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MULTIPURPOSE CULTURE RAFT

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SUMMARY

1. Of the many types of aquaculture studied by the Fisheries Division of Fiji, oyster culture has shown the most potential and is now receiving greater attention. Initially the tray method was used in the cultivation of native and selected imported species. Growth of these oysters was fair but survival was generally very poor.

2. Much better results have been obtained from the long line system, utilizing sealed PVC pipes, as demonstrated by SPIFDA shellfish consultant, John Glude. Survival, particularly during the early stage when the oyster shell is thin, continues to be a problem; it is suspected that predation by fish is the main cause. Another problem is the inability of the long line to support a large weight of oyster strings in the most productive first meter of water. In addition, fouling was evident but not severe.

3. In order to overcome these problems, large ferro-cement rafts measuring about 20' x 40' and each capable of supporting 5 tons of oysters with a 9" freeboard, are being constructed. Around the underside of the raft a plastic mesh cage will be fitted to provide protection from predators. Non-predator species of Siganidae and Mugilidae will be stocked inside this cage in an attempt to reduce the amount of fouling on the oysters as well as on the plastic mesh. Lastly, funnel fish traps are planned for the space immediately underneath the two pontoons to catch the predator fish which will inevitably be attracted to the raft. The culture and trapping of fish could well become a valuable adjunct to oyster cultivation, providing the individual oysterman with an added incentive to make the necessary regular visits to the rafts.

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THE MULTIPURPOSE CULTURE RAFT

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INTRODUCTION

The Fisheries Division, Department of Agriculture, Fiji, has maintained a strong interest in aquaculture for several years. Pilot studies have been carried out to aid the selection of a particular culture which not only is easy to develop and has much potential, but which will also easily lend itself to village participation. Results from these preliminary studies have shown oyster culture to be the appropriate type of culture for our purposes.

As our ultimate aim in aquaculture is village participation, much oyster research has accordingly dealt with the development of culture methods which will be attractive to the village and of course produce the maximum number of oysters possible. We have tried to develop a combination culture method which will provide the oystermen with a daily benefit and not just the long term income from the crop of oysters. The results of this research into combination culture methods is the multipurpose culture raft which is presently under construction in Fiji. This paper briefly describes the research leading to the raft's development and the purpose of the various raft constituents.

RESEARCH LEADING TO MULTIPURPOSE RAFT

The Fisheries Division has studied a number of the more economical culture techniques during its search for a suitable oyster culture method. Initially, the tray system was used to cultivate native and imported oysters (Crossostrea gigas, virginica and commercialis). At the outset this tray method seemed inexpensive but later proved uneconomical and problem prone. Workmen found it very difficult to construct the racks in the soft muddy flats which characterize the areas where the water quality is suitable for oyster growth. Secondly, wave action, in even sheltered bays, strongly washed the oysters and crowded them into corners of the trays causing mortality and retarded growth. Thirdly, during low midday tides, the sun's heat apparently proved detrimental for a majority of the oysters and some mortality was noted to occur after such a series of low tides. Furthermore, natural enemies such as crabs, fish as well as borers easily found their way into the trays and caused considerable damage. A few of these problems could be solved by using techniques developed in countries where trays are used on extensive tidal flats but the installation costs of these extra techniques would not justify the benefit it would bring to the small tidal areas of Fiji.

A second culture method, a type of suspension system, was developed during John Glude's, (S.P.I.F.D.A. Shellfish Consultant), recent tour of Fiji. The long line suspension system used sealed 3" PVC pipes of 10' length for floatation and was extensively utilized in the experimental culture of Japanese (C. gigas) cultchless and attached spat. Results indicate the growth and survival of long line cultured oysters was much better when compared to the tray method. The imported C. gigas oyster cultch spat, for example grew 130% and experienced a 25% mortality during the first month of longline culture while the same spat, under tray culture, grew only 30% and suffered a 70% [illegible] in the same one month period.

A large portion of the 25% mortality of long line spat is believed to be caused by fish, a common predator of oysters raised in trays. In addition, fouling was evident, but generally not severe enough to cause concern. The fouling of suspension cultured oysters is very common and is thought to be the greatest problem of suspension cultured oysters (Quayle, 1971). Other lesser problems associated with the longline method, were the difficulty in fastening the oyster strings so that they would hang in the most productive surface meter of water, the low floatation value of the PVC pipe making it necessary to use up a large area of water in supporting a few strings, and the general awkwardness of working around the long line strings from a punt.

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Upon evaluating the merits and problems of the PVC longline and tray technique, it was decided that although the longline system is superior, modifications must be made to overcome the apparent problems of the present suspension technique. The ideal floating device for oyster culture should be able to support a large weight of oysters in a reasonably small area, prevent marauding fish from preying on the young oysters and somehow reduce fouling of the oyster strings. Furthermore, in order to make oyster culture appreciated by villagers, the floating device should be easy to work on, and, if possible, provide the village oystermen with some direct regular benefit.

THE MULTIPURPOSE CULTURE RAFT

The multipurpose culture raft which is designed to overcome the problems outlined above, is illustrated in Fig.1. A description and estimated cost of the main constituents is given below.

Raft skeleton and hanging framework

The floatation for the raft is provided by two 20' x 5' x 4' pontoons. Three cement beams fix these pontoons and provide attachment points for the wooden framework from which the oyster strings will be hung. $2,000

Plastic mesh cage

A fence of ½" plastic mesh will be fitted around and underneath the cement raft. As the oyster strings should only extend 4-6' below the surface, a 9' depth of the cage walls should suffice. A frame made from ½" PVC pipe will preserve the shape of the cage and form the attachment points of the cage to the raft. 500

Funnel fish traps

Two funnel fish traps are planned for the underside of each pontoon. The funnels will open to the outside of the mesh cage and lead to a chamber where the trapped fish can be taken out. 100

TOTAL $2,600

Discussion

In designing and putting together such a floating oyster culture device that described above, durability and availability of the materials was given preference to expense. The importanceof the role costing and economics play was not forgotten, but it was thought best to initially use materials which would permit our long term experimentation to be effected without having to consider repairs or major maintenance tasks. Once such an ideal culture device was in operation, means of reducing costs would be investigated and studied. Thus the costs given for the various components making up the multipurpose culture raft described do not represent the most economical version of the raft.

One of the more formidable problems outlined was that of a large support capacity. The cement pontooned raft proposed can support 5 tons of weight with 9" free board and will yield approximately 1" of free board for every additional ton of weight added.

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Furthermore, as the wooden framework of 2" x 4" planks can be fitted with 350 oyster string attachment points, the raft should be able to cope with a sufficient number of oyster strings. Such a floating device will also be stable and give a good platform to work from while attending the oysters.

In order to protect the oysters suspended from the raft platform from fish, the proposed plastic mesh cage will surround the raft on all sides. The cage will keep out all predator species, and, at the same time, can be used to hold and culture beneficial species of Siganidae and possibly Mugilidae inside with the oyster strings. These stocked fish should tend to reduce the amount of fouling on the oyster strings and could possibly keep the plastic mesh from fouling as well. The number of fish stocked into the cage is difficult to estimate but will depend on the species used, the kind and extent of fouling experienced and other factors. Small cages have been used for several years in the United States for the holding of trout, salmon, catfish and other species (Pagon, 1970) (Lewis, 1970). The fish are intensively fed prepared foods and usually two crops of fish can be harvested per year. The ideal stocking rate for the small cages is about 0.7 fish/m^3, or, for our raft cage, this rate would dictate stocking about 250 fish. Although it is not envisaged to feed prepared foods to the fish, the oyster strings should increase the food in the cage in a fashion similar to the plastic strips used to increase the productivity of fish ponds (Chen, 1966; Shehadeh , 1970). Therefore a stocking rate of 250 fish may not be unreasonably heavy for the proposed mesh cage.

The cultivation of beneficial fish in the raft's cage will give the oystermen another source of income but fish culture is still a long term operation giving results after several months work. In order to provide a daily if possible income, funnel fish traps are designed for the raft. The traps will be placed under the pontoons so as to utilize the hanging space which cannot be used by oyster strings. The catch from such traps, like the productivity of culturing fish in the cage, is difficult to estimate. However, it is thought that the small browsing fish in the cage and the oysters themselves should provide enough attraction to ensure the success of the traps on at least a subsistance level.

The multipurpose culture raft described attempts to solve the support capacity, predator fish and other problems of the long line oyster culture method. It is furthermore designed to yield fish by culture as well as trapping. The latter asset may be the key to the success of our oyster culture development programme in Fiji. This could be due to the fact that oysters are raised solely for the tourist market in Fiji and the usual culture methods offer no direct food income to the individual oystermen. Secondly, daily maintenance of the oysters and the culture facilities is not very attractive in itself and it is often difficult to persuade the novice that such frequent checks are essential for oyster production. The tray or longline oyster culture techniques therefore do not give the villager a quick return and appear to require too much labour initially for the cash income. However, the multipurpose raft cultured fish, and especially fish traps, should attract the new oystermen to the raft on a regular basis. Once on the raft it will be convenient for him to observe the oysters and make any minor repairs or adjustments to the facilities.

Conclusion

The multipurpose culture raft represents the results of research into an appropriate village oyster culture technique. The raft should interest the village oystermen by providing a daily subsistence income and produce oysters as a long term high cash crop as well.

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