to the benthic stage in 3 to 4 weeks in the laboratory, and, at least fr
biological standpoint, prospects for future culture look bright.

A recent development in clam culture is the stocking and fatteni
Tapes decussatus and *Venus verrucosa* in the brackish-water Bizerta I
Tunisia. The former species yielded 85 metric tons in 1967.

FRESHWATER CLAMS

Freshwater "mussels" (family Unionidae), despite their common n
are classified in the order Eulamellibranchia with clams and coc
Most Unionidae are of little commercial importance, except as produ
of pearls, but *Lampsilis claibornensis* of the Tennessee and upper
sissippi River valleys of the United States, was formerly sought by fis
men for its shell, used in the production of buttons and ornaments.
prevalence of plastic buttons and the siltation of large American ri
have drastically reduced the importance of the fishery for *L. claibor*
sis, but the species is still sought as a source of food. Recently, *L. clai*
nensis shells, cut or ground into small pellets, have been found t
ideal "seed" for culture of pearls, and their shells are now exported f
the United States to Japan for that purpose.

Experiments conducted at the Auburn University Agricultural
periment Station in Alabama by H. S. Swingle indicate that *L. claibor*
sis has great potential value for culture in ponds, alone or with fish.
0.8-ha pond was stocked with a few mussels, along with 3125 bluegill
fish (*Lepomis macrochirus*)/ha, 1565 redear sunfish (*Lepomis mi*
lophus)/ha, and 312 largemouth bass (*Micropterus salmoides*)/ha.
mussels multiplied rapidly and were harvested annually, along with
over a 5-year period, yielding an average of 1010 kg/ha of unshelled m
sels (318 kg/ha of meat). The sixth year, the pond was drained and 1
kg/ha of mussels recovered (400 kg/ha of meat). The standing crop
fish was 464 kg/ha. In a control pond, stocked with the same numb
of fish but no mussels, the standing crop of fish was 317 kg/ha. It is
lieved that the difference in fish production was a function of the filte
action of the 49,440 mussels/ha which were found on the pond bott
As the methods used in Swingle's study were far from intensive, al
these yields could undoubtedly be improved.

Larvae of *Lampsilis* spp. are parasitic on freshwater fishes, but
festations are seldom heavy and the results not usually serious. Thu
appears that *L. claibornensis* and its relatives could make a valua
contribution to aquaculture, particularly in ecologically integrated p
culture systems, where a host fish species might be stocked along with

main fish crop. In addition to the benefits already described, freshwater mussel exometabolites, commonly called "mussel mud," are a superior fertilizer for vegetables. The recycling capacity of a mussel-fish community is further enhanced by the possibility of periodically crushing excess small mussels and feeding them back to the fish.

PROSPECTUS

In attempting to formulate a prospectus for the culture of clams, one finds oneself dealing with two very different situations. In North America and Europe, clams are still a luxury food, whereas in most Asian countries they are presently or potentially one of the cheapest and most important sources of protein. The economic situation in North America and Europe, plus the fact that destruction of the estuarine environment is proceeding most rapidly on these continents, dictates that this is where research in intensive clam culture, especially hatchery methods, will be centered. Of particular value would be the continuation of the genetic work on *Mercenaria mercenaria* which was begun around 1960. It would also be advantageous if someone were to develop a method for growing uniform size clams, so that mechanical harvesting could be employed.

Some of the results obtained by American and European researchers may be of value to Asian culturists, but clam culture in Asia (outside of Japan, where the importance of shellfish hatcheries is likely to increase) will probably continue to be characterized by low-intensity methods for some time, particularly if the present high yields are sustained.

It should be borne in mind that there are hundreds of species of edible clams, including many which are unexploited by fishermen, let alone culturists. One or more of these species may be found to possess characteristics such that it will revolutionize the economics of clam culture. A number of presently uncultured species of clam, including the transverse ark clam (*Arca transversa*), Morton's cockle (*Laevicardium mortoni*), the small clam (*Pita morrhuana*), the razor clam (*Ensis directus*), and the surf clam (*Spisula solidissima*) have been artificially propagated experimentally at Milford, and this work should be extended.

At present, clam growers must compete, on the one hand with gatherers of "wild" clams, which are still abundant and easy to collect along many coasts, and on the other hand with such established growers of luxury foods as oyster culturists. Except for areas where there is a large established market for clams, for example, the market for quahogs in New England and New York or that for cockles in Singapore, the immediate