LITERATURE CITED

BELDING, D. L.
1931. The quahaug Fishery of Massachusetts, Commonwealth of Mass., Boston, 41 p.

CHANLEY, P. E.
1959. Inheritance of shell markings and growth in the hard clam, *Venus mercenaria,* Proc. Natl. Shellfish. Assoc., *50*: 163-169.

CHESTNUT, A. F., W. E. FAHY AND H. J. PORTER
1956. Growth of young *Venus mercenaria, Venus campechiensis,* and their hybrids. Proc. Natl. Shellfish. Assoc., *47*: 50-56.

DAVIS, H. C. AND RAVENNA UKELES
1961. Mass culture of phytoplankton as foods for Metazoons. Science *134* (3478): 562-64.

HAVEN, D., AND J. D. ANDREWS
1956. Survival and growth of *Venus mercenaria, Venus campechiensis,* and their hybrids in suspended trays and on natural bottoms, Proc. Natl. Shellfish. Assoc., *47*: 43-49.

LOGIE, R. R. AND R. E. DRINNAN, AND E. B. HENDERSON
1961. Rehabilitation of disease-depleted oyster populations in Eastern Canada, Proc. Gulf and Carib. Fish. Inst., *13*: 109-113 (1960).

LOOSANOFF, V. L.
1954. New advances in the study of bivalve larvae, Amer. Sci., 42: 607-624.
1961. Recent advances in the control of shellfish predators and competitors, Proc. Gulf and Carib. Fish. Inst., *13*: 113-128 (1960).

LOOSANOFF, V. L. AND H. C. DAVIS
1950. Conditioning *Venus mercenaria* for spawning in winter and breeding its larvae in the laboratory, Biol. Bull., *98*: 60-65.

MACKIN, J. G.
1961. Status of researches on oyster diseases in North America, Proc. Gulf and Carib. Fish. Inst., *13*: 98-109 (1960).

MENZEL, R. W.
1960. Growth and mortality of northern hard clam in Florida waters, Assoc. South. Biol. Bull. 7: abstract.

SWINGLE, H. S. AND E. V. SMITH
1950. Management of farm fish ponds, Agri. Exper. Stat., Ala. Polytech. Inst., Bull., *254*: 30 p.

Preliminary Experiments on the Rearing of the Fresh Water Shrimp, Macrobrachium carcinus (L)

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Abstract

M. carcinus is a freshwater shrimp which has been reported from fresh and brackish water in Eastern America from Florida to Southern Brazil. It reaches a large size at maturity, specimens of 200 mm being not unusual.

Attempts to rear larvae and culture methods for rearing of juveniles in ponds and reservoirs are described. Breeding and growth rate data are presented and the general ecology of the species in Barbados is described. The possibilities of the establishment of an industry for culturing on a commercial scale are discussed.

MACROBRACHIUM CARCINUS (L) IS A PALAEMONID SHRIMP, which occurs in fresh and brackish waters of Eastern America, from Florida to Southern Brazil, and in the West Indies. Of some 26 species of the genus occurring in America, it is one of the largest, specimens 20 to 23 cm long being not uncommon.

It is used as food in the West Indies but on a very small scale, and it is also taken in Florida.

M. carcinus occurs in Barbados in a wide variety of habitats, in brackish water coastal ponds, shallow water streams, irrigation run-off ponds, and in both running and stangnant water. In these situations, it occurs with several other smaller species of the same genus.

The possibility of artificial rearing of *M. carcinus* was recognized in 1958 when rearing trials were made in small aquaria. While these tests indicated that the species will feed upon a wide variety of protein and naturally occurring algae, growth rates in small enclosed tanks were low, and mortality high. A high degree of cannibalism suggested that insufficient food was being supplied.

About this time Ingle in Florida noticed heavy populations of several species of *Macrobrachium* in streams into which garbage had been dumped. He found that they could be reared in the laboratory and were omnivorous. In Mexico, Mercado has reported plans for a small hatchery for *M. carcinus*.

This year further rearing trials were made in large concrete tanks. Juveniles and mature specimens were placed in narrow tanks with water up to 1 ft deep, or in large tanks containing up to 6 ft of water. The following size increase were recorded:

1. Juveniles of *M. carcinus* with mean length of 18.9 mm reached 28.4 mm in the first month, and 39.0 mm at the end of the second month in a shallow tank. This group, consisting of 50 individuals, was fed entirely upon a species of the algae *Cosmarium* which was introduced into the tank.

2. Adult *M. carcinus* with a mean size of 80 mm increased to 92.1 mm in one month. This group was fed upon trash fish, but no attempt was made to supply an optimum amount of food. The slightly higher growth rate in this group suggests a greater efficiency of protein as food. This group is of what we consider marketable size.

3. In deep water ponds with naturally occurring species of algae *Cosmarium* mixed cultures of *M. carcinus* and two other species in the 20 mm mean size range showed an increase of 20.5 to 28.8 mm in one month.

4. Mixed cultures under the same conditions of somewhat larger size showed an increment of from 33.2 to 49.9 mm in one month.

5. In a shallow pond a mixed culture feeding upon *Cosmarium* showed an increase of 26.8 to 33.5 mm in the first month, 33.5 to 40.6 mm in the second, and 40.6 to 46.2 mm in the third month.

These results, while based mostly on shrimp of smaller sizes, have shown the possibility of culture in concrete ponds. In the experiment on individuals of larger marketable size, there was still a high degree of cannibalism. It is thus felt that more suitable food might be found for the larger stages.

M. carcinus breeds during the summer months, the period July, August, and September being apparently the peak period of breeding activity. The rearing of juveniles from eggs has not as yet been successful, but we have succeeded in keeping the larvae alive for up to 14 days, and past the second larval moult. Larvae were reared for this period in plunger jars, and cultures of protozoa, single cell algae, and finely ground fish were supplied for food. It was found that larvae will not develop to even the first larval moult in fresh water alone, but require brackish water. Furthermore, it was found that the larvae will not live in water with pH above 8.5.

There are several problems which confront us in future work. The juvenile stages of the various species of the genus closely resemble one another, and to obtain specimens for stocking, juveniles of *M. carcinus* at least must be recognizable.

We believe it is now possible to recognize juvenile stages of *M. carcinus* from about 2 cm upwards, but the smaller stages have still to be described.

For the most practical stocking of a pond or tank, it would of course be most desirable to supply ovigerous females or freshly hatched larvae. This is perhaps the most important problem facing us. Further larval culture experiments are planned for the next breeding season.

While the current experiments have shown that growth of this species is rapid, and at least one crop each year may be possible, we feel that faster growth rates are possible on more suitable food. It has been found that both juveniles and adults will feed avidly on dried processed fish meal. Experiments are now in progress with this high protein food.

Finally, it is still necessary to follow the growth rates over the whole life cycle of a population, and to test the method in larger ponds on a commercial scale.

Tagging Reef Fishes in the Virgin Islands[1]

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OUR KNOWLEDGE OF THE HABITS of reef fishes in the Atlantic is very limited. Only the primarily taxonomic works of Beebe and Tee-Van (1928) and Longley and Hildebrand (1941) deal significantly with the habits of a number of species. The only tagging study of reef fishes in the Western Atlantic known to the author prior to the initiation of the present one was that from Bermuda reported by Bardach and Menzel (1957) and Bardach (1958).

The principal commercial fishery in the Virgin Islands is a trap fishery for reef fishes (Idyll and Randall, 1959). Many species comprise the catch. With so little known of the growth and movements of reef fishes, a decision was made to embark on a tagging program based largely on fishes taken in traps in the Virgin Islands. Rather than concentrate effort on just a few species, many were tagged. It was realized that data from some would be fragmentary.

The tagging was one phase of a marine biological-fisheries survey of St. John,

[1]Contribution 362 from The Marine Laboratory, University of Miami.