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A PRELIMINARY REPORT ON ORGANISMS FOULING OYSTER CULTURES IN MALTA (CENTRAL MEDITERRANEAN)

PRIME OSSERVAZIONI SUGLI ORGANISMI INCROSTANTI IN COLTURE DI OSTRICHE DI MALTA

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(4 figures in the text)

ABSTRACT

A list of organisms associated with the oysters and with the fouling forms is given. The main organisms fouling oyster cultures in Malta are ascidians, bryozoans and polychaetes. Eight species of Bryozoa are recorded, two of which, *Celleporaria pilaefera* and *C. aperta*, are new to the Mediterranean. Minor fouling organisms include barnacles and the saddle oyster *Anomia ephippium*. Fouling occured mainly at Rinella, especially at a depth of 3m. It was of minor importance at Marsaxlokk and Mistra. There appeared to be no succession of species, and the fouling forms seem to reproduce continuously throughout the year.

RIASSUNTO

Viene data una lista di organismi incrostanti e associati con le ostriche. I gruppi principali di animali che si attaccano agli impianti di ostricultura a Malta sono le Ascidie, i Briozoi e i Policheti. Due delle otto specie di Briozoi registrate, *Celleporaria pilaefera* e *C. aperta*, sono nuove per il Mediterraneo. Di minore importanza sono i Balanidi e l'ostrichella *Anomia ephippium*. La densità di organismi aderenti è variabile secondo la località e la profondità. Non risulta che ci sia una successione di specie e gli organismi incrostanti si riproducono ininterrottamente durante tutto l'anno.

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Introduction

During the course of oyster growth trials in Maltese inshore waters (Agius 1976) preliminary data on fouling organisms and other associated fauna were collected over a period of twelve months from February 1975 to February 1976. Since no records exist of fouling organisms from the Maltese islands it was thought useful to present these data for two reasons: to form a basis for future work on fouling organisms in Maltese waters, and, because a fair percentage of the organisms recorded are new to the Maltese fauna, while two are new to the Mediterranean.

Methods

All the organisms recorded in this study were found either attached to the oyster shells or the structures containing them or else living unattached within or around these structures. Oyster spat of *Crassostrea gigas* Thunberg and *Ostrea edulis* (L.) were placed in plastic mesh bags (Extruded Fabrics Ltd., U.K.) and the bags themselves were held in French-manufactured plastic 'cages' called plenos. These cages were suspended off the bottom by means of a flotation chamber. Plenos were set up at depths of 3 and 10m in three different localities round the Maltese coast. The stations are shown on the map in Fig. 1. While Marsaxlokk and Mistra bays are essentially open water sites, Rinella Creek provides a typical harbour situation which is, in many respects, different from the former two.

Marsaxlokk bay lies in the S.E. of Malta. Though it is otherwise a relatively sheltered inlet, it is open to considerable wave action when strong S.E. winds occur. Its waters are relatively shallow, being less than 20m deep in most areas, reaching 30m only at the very entrance of the bay. The bottom, which consists predominantly of soft globigerina limestone rocks, is covered for the main part with dense beds of *Posidonia oceanica* (L.); these are however frequently broken up by patches of sand of variable texture.

Mistra bay, an inlet of St. Paul's Bay, is open to considerable wave action when N.E. winds occur. The bottom consists mainly of hard coralline limestone rocks

and is covered in most areas by dense *Posidonia* beds.

Rinella Creek is the extreme north-easterly branch of the Grand Harbour. It is well sheltered and in many respects different from the other two sites. It is certainly richer in flora and fauna and supports dense populations of suspension feeders. The bottom is muddy and supports large numbers of mud-inhabiting organisms.

While the precise extent to which these stations are polluted cannot as yet be ascertained, it appears that while Marsaxlokk and Mistra bays are essentially unpolluted, Rinella Creck is more liable to be contaminated both because of the multiple uses to which the harbour as a whole is put, and from sewage effluents.

The performance of the oysters was monitored by regular sampling at intervals of two months. At each sampling, the fouling organisms were studied and then the plenos were cleaned. It was thus possible to carry out a subjective estimate of the relative abundance of the different fouling organisms. Moreover, this also enabled us to deduce whether the different species exhibited any seasonal variations in population density and to gain some insight

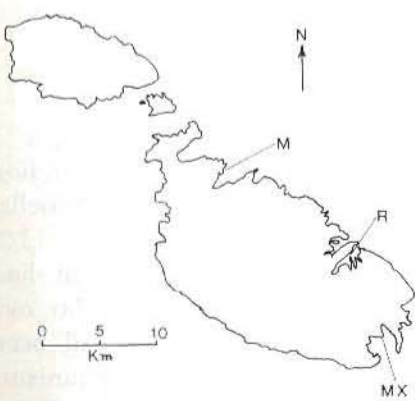

Fig. 1.

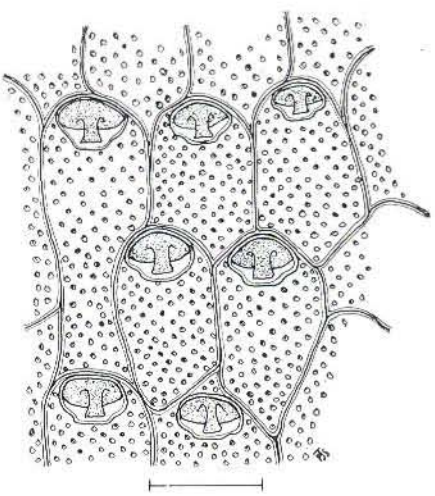

Fig. 2.

Fig. 1 - Map of the Maltese Islands showing the three stations where oyster cultures were set up. M. - Mistra, MX - Marsaxlokk, R - Rinella.

Fig. 2 - *Watersipora subovoidea* (d'Orbigny). Colony from Rinella. Scale 5 mm.

into such important physiological processes as growth rate and breeding cycles.

Fouling organisms were collected, narcotized and fixed using standard methods (MAHONEY 1973). Species were identified by the authors using published keys and descriptions. Difficult species were sent to various specialists (see acknowledgements).

List of main fouling species

ANNELIDA

Polychaeta

Serpulidae

Hydroides sp. Rinella.
Pomatoceros triqueter (L.). Occasional. Mistra.
Salmacina incrustans Claparède. Mistra.
Serpula sp. - common on shells, bags and plenos. Mistra, Rinella.
Spirorbis sp. - very abundant on the oyster shells. Marsaxlokk, Mistra, Rinella.

Sabellidae

Branchiomma lucullana (delle Chiaje) - very common on bags and plenos. Rinella.
Spirographis spallanzani Viviani - Occasional on plenos. Marsaxlokk.

ARTHROPODA

Crustacea
Cirripedia

Balanidae

Balanus (?) *perforatus* Brug. - common on plenos. Marsaxlokk, Rinella.

MOLLUSCA

Lamellibranchia

Anomiidae

Anomia ephippium (L.) - Large individuals common on plenos, juveniles very common on oyster shells. Mistra, Marsaxlokk.

BRYOZOA

Cheilostomata

Bugulidae

Bugula neritina (L.) - common on bags and plenos. Rinella. Specimens collected on 13/X /75 were breeding and had orange embryos in the ovicells. Since plenos had been cleaned of fouling organisms during the last week of August, the animals must have settled, grown and reached sexual maturity in a space of about six weeks.

Bugula stolonifera Ryland - very common on bags and plenos. Rinella.

Watersiporidae

Watersipora subovoidea (d' Orbigny) - (Fig. 2) abundant on bags and plenos. Rinella.

P. L. Cook, (personal communication, 1975) comments:

« [*W. subovoidea* is] one of the commonest, world-wide, warm-water fouling 'species'. Records may belong to several species and subspecies, but work on them is only just beginning. This does belong to *W. subovoidea* as defined by Ryland. All the forms have dark brown cuticle, usually orange tentacles, coelomic tissues and embryos when alive. The colonies grow extremely rapidly and are almost completely resistant to copper-based anti-fouling paints. Larger forms such as serpulids and barnacles can settle on surfaces covered by *Watersipora* which

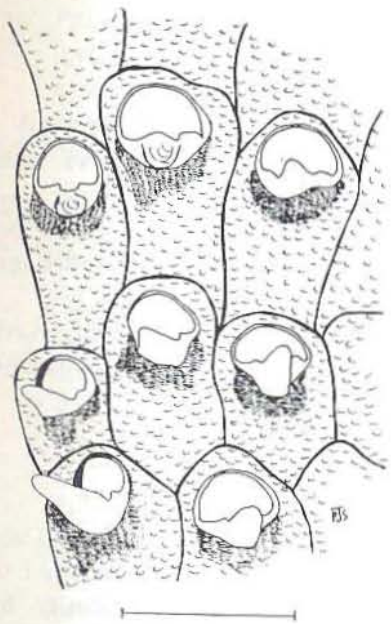

Fig. 3.

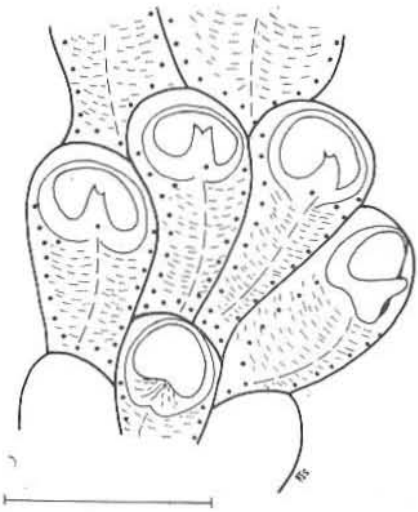

Fig. 4.

Fig. 3 - *Celleporaria aperta* (Hincks). Colony from Rinella. Scale 5 mm.

Fig. 4 - *Celleporaria pilaefera* (Canu and Bassler). Colony from Rinella. Scale 5 mm.

have been treated with anti-fouling paints; hence it is an important preliminary fouling organism ».

Scrupocellariidae

Scrupocellaria bertholettii (Audouin) - very common on bags and plenos. Mistra, Rinella.

Schizoporellidae

Schizoporella errata (Waters) - common on bags and plenos. Rinella.

Aeteidae

Aetea truncata (Landsborough) - common on bags and plenos. Rinella.

Celleporariidae

Celleporaria aperta (Hincks) - (Fig. 3) common on bags and plenos. Rinella.
Celleporaria pilaefera (Canu & Bassler) - (Fig. 4) rare, on baskets. Rinella.

CHORDATA

Tunicata
Ascidiacea
Enterogona

Cionidae

Ciona intestinalis (L.) - very abundant on bags and plenos. Rinella.

Ascidiidae

Ascidia sp. - common on bags and plenos. Rinella.
Ascidia (?) *mentula* Müller - rare on baskets. Mistra.

Pleurogona

Styelidae

Styela partita (Stimpson) - occasional on oysters and bags. Rinella.
Styela plicata (Lesueur) - occasional on oysters and bags. Rinella.
Botrylloides (?) *leachi* (Savigny) - abundant on bags and plenos. Rinella.

Associated Fauna

Other species which are not considered as fouling were regularly found in close association with the oyster - fouling organism community. These included those species whose larvae had settled in the oyster bags and whose adults could not escape through their fine mesh. Also included were those species which seemed to be living in this community by choice, perhaps because of the protection afforded by the structures containing the oysters and, being cut off from the bottom, due to the absence of certain benthic preda-

tors (e.g. asteroids). The associated fauna included:

CNIDARIA

Hydrozoa

Plumularia sp. - common on plenos. Rinella.
Unidentified hydroid - common on plenos. Rinella.

ARTHROPODA
Crustacea
Decapoda
Macrura Natantia

Palaemonidae

Palaemon adspersus Rathke - very abundant around bags and plenos but not found anywhere else in the surrounding area. Rinella.

Macrura Reptantia

Cancridae

Carcinus mediterraneus Czerniavsky - juveniles only; abundant on bags and plenos. Rinella.

Xanthidae

Pilumnus hirtellus (L.) - juveniles only; common on bags and plenos. Marsaxlokk, Rinella.

MOLLUSCA

Gastropoda
Prosobranchia

Muricidae

Truncullariopsis trunculus (L.) - juveniles only; common on bags and plenos. Rinella.

Buccinidae

Euthria cornea (L.) - juveniles only; common on bags and plenos. Rinella.

Opisthobranchia

Bullariidae

Bullaria striata Brug. - juveniles and young adults; common amongst oysters and on bags. Mistra.

Lamellibranchia

Pectinidae

Chlamys varius (L.) - all stages from juveniles to adults; common in bags amongst oysters. Marsaxlokk, Mistra, Rinella.
Chlamys glabra (L.) - all stages from juveniles to adults; occasional in baskets amongst oysters. Marsaxlokk, Mistra, Rinella.

ECHINODERMATA

Echinoidea
Regularia

Arbaciidae

Arbacia lixula (L.) - juveniles only; common in and on bags. Marsaxlokk, Mistra.

Discussion

The main fouling organisms appear to be ascidians, followed closely by bryozoans and polychaetes. Less important fouling organisms include barnacles and bivalves. The fouling organisms are nearly all filter feeders and thus compete directly with the oysters for food and space. The very presence of the organisms themselves on the bags and plenos especially when the population density is high offers mechanical resistance to the water flow, thus minimising exchange of water with the surroundings. This exchange is obviously important for the replenishment of food and oxygen as well as for the efficient dispersal of waste products. In some cases at Rinella, anoxic conditions may have prevailed inside the cages due to the combined effect of the mechanical obstruction by the fouling organisms and the settlement of mud on the plenos. The anoxic conditions were evidenced by the strong smell of hydrogen sulphide emanating from the plenos when these were hauled on shore. Those fouling organisms which settle on the oysters themselves (e.g. serpulids) have often been found to occupy such critical positions as the junction of the two shell valves and may thus actively interfere with the oysters.

Of the fouling Bryozoa, six species are typical Mediterranean fouling forms of which *Bugula neritina, Schizoporella errata* and *Watersipora subovoidea* are the most important and occur regularly and abundantly in warm water (Ryland 1965). The presence of the two species of *Celleporaria* is interesting as they do not seem to have been recorded from the Mediterranean previously (P. L. Cook, personal communication, 1975). *C. pilaefera* is an Indo-West Pacific form while *C. aperta* has a world-wide, warm-water distribution. It is quite conceivable that these two species have reached the Mediterranean via shipping. Ryland (1967) notes that fouling of ship hulls by Bryozoa may be related to the spread of species beyond their original area of distribution. Thus it seems that *Watersipora* was introduced to Australian ports and from there to New Zealand via shipping, while *Bugula neritina* has reached Britain and *Bugula flabellata* Australia in the same way (Ryland 1970). The arrival of the two species of *Celleporaria* into Mediterranean waters may thus be easily understood. Mawatari (1974) recorded *C. aperta* as one of the Bryozoa fouling oyster cultures in Japan.

Fouling was heaviest at Rinella at 3m depth. At this station, the plenos at 10m sustained relatively little fouling, although at times they had a heavier load of mud. Fouling was only of minor importance at both Marsaxlokk and Mistra. Here, the oysters themselves were invariably found to be relatively clean and such fouling as there was, was on the whole restriced to the bags and plenos. No appreciable quantities of silt or mud were at any time found on these plenos.

No definite succession of fouling species was evident, but rather the same species were found almost throughout the year, though fouling was heaviest from about August to February. Since the cages and bags were serviced every two months, this indicates that many, if not all of the species recorded can grow at relatively fast rates and can breed through most of the year. This is probably associated with the year round high temperature (14°C - 26°C).

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