SOME LABORATORY EXPERIMENTS ON THE ACTIVITY OF THE MACROFAUNA IN THE FRAGMENTATION OF DETRITAL LEAVES OF *POSIDONIA OCEANICA* (L.) DELILE.

by

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Resumé. *Les accumulations naturelles des feuilles mortes dans l'herbier de* Posidonia oceanica *sont colonisées par une macrofaune à dominance de Crustacés, Amphipodes et Isopodes en particulier. Les expériences au laboratoire on montré que, dans une période de trois jours: 1) l'activité de ces animaux produit une diminution de 1.3 à 2.5 fois (moyennes arithmétiques) ou de 1.5 à 5.4 fois (moyennes geometriques) de la dimension moyenne des particules (maille minimale 0.055 mm); 2) la consommation d'oxygène par le detritus augmente de 2.7 fois à cause de la présence et de l'activité de la macrofaune. Comme dans l'environment terrestre, la faune parait jouer un rôle important en tant qu'accélerateur de la décomposition de la matière organique sous conditions aérobiques.*

The *Posidonia oceanica* ecosystem belongs to one of the most productive benthic marine systems. For the seagrass meadows around the island of Ischia (Gulf of Naples), OTT (in press) estimated an annual leaf production of 3110 g dry weight per m^2. We assume that almost all this production passes into the detritus food web. The annual leaf fall (September-October), the continous decay of the tips of the leaves, and the erosion of living material caused by water movement contribute to the formation of detritus. OTT (cit.) assumes that about half of the detrital annual leaf production is exported into the pelagic system where it is consumed and / or transported elsewhere. The remaining part of the detritus is consumed in the system. A large part of the detritus is deposited in the seagrass meadows. Detrital accumulations are found over the entire extension of the meadows from 1 to 35 m depth, frequently in sand patches, but also in the dense prairie. The leaves remain on the bottom several weeks after deposition in summer and as much as months in winter. Detritus undergoes fragmentation due to: 1) physical phenomena, e.g. water movement; 2) biological phenomena, e.g. activity of detritivorous macrofauna.

To investigate this latter point, 5 samples (4-34 g dw) were taken from leaf accumulations at depths from 2 to 4 m in a prairie around the island of Ischia. The macrofauna which was found associated with the leaves is dominated by Crustacea (mainly detritivorous amphipods and isopods) and, to a smaller amount, by polycladid Turbellaria. In terms of decalcified dry weight the Crustacea dominate by 68-97%. The most important species are the amphipods *Atylus guttatus* (Costa), *Melita palmata* (Montagu), *Pherusa fucicola* Leach, *Gammarus subtypicus* Stock, and the isopods *Zenobiana prismatica* (Risso) and *Idotea baltica basteri* Audouin. The macrofauna contributes to 0.22-0.70% dry weight of detritus.

Samples of aged natural detritus were brought into laboratory. The particle size distribution was determined by sieving with mesh sizes of 8, 4, 1.99, 1.04, 0.436, 0.209, 0.114, and 0.055 mm. Following this, the detritus (about 200 g dw) was cultured 3 days at 26°C in 2 liter chambers with aeration in the overlaying water level. Each of the 3 experiments was performed both with and without macrofauna. It is shown in Tab. 1 that the macrofauna contributes to a diminution of the average particle size by 1.3-2.5 fold when the arithmetic means are compared, or to 1.5-5.4 fold for geometric means. The fragmentation is mainly caused by the

Tab. 1. *The effect of the attached fauna on cumulative particle size distribution of leaf detritus after incubation of 3 days at 26°C. Experiments with (+) and without (-) macrofauna are distinguished.*

mesh size	cumulative percentage of particles					
in mm	-	+	-	+	-	+
8	78	22	82	36	76	52
4	83	31	88	61	81	63
1.99	87	46	89	64	82	69
1.04	89	52	91	74	88	73
0.436	93	67	94	80	91	78
0.209	95	81	96	92	95	87
0.114	96	88	96	95	96	93
0.055	100	100	100	100	100	100

feeding activity of the animals. In particular, the amphipods produce numerous bite marks on the leaves. The small fragments pass the digestive tract almost undigested and are found in the fecal pellets. Obviously, the animals digest the bacterial epigrowth of the detrital particles. This is a well known pattern of aquatic detritus utilization.

A similar ten days experiment was performed in order to evaluate the effect of the fauna on the oxygen uptake of detritus. The material was cultured at 26°C. Subsamples were taken from the experiment every two days and their respiration was measured in a closed system (320 ml) using polarographic electrodes. For the period of the 4th to the 10th day of the experiment, the macrofauna caused an increase of weight specific respiration of detritus from an average of 0.36 mg O_2 g $dw^{-1}h^{-1}$ (0.32-0.38) to 0.98 mg O_2 g $dw^{-1}h^{-1}$ (0.90-1.19). We assume that the increase of oxygen uptake is due to the increased surface-weight ratio of detrital particles which, according to FENCHEL (1977), allows increased bacterial colonization. In addition, the excretion of nutrients by animals stimulates the bacterial metabolism. By grazing on the microflora, the macrofauna increases the turnover rate and thus keeps the bacterial population in an active state (see FENCHEL, 1977).

In aquatic biomes, the conditions under which decomposition of vascular plant detritus takes place are highly variable due to seasonally and locally varying climatic, edaphic, and biotic factors. Therefore, laboratory results should be transferred into the field with some cautions. Nevertheless, this and previous studies indicate that the macrofauna is responsible for a manyfold acceleration of decomposition under aerobic conditions. This situation is similar to that of terrestrial biomes.

REFERENCES

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