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Short Communication

GROWTH OF *MYTILUS EDULIS* L. IN A WASTE RECYCLING AQUACULTURE SYSTEM

ROGER MANN

Woods Hole Oceanographic Institution, Woods Hole, Mass. 02543 (U.S.A.)

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ABSTRACT

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The mussel, *Mytilus edulis*, was grown in a waste recycling aquaculture system at 14°C on a diet of *Phaeodactylum tricornutum* and *Skeletonema costatum* cultured in a 15% sewage—seawater mixture. Mussels exhibited a 116% increase in mean live weight (5.5 to 11.9 g), a 718% increase in mean dry meat weight (0.11 to 0.90 g), and 4% mortality over a 28-week period.

INTRODUCTION

In a previous publication, Mann and Ryther (1977) described initial studies on the growth of six species of bivalve molluscs in a waste recycling aquaculture system. Results obtained with one of these species, *Mytilus edulis*, were unusual in that, although a 45% mortality was recorded over a 2-month period at 20°C, surviving individuals increased their mean dry meat weight from 58.1 to 120.1 mg over this same period. Recent work by Bayne et al. (1977) suggested that the observed mortalities may have been due to the experimental temperature used, as *M. edulis* exhibits increasing difficulty in acclimating physiologically as water temperatures rise in excess of 20°C. This report presents results of further studies of the growth of *M. edulis* in a waste recycling aquaculture system at a temperature of 14°C.

METHODS

M. edulis was collected from Chatham Harbor, Massachusetts, in September 1976 and maintained in the aquaculture facility at Woods Hole prior to use. Experimental facilities and operations were as previously described (Mann and Ryther, 1977) except that only 12 stacks of shellfish holding trays, arranged in six pairs, were used in the experimental raceway. Sand

filtered seawater, maintained at 14±2°C was supplied at a rate of 40 l/min at one end of the raceway to flow through the trays. Phytoplankton culture was supplied to the raceway at a rate of 8 l/min, divided equally between inputs adjacent to the seawater supply at the anterior end of the six pairs of stacked trays and between the third and fourth pair of stacks.

Four populations of *M. edulis* (each of the 182 individuals, mean live weight 5.5 g) were placed in individual holding trays in late September 1976. Two trays were placed in a stack adjacent to the seawater input and two in the third stack along the raceway. All other trays contained juvenile *Crassostrea gigas* at a density of 500 g live weight/tray. Growth of *M. edulis* populations was monitored at four-weekly intervals over a 28-week period for live weight, dry meat weight, and cumulative mortality, by methods described previously (Mann and Ryther, 1977). During this period animals were fed on *Phaeodactylum tricornutum* (weeks 0—6, mean concentration 9.29×10^5 cells/ml) and *Skeletonema costatum* (weeks 7—28, mean concentration 2.69×10^5 cells/ml) grown in a 15% mixture of secondary treated sewage effluent in seawater.

RESULTS AND DISCUSSION

No significant differences were found in growth and mortality between the four experimental populations. Therefore, results have been pooled and are given in Fig.1. The range of the four mean values is given for mean live weight data.

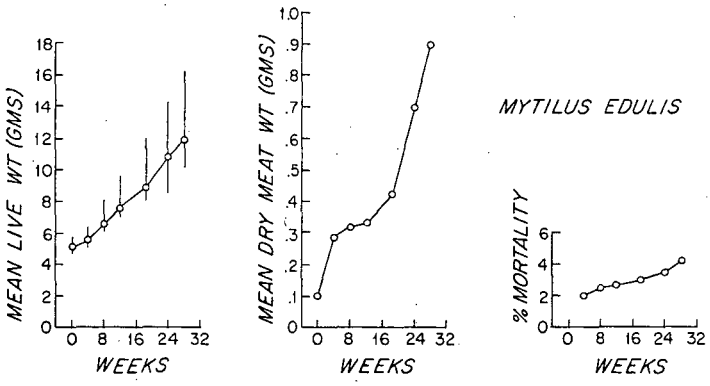

Fig.1. Growth of the mussel *Mytilus edulis* in a waste recycling aquaculture system over a 28-week period at 14°C. Live weight data are the mean and range of individuals from four populations. Mortality and dry meat data are mean values of pooled data from individuals from four populations.

Mean live weight increased steadily over the experimental period from 5.5 g to 11.9 g. Mean cumulative mortality over this period was 4.2% with 2.0% occurring during weeks 0—4. Mean dry meat weight, obtained from a subsample of 10 animals per population, rose from 0.11 to 0.90 g during the study.

It is notable that growth of *M. edulis* in the present study is not only superior to that recorded for the same species in the previous study of Mann and Ryther (1977), but is also superior to that of all other species recorded in that same study. This is undoubtedly attributable to three significant differences between the present and previous studies. The first of these is a decrease in seawater temperature as previously discussed. The second is the improved control of both food concentration and distribution within the raceway. In the present study, food concentration varied from 8.46×10^4 cells/ml of *P. tricornutum* adjacent to a phytoplankton input following dilution to a minimum value of 2.5×10^4 cells/ml of *P. tricornutum*. In the previous study of Mann and Ryther (1977) concentration decreased from 10^5 to less than 10^4 cells/ml along the raceway containing the experimental animals. Improved control of food distribution is further evidenced by the fact that no significant differences in growth were observed between populations situated at different raceway positions. The third difference is the occurrence of *Skeletonema costatum* in the phytoplankton food supply.

The influence of temperature on species competition in mass cultures of marine phytoplankton has recently been described by Goldman and Ryther (1976). In the present study, it is relevant to note that, although *Skeletonema costatum* predominated in sewage enriched cultures, similar cultures not used for bivalve feeding and enriched only with the inorganic salts NH_4Cl and $NaH_2PO_4 \cdot H_2O$ contained almost exclusively the diatom *Phaeodactylum tricornutum*. This occurred despite the fact that algal cultures were maintained at ambient temperature (0—14°C) throughout the study, excepting during the period January—March 1977 when sufficient heating was effected to prevent ice formation. As dilution rate (= growth rate) was equal in both enrichment regimes, it is evident that a factor or factors other than temperature influenced the observed species dominance. The possibility exists that secondary sewage effluent may provide some trace nutrient necessary to effect dominance of *S. costatum* over *P. tricornutum* at low temperatures. However, a complete explanation of the observed phenomenon must await further study.

The facts that the growth of *M. edulis* in the present study and growth observed in recent trials with *C. gigas* (in preparation) are markedly increased over those reported by Mann and Ryther (1977) must encourage further examination of the prospects of bivalve culture in waste recycling systems, with a parallel emphasis being placed in the area of public health related aspects.

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