The Freshwater Conch Pomacea urceus (Müller) as a Potential Culture Species for Trinidad and Tobago

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ABSTRACT

The ampullariid snail Pomacea urceus (Müller) shows potential for development as a commercial species. It exhibits high fecundity and the life cycle is simple, lacking a larval stage. It can be stocked at high densities and being a herbivore, is easy to feed.

Sexually mature adults collected during the breeding season were placed in glass tanks and fed until copulation took place. The females were placed in a mud trough which was allowed to dry. After burrowing, egg masses were produced in their mantle cavities within 10-14 days. A high percentage of the eggs hatched and the young snails remained in a state of aestivation until exposed to water, after which they foraged and fed.

The hatchlings were stocked at varying densities and fed with vegetable leaves. Growth rates were determined by comparison of successive modal lengths.

INTRODUCTION

The Institute of Marine Affairs in conjunction with the Zoology Department of the University of the West Indies, St. Augustine, initiated a Pilot Aquaculture Research Program in late 1984. This aquaculture research program is required to solve problems of a local nature and to adapt culture methodology to suit these conditions.

The overall goal of the project is to conduct field and laboratory trials utilizing indigenous species with the long term aim of developing strategies for exploitation to the fullest possible extent of the commercial potential of the species concerned. One of these species is Pomacea urceus) (Müller).

The species belongs to the Ampullariidae, a family of tropical freshwater snails and is of wide distribution from the Guianas, Venezuela, Colombia, Peru, Brazil, Ecuador and Trinidad (Burky, 1974). The species shows good potential for culture as it feeds on most vegetable matter (Lum Kong, 1985) and can be stocked at high densities in poor quality water.

CURRENT EXPLOITATION

Collection methods for Pomacea urceus vary from baiting with vegetable matter in the rainy season to searching for aestivating adult individuals in the ground during the dry

season. This is done year round for private consumption as well as for sale. They are extracted from their shells and sold live at local markets for approximately TT$5.00 (US$2.00) per pound. The meat is prepared in a variety of dishes such as salads, stews, curries and chowder.

The natural habitats of Pomacea urceus are threatened by other land use such as agriculture with its consequential burning of vegetation, excavation of drainage canals and ditches, use of chemicals and pesticides, and livestock rearing.

LIFE HISTORY

The life history of Pomacea urceus may be considered in relation to the annual wet (July to November), and dry (December to June) seasons and is summarized in Figure 1.

Copulation occurs at the end of the wet season and this is followed by the burrowing of adults in the soft mud in shallow pools, or in banks of rivers, streams and drainage ditches. Oviposition is at the beginning of the dry season after females burrow in surface mud. Egg clutches average 120 (Burky, 1974). The young hatchlings aestivate in the mantle cavity of the female until the arrival of the first rains when they emerge to forage and feed.

METHODOLOGY

Adult snails were collected from the Nariva Swamp, a seasonally inundated freshwater area of approximately 90 km situated on the east coast of Trinidad (Bacon et al., 1980), from late December, 1984 to early January, 1985. Most were found submerged in muddy pools in inundated areas of the swamp. Some snails were collected in February and March, 1985 from their positions of aestivation in the dried mud and included females with egg clutches in their mantle cavities. The number of aestivating hatchlings per female and the adult shell lengths were recorded. Shell length is defined as maximum distance between the apex and the edge of the margin.

Sexually mature adults were placed in two glass aquaria at a density of 73/m^2. They were fed daily on vegetable trimmings and leaves of the wild dasheen, Colocasia esculenta. Water depth was 15.0 cm. Daily temperatures were recorded.

Copulation was observed in the aquaria and after seven days snails were removed and placed outdoors in wooden plastic lined troughs at a density of 28/m^2. The troughs were filled to a depth of 20 cm with a mud slurry and covered with plastic sheeting and 70% shade SARAN netting. The mud was allowed to dry until cracked. (Fig. 2).

Adult females were monitored daily for oviposition and those with egg clutches were carefully removed and returned indoors to the laboratory and their shell lengths recorded. The egg clutches were removed from the mantle cavities, labelled and placed in wooden cubicles. Moist paper tissue was used in each cubicle to prevent desiccation of the egg mass. (Fig. 3).

The numbers of hatchlings and unhatched eggs per brood were

recorded. The hatchlings were stocked at different densities in circular shaded plastic tanks and fed daily. Shell lengths were recorded weekly and growth was determined by comparison of successive modal length values. Daily temperatures were recorded. (Fig. 4).

RESULTS AND DISCUSSION

Of 16 aestivating adults with broods collected during the dry season, the number of live hatchlings varied from 19 to 96 with a mean survival of 54.8 per brood (Table 1). Of 80 adults placed in the outdoor mud trough, 15 females with clutches of between 99 and 160 eggs (Table 2) were transferred to the laboratory. Hatching occurred after 2-3 weeks.

Table 1. Aestivating P. urceus females with broods from Nariva Swamp

Shell Length/mm	No. of Live Hatchlings/ Brood
89.00	96
92.00	54
93.00	19
94.80	84
95.00	40
96.40	59
97.00	34
101.00	48
101.60	27
102.00	92
103.00	68
105.00	45
105.00	65
108.00	70
110.00	36
110.10	41
Mean 100.18	54.8
(Range 89-110) S.D. = 6.53	(Range 19-96) S.D. = 22.9

Numbers of live hatchlings ranged from 87 to 157 with a mean survival of 94.8%. Water temperature in indoor growth tanks varied between 23°C and 29°C compared to 23°C and 32°C in outdoor unshaded tanks. Hatchlings tended to crawl out of tanks when food was totally consumed. On reaching dry areas outside

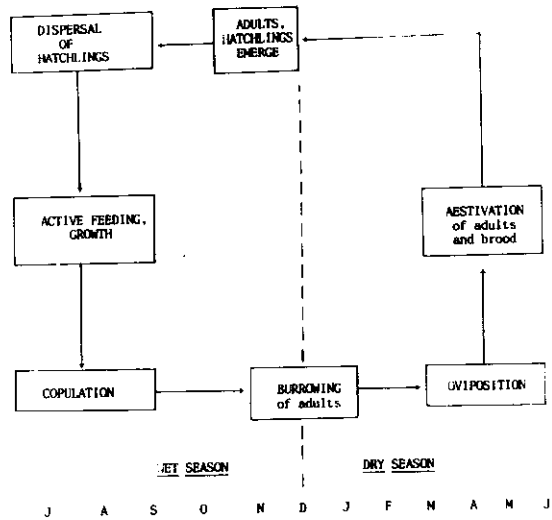

Figure 1. Simplified diagrammatic representation of the life cycle of P. urceus in a seasonally inundated swamp.

Figure 2. Adult Pomacea urceus being placed in mud slurry after copulation.

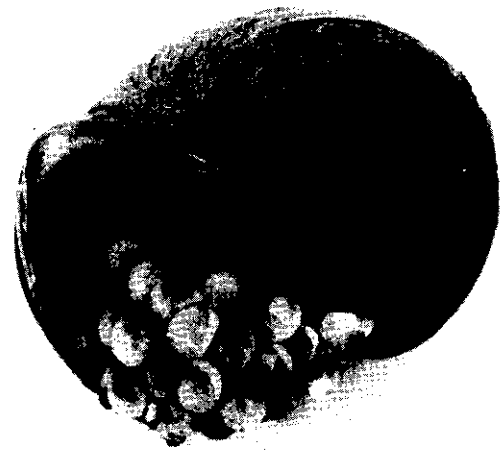

Figure 3. Adult female Pomacea urceus with egg mass in mantle cavity.

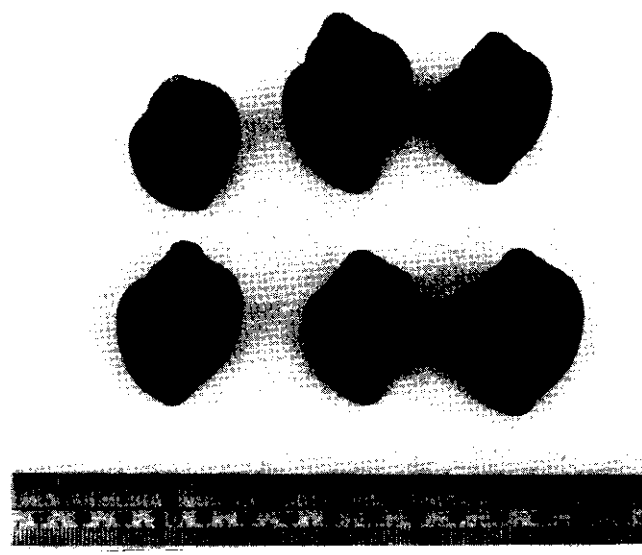

Figure 4. Juvenile Pomacea urceus.

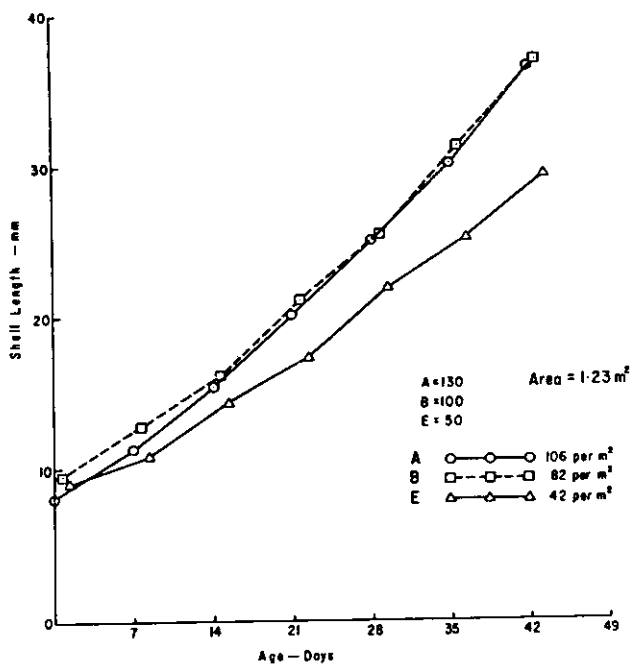

Figure 5. Age-length relationship of hatchlings at different densities.

tanks, young snails found dark areas where they remained inactive.

Some mortality was observed in the unshaded outdoor tanks and high water temperatures during the day may have been responsible for this.

Table 2. Aestivating P. urceus females with broods from outdoor troughs

Shell Length /mm	# Live Hatchlings in Brood	# Unhatched Eggs in Clutch	Total # Eggs in Clutch	% Hatched
91.40	98	2	100	98.00
92.00	138	2	140	98.57
92.60	105	5	110	95.45
94.50	121	0	121	100.00
95.00	108	3	111	97.30
97.80	137	2	139	98.56
98.30	93	6	99	93.94
101.00	126	12	138	85.14
101.20	157	3	160	98.13
104.00	132	7	139	94.96
106.10	87	14	101	86.14
106.70	122	5	127	96.06
107.00	112	9	121	92.56
109.40	109	6	115	94.78
112.00	128	10	138	92.75
Means 100.6	118.2	5.73	123.9	94.8
S.D. 6.7	18.9	4.0	18.1	4.3

Stocking densities varied between 41 to 106 snails/m^2 and range of growth rate determined was 0.45 mm - 0.55 mm/day over a 42 day period (Table 3). There was no apparent correlation between stocking density and growth rate ($r = 0.38$) (Fig. 5).

From results of the preliminary work done on the snail, P. urceus (Müller), it shows good potential as a viable commercial culture species for Trinidad and Tobago. It has a relatively simple life cycle which is geared towards the seasonal climatic changes and allows for easy manipulation of its reproductive biology. It exhibits relatively high fecundity and although oviposition is seasonal, production may be staggered by allowing hatchlings to remain in a state of aestivation until needed, when they are activated by expossure to water. In the natural environment production of surviving hatchlings was significantly lower than those in the laboratory. Bush fires and desiccation through fissures in dried soil accounted for some mortality in the seasonally inundated areas of the swamp. Apart from predation by the snail kite, Rostrhamus sociabilis (ffrench,

1980), and an unidentified boring organism in the swamp, the snails tend to be very hardy animals and there was no observation of parasites or disease. They showed a tolerance for low dissolved oxygen by switching from aquatic gill to aerial pulmonary respiration.

Table 3. Growth of P. urceus hatchlings at varying densities for a 42 day period

Batch #	Number in Sample	Stocking Density /m^{-2}	Average Increase in Length /mm	Average Growth per Day/mm
A	130	106	28	0.66
B	100	82	27	0.64
C	120	98	19	0.45
D	50	41	24	0.57
E	50	41	20	0.48
F	50	41	21	0.50

Hatchlings can be stocked and cultured at relatively high densities and this made no apparent difference in the growth rates recorded.

The species occupies a low tropic level, feeding on a wide variety of vegetable matter, including cabbage, lettuce and leaves of root crops. The feeding cost can therefore be kept to a minimum utilizing vegetable wastes.

Breeding of the snail P. urceus is now restricted to the end of the wet season and onset of the dry season, and further research on induced reproduction is necessary.

SUMMARY

1. The ampullarid snail, Pomacea urceus (Muller), shows good potential as a viable commercial culture species.

2. The apparent simplicity of its life cycle geared towards the wet and dry seasons, allows for easy manipulations of its reproductive biology.

3. From laboratory results Pomacea urceus produces viable broods of 87 to 157 hatchlings. Field observation yield range of 19 to 96 live hatchlings.

4. Hatching mortality in laboratory conditions is low, 5.2%, with mean number of live hatchlings per clutch being 118.2.

5. Both adult and hatchling Pomacea urceus can be stocked at high densities from 65/m^2 to 106/m^2.

6. Pomacea urceus occupies a low trophic level, feeding on vegetable matter and hence decreasing feeding costs.

7. Hatchlings immediately aestivate or feed on exposure to water. They show good early growth rates of from 0.45 to 0.66 mm/day.

8. Pomacea urceus can withstand poor water quality (low dissolved oxygen) by switching from gill to pulmonary respiration.

9. Other areas where further research is needed includes aestivation of hatchlings, feeding and growout.

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