FISH COMMUNITY ASSOCIATED WITH AN ARTIFICIAL REEF NORTH OF FORMENTERA ISLAND (WESTERN MEDITERRANEAN)

J. COLL, J. MORANTA, O. REÑONES and I. MORENO

Marine Biology Laboratory, Universitat de les Illes Balears 07071, Palma, Spain

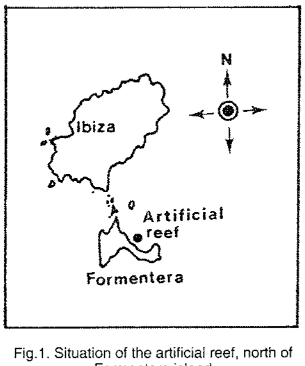
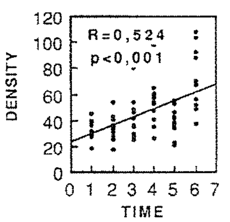


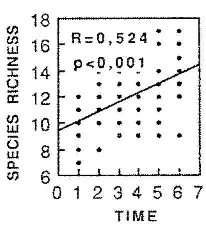
Fig.1. Situation of the artificial reef, north of Formentera island

An artificial reef moored in Playa de Tramontana, between Punta Prima and Recó des Caló, N of Formentera Island (Fig. 1.), situated in 38°41'75'N 01°30'00' E has been studied. The reef composed of 50 boulders of 8 m^3 is 30 m deep and occupies an aproximate area of 39.000 m^2. The fish community established in the reef after one year and its temporal evolution over the course of two years is given. The monitoring has been carried by visual census, using scuba dives, in February, May and September of 1992 and 1993. Nine to twelve previously marked boulders, located on *Posidonia oceanica* meadows, were sampled every time. The mean density for each species and the average values of the specific richness, diversity (Shannon-Weaver), total density and the density of categories 3, 4, 5 and 6 of HARMELIN (1987) have been calculated. In order to establish the temporal succession, the analyses of hierarchic classification and correspondence have been taken into account. The community descriptive indexes have been calculated by means of correlation analysis and ANOVA (SOKAL & ROLF, 1979). Thirty nine species have been counted (Table I), the most representative of which during the whole study have been: *C. chromis, C. julis, S. tinca, D. vulgaris, A. imberbis, S. mediterraneus, S. cabrilla, S. scriba, S. melanocercus, S. rostratus, L. viridis, L. merula, S. doderleini, S. scrofa, B. rouxi* and *M. helena*. The specific composition of the samples was very similar during the study period. However, the average number of species per boulder and the density of those belonging to categories 3, 4, 5, and 6 increased significantly from February 92 to the end of the study in September 93 (Figs. 2 and 3). Therefore, colonization by most of the caracteristics rocky bottom and *Posidonia* meadow species at 30 m had already taken place during the first year, but the frecuency around the boulders increasd with time.

	Febr. 92	May. 92	Sept. 92	Febr. 93	May. 93	Sept. 93
M. helena	0.33±0.24	0.17±0.11	0.15±0.10	0.15±0.10	0.17±0.17	0.09±0.09
E. caninus	-	-	-	0.08±0.08	0.08±0.08	0.09±0.09
E. alexandrinus	-	-	-	0.15±0.15	-	-
E. guaza	-	-	0.15±0.15	-	0.42±0.23	0.18±0.12
S. cabrilla	1.67±0.17	1.33±0.14	1.08±0.14	1.38±0.35	0.67±0.14	0.18±0.26
S. scriba	1.22±0.76	0.83±0.32	0 .46±0.18	1.31±0.55	2.33±0.48	1.45±0.59
A. imberbis	2.00±0.71	2.08±0.47	2.46±0.48	2.54±0.76	1.58±0.45	5.27±1.01
S. dumerili	12.9±8.28	-	-	-	54.2±42.4	10.5±7.40
S. umbra	0.11±0.11	0.25±0.13	0.54±0.31	0.15±0.10	0.33±0.14	1.27±0.79
M. surmuletus	-	-	0.31±0.17	0.31±0.17	-	0.45±0.37
D. annularis	0.11±0.11	0.67±0.22	0.69±0.24	0.31±0.13	0.71±0.11	1.55±0.78
D. puntazzo	-	-	0.31±0.13	0.31±0.24	0.25±0.13	0.45±0.37
D. sargus	-	-	0.31±0.31	0.38±0.24	0.75±0.43	3.00±1.47
D. vulgaris	1.78±0.72	2.17±0.58	3.46±1.54	8.31±3.39	2.50±1.64	2.45±1.60
S. cantharus	-	0.08±0.08	-	-	-	0.36±0.36
S. maena	-	-	-	11.6±11.5	6.33±6.24	1.82±1.82
S. smaris	-	-	-	3.15±2.08	-	3.64±3.64
C. chromis	73.4±12.0	64.8±13.4	88.3±15.2	110±11.44	106±28.37	59.0±10.5
C. julis	15.2±2.18	18.4±2.11	21.7±3.09	24.3±2.67	17.1±1.71	38.4±5.06
L. bimaculatus	-	0.08±0.08	-	-	-	-
L. merula	0.78±0.22	0.42±0.19	0.38±0.14	0.08±0.08	0.42±0.15	0.18±0.12
L. viridis	0.33±0.24	-	0.15±0.10	0.23±0.17	0.67±0.19	0.82±0.18
S. doderleini	0.11±0.11	0.50±0.19	0.77±0.17	0.38±0.14	0.33±0.14	0.55±0.28
S. mediterraneus	0.98±0.26	2.58±0.15	2.00±0.44	2.08±0.50	2.75±0.49	2.82±0.54
S. melanocercus	0.44±0.18	0.58±0.15	1.40.33	1.00±0.36	1.50±0.19	1.09±0.28
S. ocellatus	-	0.50±0.19	-	-	-	3.91±1.56
S. rostratus	0.33±0.17	0.58±0.19	0.31±0.13	1.15±0.67	1.08±0.36	0.27±0.19
S. tinca	6.44±2.16	2.92±0.61	1.31±0.35	7.69±1.73	3.25±0.48	2.09±0.59
T. pavo	-	-	-	-	-	0.09±0.09
G. auratus	-	-	0.31±0.21	-	0.08±0.08	-
G. cruentatus	-	0.08±0.08	-	0.08±0.08	-	-
G. geniporus	-	-	0.15±0.10	0.08±0.08	0.08±0.08	-
G. vittatus	-	-	0.31±0.31	-	0.17±0.17	-
Gobius sp.	0.89±0.89	-	-	-	-	0.09±0.09
B. rouxi	-	0.08±0.08	0.54±0.22	0.46±0.27	0.08±0.08	2.18±2.18
T. delaisi	-	0.25±0.18	0.38±0.21	-	0.83±0.27	1.55±0.51
Tripterigion sp.	-	-	0.46±0.24	0.23±0.17	0.67±0.26	-
S. porcus	-	-	-	0.08±0.08	-	-
S. notata	0.33±0.17	0.17±0.11	0.15±0.10	1.08±0.24	0.67±0.28	-

Table 1.Mean density and standar error per boulder for all species censused.





Figures 2 and 3. Corrrelation analysis between number of species (Fig. 2) and density of categories 3, 4, 5 and 6 (Fig. 3) and time (1 : February 92 to 6 : September 93).

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PHENOLOGY OF A RECENT *POSIDONIA OCEANICA* SETTLEMENT IN THE LIGURIAN SEA, WESTERN MEDITERRANEAN

L. DAVICO and G. MATRICARDI

Istituto di Anatomia Comparata dell' Università di Genova, 16132 Genova, Italia

The litterature on *Posidonia oceanica* phenology is rich and reports data from different geographical areas and depths of the Mediterranean Sea (BOUDOURESQUE *et al.*, 1984; BOUDOURESQUE *et al.*, 1987). Information mainly concerns large meadows and is often related to regression problems. Few data are available on the phenology of a beginning settlement of the seagrass (COOPER, 1979; MEINESZ and LEFEVRE, 1984). So, on 1992, we began to collect data on the dimensions and on the phenology (shoot density, number of leaves per shoot, leaf length and width) of some little tuft of *Posidonia oceanica* settled on hard substrate, at 4 m depth, near Cogoleto (8°39' E, 44°24' N) in the Ligurian Sea. No traces of living or death meadow have been found all around the site. Local fishermen and SCUBA-divers, besides, agree in dating four or five years back the first observation of these settlements of the seagrass. Owing to the reduced size of the tufts (the largest is about 100 cm long and 70 cm wide), a not destructive procedure has been followed to collect data *in situ*, by SCUBA-diving, without sampling. All the dimensions have been measured in mm, by a soft rule, while densities have been calculated from a 400 cm^2 surface and leaf counts have been made by direct observation. By such a procedure, underestimates of phenological parameters are probable : leaf base are not considered, youngest leaves cannot easily be detected, etc. So, the reported results must be considered as a preliminary information about the development of these *Posidonia* tufts.

Mean shoot density (calculated inside the tufts) is very high : 1327.0 shoots/m^2 (s.d. 175.8). Although it is hard to compare this figure with the available information about large meadows settled in comparable environmental conditions, we can observe that the Prelo meadow (Portofino promontory : 9°13.6' E, 44°20.2' N; 4 m depth. Personal observations) is characterized by a mean density of 670.0 shoots/m^2 (s.d. 227.3) and that PESSANI *et al.* (1987) report for the Punta Garavano meadow (7°29' E, 43°45' N; 6 m depth) a density of 950 shoots/m^2. In the Cogoleto tufts, the mean leaf number per shoot is 4.6 (s.d. 0.3) and is quite different from that reported by PESSANI *et al.* (1987) (8.5 leaves per shoot); on the other hand, this figure is similar to that of the growing margin (plagiotropic axes dominant) of a large meadow 2.5 km far from the tufts : 4.4 leaves per shoot (s.d. 1.0). Leaves dimensions differ from those of other prairies: the mean leaf length of the tufts is 141.8 mm (base excluded) while the mean length measured in the margin of the Cogoleto large meadow is 202.9 mm (base excluded). Seasonal figures show a clear trend (fig.1): the highest mean length has been measured in June (215.0 mm), the lowest in November (95.0 mm). BUIA *et al.* (1992) report a similar trend for intermediate and adult leaves of a meadow at 5 m depth (Ischia island). The mean leaf width of the Cogoleto tufts is 7.8 mm (s.d. 0.9), while the Cogoleto meadow figure is 9.0 mm and the Punta Garavano figure (PESSANI *et al.*, 1987) is 8.9 mm. During cold season, the mean leaf width of the tufts is higher (8.1 mm in November; 7.8 mm in January), while in summer is lower (6.5 mm in july). Leaf area index (LAI) shows a seasonal trend related to the water temperature (fig.2): the lowest mean value has been observed in November (4.2 m^2/m^2), the highest in June (10.5 m^2/m^2); a summer decrease is evident. PESSANI *et al.* (1987) report a LAI of 15.8 m^2/m^2. Phenological features quite similar to those described in this work have been observed in a little tuft sampled on May 1994 in the Sori meadow (9°7' E, 44°23' N; 4 m depth), on hard substrate. In this site, the residuals of a largest meadow (deepest at present), scattered on hard substrate widely not covered by *Posidonia oceanica*, show phenological parameters quite different from the sampled tuft (data not published). The hypothesis that the Cogoleto and Sori tufts represent a recent settlement of *Posidonia oceanica* is supported, besides, by the growth observed at Cogoleto; single and randomly placed external rhizomes, marked at the base of the youngest scale, showed a 7.0 cm/year elongation during the experiment. More data are requested to confirm this hypothesis and to describe the phenology of *Posidonia oceanica* during substrate colonization.

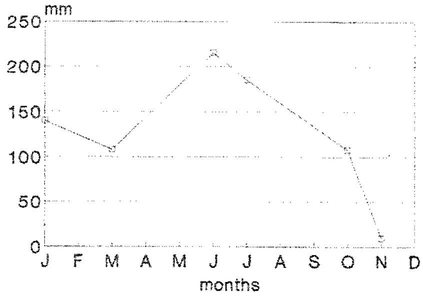

Fig. 1. Leaf length

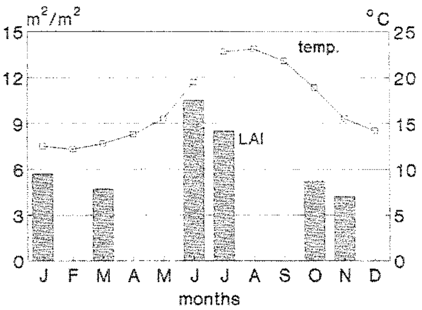

Fig. 2. L.A.I and water temperature

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