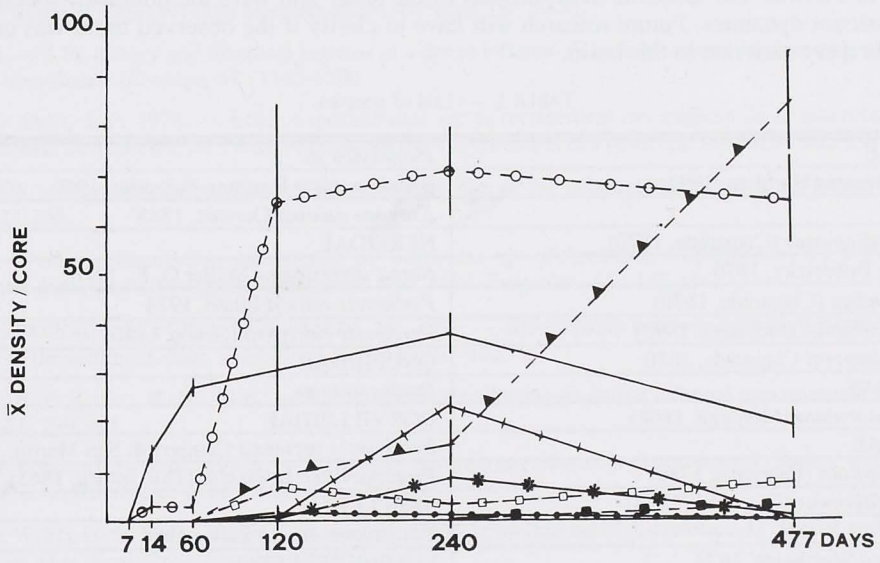

FIG. 2. — Successional trends of the collected species in the experimental boxes. The error bars are standard errors.

C. cf. capitata ——— *B. oculata* o—o—o—o;
S. shrubsolii ▲—▲—▲—▲ *S. edentata* □—□—□—□;
M. fuliginosus •—•—•—• *P. rullieri* +—+—+—+;
C. tentaculata ■—■—■—■ *D. ornata* ✱—✱—✱—✱;

DISCUSSION

Life-history features are important factors that allow settling and exploitation of the disturbed habitats (ZAJAC & WHITLATCH, 1982a , b; WHITLATCH & ZAJAC, 1985; DIAZ-CASTANEDA & SAFRAN, 1988). Most of the species collected in monthly boxes are considered opportunistic but only *B. oculata* and *C.* cf. *capitata* were able to colonize the defaunated habitat in all the study months. The settling periods of many species which were present within experimental boxes were observed between May and September (LARDICCI, 1992). Recolonization could also be due to both postlarvae and adult movements in addition to larval settlement. The presence of benthic adults in the water column was previously reported in this basin (LARDICCI, 1992) and it may be of importance in maintaining the persistence of the assemblage in shallow water (LEVIN, 1984; FRID, 1989). Variability in recolonization may be explained by fluctuations in abiotic parameter fluctuations. Many of the species were

surface or near surface deposit-feeders, and their food resource could be influenced by processes such as sedimentation, resuspension and transport of particulate organic matter (ZAJAC & WHITLATCH, 1982a). Fifteen days after the setting of experimental boxes, the substrate was covered by a thin layer of sediment which had been resuspended and deposited by the tidal current. This sediment constituted a very favourable habitat for *B. oculata* and *C.* cf. *capitata*; this last species was particularly attracted by organically enriched sediment (DIAZ-CASTANEDA *et al.*, 1989; TSUTSUMI, 1990; TSUTSUMI et al., 1990). The time of disturbance was another important factor which could affect the processes of settlement (ZAJAC & WHITLATCH, 1982b; DIAZ-CASTANEDA *et al.*, 1989). In the period beginning in July an early phase was noted up to 60 days in which only *C. cf. capitata* and *B. oculata*. This was followed after 120 days with the occurrence of other species such as *S. shrubsolii*, *S. edentata* and *M. fuliginosus* began to appear. *C.* cf. *capitata* is a well-known opportunistic species (GRASSLE & GRASSLE, 1974) and it appeared able to colonize successfully the defaunated sediment both in successional and monthly experiment in this basin. *B. oculata* is not a so-called opportunistic species but the presence of external gestation and adult mobility could be the mechanisms that allow this species to quickly colonize the substrate. Colonization by postlarval stages, and particularly by adults carrying a full complement of young, permits extremely rapid local increases in population size following very few colonization events (LEVIN, 1984). Hence the recolonization in this small brackish basin was characterized by two species (*B. oculata* and *C.* cf. *capitata*) which are able to colonize the substrate in all months of the study and were the dominant species in the initial phase of successional dynamics. Future research will have to clarify if the observed trend was only a matter of seasonal effect or a constant rule in this basin.

TABLE 1. — List of species.

PARAONIDAE	*Pionosyllis* sp.
Cirrophorus furcatus Hartman, 1957	*Brania oculata* Hartman-Schröder, 1960
SPIONIDAE	*Exogone naidina* Oersted, 1845
Malacoceros fuliginosus (Claparède, 1870)	NEREIDAE
Spio decoratus Bobretzky, 1870	*Nereis diversicolor* Müller O. F., 1776
Spiophanes bombyx (Claparède, 1870)	*Perinereis rullieri* Pilato, 1974
Streblospio shrubsolii (Buchanan, 1890)	*Perinereis cultrifera* (Grube, 1840)
Prionospio malmgreni Claparède, 1870	ONUPHIDAE
CIRRATULIDAE	*Hyalinoecia* sp.
Cirriformia tentaculata (Montagu, 1808)	DORVILLEIDAE
CAPITELLIDAE	*Pettiboneia urciensis* Campoy & San Martin, 1980
Capitella cf. *capitata* (Fabricius, 1780)	*Protodorvillea kefersteinii* (Mc Intosh, 1865)
Heteromastus filiformis (Claparède 1864)	SABELLIDAE
SYLLIDAE	*Desdemona ornata* Banse 1957
Syllides edentata Westheide, 1974	LUMBRINEREIDAE

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