Crown
Estate Commissioners

Mussel Stocking Density Trials

Seafish Report No. 386

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SEA FISH INDUSTRY AUTHORITY

Marine Farming Unit, Ardtoe

CROWN ESTATE COMMISSIONERS

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SUMMARY

During 1987, thirty spatted mussel collector ropes were used as a basis for a suspended culture trial to determine the effects of reduced stocking density on the production of market size mussels. Excess spat were retubed for ongrowing in "Pergolari" mesh and marketable yields from thinned and tubed stocks were compared with those from untouched ropes.

Growth of mussels in the various treatments was measured over a 20 month period to December 1989 during which time the average shell length increased from 22mm to 45mm.

Results clearly indicated that reducing stock density and retubing the thinnings caused a considerable increase in yields of market size mussels. The tremendous benefits in terms of increased production by retubing mussel spat is noted, especially with respect to availability of supply.

Application of these trial results will be most helpful to growers in maximising the harvest from mussel cultivation.

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1. INTRODUCTION

Suspended culture of the mussel (Mytilus edulis L.) relies upon proven techniques for the collection of natural spat which can be ongrown using various methods. The density at which the mussels are held is an important factor in achieving optimum growth rates and hence maximum production.

Typically, spat are collected by suspending ropes of a coarse, fibrous nature in the water column at sites where good natural spatfall can be expected. The ropes have wooden or plastic pegs placed through them at regular intervals in order to prevent the mussels sliding off as they grow. The pegs also serve to increase the surface area available for spat settlement. The young mussels are often thinned in order to prevent stunting of growth due to overcrowding. The excess stock removed from the collector ropes is utilised by placing it in mesh tubing, of various descriptions but collectively known as "Pergolari", which is suspended in the water column in the same manner as the ropes.

Amongst mussel growers, there currently exists some confusion regarding the optimum stocking density for ongrowing ropes and also the most productive use of collected spat. Both the efficiency and methods of thinning spatted ropes, together with the density at which the mussels should be retubed to achieve maximum yields, have not been fully investigated and the lack of this knowledge may have led to inefficient working practices in the past.

The trial was undertaken using 10 spatted ropes for the untouched and thinned treatments and 5 for the peg stripped treatment with each rope randomly positioned on the mussel raft to prevent any bias. The growth of the mussels was monitored on a regular basis by measuring the shell lengths of at least 50 individuals sampled from each treatment. At the end of the trial, all of the stock was harvested and samples of at least 100 individuals from each of the cultivation methods were obtained. These mussels were measured for length and wet meat weight. The total weight of mussels harvested from each treatment was determined together with that from the retubed stock. The mussels were then graded using a commercial machine into 3 size categories based on shell length, >50mm, 50-30mm and <30mm with those of >50mm considered to be marketable stock.

3. RESULTS

The growth of the mussels throughout the trial for the 3 different rope treatments is shown in Figure 1. There was found to be little difference between the treatments in terms of growth in shell length throughout the 20 month period, and by the end of the trial the average length of mussels varied by no more than 2mm between any of the treatments.

The final mean yields of mussels per spatted rope, for each treatment and cultivation method, are presented in Table 1. The results are based on the total harvested stock of 25 ropes and the mussels grown in Pergolari mesh. As would be expected, the yields from the ropes only were found to be greatest for the untouched stock followed by the peg stripped and thinned treatments in decreasing order. Much more importantly, however, the retubed thinnings from the peg stripped and thinned treatments produced considerable yields of mussels which equalled (peg stripped) or exceeded (thinned) those of the respective ropes. Consequently the total yields of mussels from the peg stripped and thinned treatments for both cultivation methods were considerably greater than for the untouched ropes.

percentage of small mussels of <30mm for the untouched rope at the end of the trial was found to be higher than for any of the other treatments. This indicates that in comparison with other treatments, growth was restricted for a higher proportion of the mussels in the untouched treatment, indicating that they were possibly too densely stocked. It should also be noted that the thinned rope treatment also produced a high percentage of <30mm mussels. Although the exact reason for this is not known, the possibility exists that the considerably reduced density of mussels on the thinned rope at the start of the trial allowed a higher level of fouling by other marine organisms which subsequently restricted the mussels' growth.

The difference between the treatments with respect to the total marketable yields was considerable. Both peg stripped and thinned treatments produced higher marketable yields than the untouched ropes, which indicates that these forms of stock management are extremely beneficial. The highest yield per spatted rope was achieved by stripping the pegs and retubing the thinnings. The removal of mussels from the pegs allows individuals from the rope to migrate to the cleared areas thereby causing an overall lowering of the stocking density. In terms of time and effort, removal of mussels from pegs is a simple and relatively quick task compared to selectively and evenly thinning the complete rope, and consequently is considered to be a far more cost effective method to use.

It can be seen from the results that in comparison with untouched ropes, reduced stocking density on spatted ropes did not in itself produce a higher marketable yield of mussels per rope. The average marketable yields per spatted rope for untouched and peg stripped ropes were found to be 10.7 and 10.2 kg respectively. Therefore the use of the stock thinned from the ropes is the important factor which can considerably increase the total marketable yields. The retubing of mussels is by far the most time consuming part of the operation but the investment of time and effort in retubing can effectively double the marketable

The projections exclude costs for the installation and maintenance of flotation systems i.e. longlines or rafts, and also harvesting costs. It is also assumed that all work is undertaken on site with no additional transport costs. Equipment costs in terms of a workbench/hopper for manual retubing of spat have also been omitted as such items are usually "home made" and inexpensive. Consequently the estimates of costs kg^{-1} of marketable mussels are presented for comparison purposes only.

The assumptions upon which the estimates are based are as follows:

The basic production unit is taken as a spatted collector rope, being 12mm polypropylene length 5m, of which 4m is in the water and fitted with a 200 x 15 x 15mm wooden peg every 0.5m (7 in total).

The time requirement for removing a collector rope, stripping the pegs and replacing it in the water is estimated as 4 minutes. The complete stripping of a rope is estimated to take 5 minutes.

Retubing of spat into Pergolari mesh at a stocking density of 1.9kg m^{-1} is estimated to take 2 min m^{-1}, which includes returning the dropper to the water.

Calculations are based on each metre of collector rope surface having 2kg of spat attached and the spat average shell length being 25mm.

The calculations used to estimate relative production costs and marketable yields of mussels per collector rope for each of the cultivation methods is as follows:

higher compared to those for the other methods, the increase in production far outweighs the higher investment of resources. In comparison to the method of leaving spatted ropes untouched, peg stripping also results in a lowering of the total production costs kg^{-1} of marketable mussels for exactly the same reasons. Consequently peg stripping is likely to considerably increase the production of marketable size mussels and result in comparatively lower production costs. Complete stripping of ropes is likely to further increase production with an additional lowering of unit costs.

6. CONCLUSIONS

i) Stock management in terms of selective thinning of spatted mussel collector ropes and the retubing in Pergolari mesh of the excess stock can considerably increase yields of market size mussels.

ii) The highest yield of market size mussels per spatted collector rope was achieved by peg stripping and retubing the excess stock.

iii) Reduction of the stocking density of spatted ropes did not in itself produce a greater marketable yield of mussels per rope. The retubing of the excess stock was responsible for the increase.

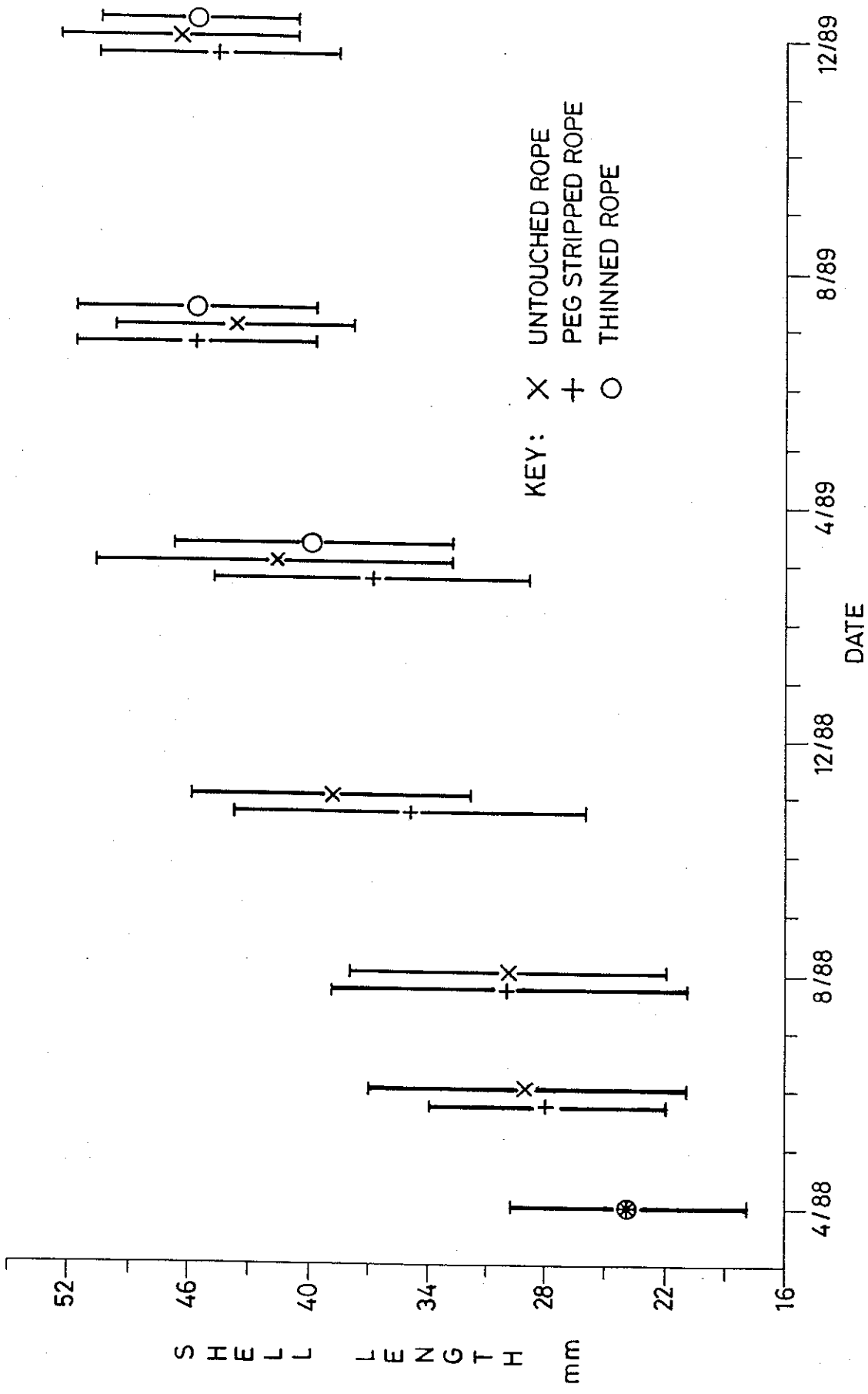
iv) The retubing of mussels in Pergolari mesh involves additional investment in both materials and labour. However, overall production costs have been shown to be able to be minimised, and production maximised by the use of such techniques.

Table 3. Total marketable yields of mussels per spatted collector rope for each treatment.

Treatment	Cultivation Method	Per Spatted rope			
		Total Yield(kg)	% Marketable	Marketable Yield (kg)	Total Marketable Yield(kg)
Untouched	Rope	19.1	56	10.7	10.7
Peg strip	Rope	16.5	62	10.2	21.0
	Pergolari I	16.8	64	10.8	
Thinned	Rope	13.5	47	6.3	16.9
	Pergolari I	16.6	64	10.6	

Table 4. Estimated costs and marketable yields of mussels for each cultivation method based on 100 collector ropes, together with the total cost per kg of production (1h = £2.50).

Cultivation method	Material costs (£)	Labour costs (min)	Marketable yield (kg)	Cost per kg Capital (£)	Time (min)	Total (£)
Untouched rope	74.00	200	1070	0.07	0.19	0.08
Peg stripped rope	78.50	900	2090	0.04	0.43	0.06
Completely stripped rope	91.00	1840	4130	0.02	0.45	0.04



Mean (± ISD) Size of Mussel for Each Treatment at the Start and Throughout the Trial.

Fig.1