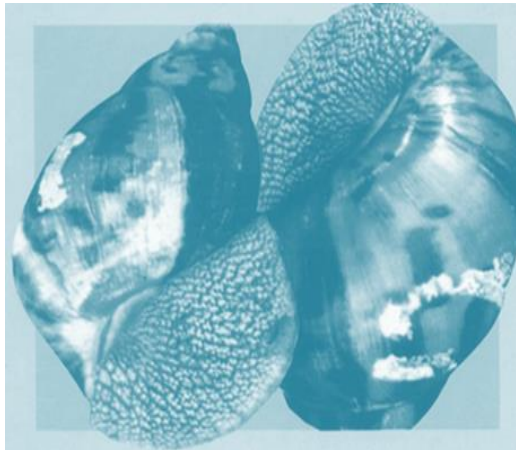


# A

# Practical Guide on Snail Farming

Production, processing and marketing



Compiled by:

[www.livestocking.com](http://www.livestocking.com)

# Contents

<b>1</b>	<b>Introduction</b>	<b>6</b>
<b>2</b>	<b>Suitable species</b>	<b>10</b>
2.1	Biology of snails	10
2.2	Suitable tropical snail species for farming	12
2.3	<i>Achatina achatina</i>	14
2.4	<i>Achatina fulica</i>	16
2.5	<i>Archachatina marginata</i>	19
2.6	Climatic and environmental requirements and restrictions for raising snails	21
2.7	Cultural and religious restrictions on handling and eating snails	22
<b>3</b>	<b>Choosing a site</b>	<b>23</b>
3.1	General considerations	23
3.2	Temperature and humidity	23
3.3	Wind speed and direction	24
3.4	Soil characteristics	25
<b>4</b>	<b>Constructing a snailery</b>	<b>27</b>
4.1	Choosing a system: the options	27
4.2	Car tyres, oil drums	28
4.3	Hutch boxes	29
4.4	Trench pens	30
4.5	Mini-paddock pens	33
4.6	Free-range pens	35
<b>5</b>	<b>Food and feeding</b>	<b>39</b>
5.1	Introduction	39
5.2	Types of snail food	39
5.3	Recommendations on natural feed	41
5.4	Recommendations on formulated feed	43
5.5	Feeding and growth	45

<b>6</b>	<b>Breeding and management</b>	<b>47</b>
1.	Selecting breeding stock	47
2.	Nursery	48
3.	Rearing density	50
4.	Seasonal and daily management	50
5.	Snail farming tools and equipment	53
<b>7</b>	<b>Predators, parasites and diseases</b>	<b>54</b>
1.	Predators	54
2.	Parasites	56
3.	Diseases	57
<b>8</b>	<b>Processing and consumption of snail meat</b>	<b>58</b>
1.	Processing	58
2.	Consumption	60
<b>9</b>	<b>Markets</b>	<b>63</b>
1.	Local markets	63
2.	Export markets	66
	<b>Appendix 1: Planning a snail farming venture - 5 steps</b>	<b>68</b>
	<b>Appendix 2: Costs of constructing snaileries</b>	<b>71</b>
	<b>Glossary</b>	<b>77</b>

# 1 Introduction

Snail meat has been consumed by humans worldwide since prehistoric times. It is high in protein (12-16%) and iron (45-50 mg/kg), low in fat, and contains almost all the amino acids needed by humans. A recent study has also shown that the glandular substances in edible snail meat cause agglutination of certain bacteria, which could be of value in fighting a variety of ailments, including whooping cough.

Edible snails also play an important role in folk medicine. In Ghana, the bluish liquid obtained from the shell when the meat has been removed is believed to be good for infant development. The high iron content of the meat is considered important in treating anaemia. In the past, it was recommended for combating ulcers and asthma. At the Imperial Court in Rome, snail meat was thought to contain aphrodisiac properties and was often served to visiting dignitaries in the late evening.

In West Africa, snail meat has traditionally been a major ingredient in the diet of people living in the high forest belt (the forested area other than the savannah forest). In Côte d'Ivoire, for example, an estimated 7.9 million kg are eaten annually. In Ghana it is clear that demand currently outstrips supply.

International trade in snails is flourishing in Europe and North America. However, in spite of the considerable foreign and local demand, commercial snail farms such as those in Europe, South-East Asia and the Americas hardly exist in Africa. In Ghana, Nigeria and Côte d'Ivoire, where snail meat is particularly popular, snails are gathered from the forest during the wet season. In recent years, however, wild snail populations have declined considerably, primarily because of the impact of such human activities as deforestation, pesticide use, slash-and-burn agriculture, spontaneous bush fires, and the collection of immature snails. It is therefore important to encourage snail farming (heliculture) in order to conserve this important resource.

## **Advantages of snail farming**

### *Environment*

Snails are environment-friendly, because, unlike poultry or pigs, neither the snail nor its droppings smell offensively. Snails can also be reared in the backyard.

### *Inputs*

Capital, technical, labour and financial inputs in simple snail farming are relatively low compared to those in other types of livestock farming (poultry, pigs, goats, sheep, cattle).

### *Snail meat*

Snail meat is a good source of protein. It is rich in iron and calcium, but low in fat and cholesterol compared to other protein sources like poultry and pigs.

## **Disadvantages of snail farming**

### *Climate*

Without expensive artificial means of climate control, snail farming is restricted to the humid tropical forest zone, which offers a constant temperature, high relative humidity, preferably no dry season, and a fairly constant day/night rhythm throughout the year.

### *Cultural restrictions*

Snail meat is considered a delicacy by some, whereas others will not even touch it for religious or cultural reasons.

### *Growth*

Snails are relatively slow-growing animals. Furthermore the consumable meat makes up only 40% (maximum!) of the snail's total live weight. Consequently snail farming is not a way to make money quickly!

### *Snails as a pest*

Snails that have escaped from a farm, or been dumped by a farmer, may quickly develop into a serious pest in agriculture and horticulture.

For these reasons it must be emphasised that snail farming should be seen as only one component in a diversified farming venture. However, with patience, good management and careful integration into existing farming activities, snail farming can provide substantial longer-term rewards.

### **Planning a snail farming venture**

A sequence of five steps is suggested:

- 1 Plan (market, production, organisation)
- 2 Pilot production and sales
- 3 Go or no-go decision
- 4 Investment in facilities and know-how (cages/pens, finance, knowledge)
- 5 Upscaling (logistics, quality, financial control)

### **Prescriptions**

The following chapters present prescriptions for the actual farming of snails, e.g. suitable snail species, environment, housing, stock, feed and health.

**Caution:** Before embarking on snail farming make sure you have a market! This may seem self evident; but there are many examples of cases in which giant African land snails (GALS) were introduced to other parts of the world for farming, but were eventually dumped (or allowed to escape) into the wild for lack of a market.

Once the snails have been introduced, dumped or allowed to escape, they develop into a serious agricultural pest. Without any natural ene-

mies they end up destroying a wide range of agricultural and/or horticultural crops and causing considerable economic damage. *Achatina fulica* has a particularly poor reputation in this respect.

Giant African snails are considered a delicacy by people accustomed to consuming them, whereas other people, even within the same country, will not even touch, let alone eat them. For that reason, **don't start farming snails unless you are absolutely sure someone will buy or eat them.**

## 2 Suitable species

### 2.1 Biology of snails

Snails belong to a group of invertebrate animals known as molluscs. Most molluscs carry a shell. Other members of this group include slugs, mussels, squid and cuttlefish.

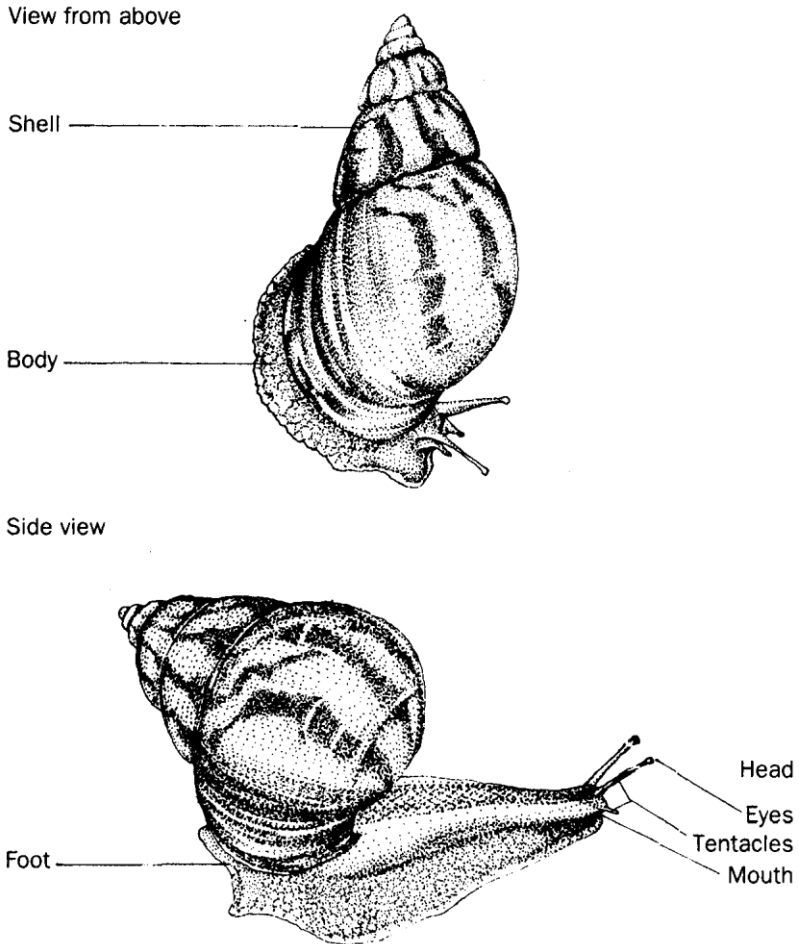
This book concentrates on the farming potential of the giant African land snails (GALS), more specifically the species *Achatina achatina*, *Achatina fulica* and *Archachatina marginata*. These belong to the family Achatinidae, a diverse group of large pulmonate land snails, originally from western, eastern, and southern Africa, with long slender shells. Their size ranges from 3 cm to 25 cm. The 14 genera are: *Achatina*, *Archachatina*, *Atopochochlis*, *Bequeartina*, *Burtoa*, *Columna*, *Callistpepla*, *Lignus*, *Limicollaria*, *Limicolariopsis*, *Lissachatina*, *Metachatina*, *Periderriopsis* and *Pseudachati*. They mostly live in jungles in tropical countries, but some may live in grassland. They primarily feed on fruits and leaves. They are easy to find and not difficult to rear. They lay several batches of eggs each year. Generally, they are quite easy to care for, being able to put up with a range of conditions.

Essentially, a snail consists of two parts, the body and the shell. The body is divided into three parts – the head, the foot and the visceral mass. The head is not well demarcated and carries two pairs of retractable tentacles. One pair of tentacles is far longer than the other and contains the eyes in the knobbed end. The long, muscular foot occupies almost the entire ventral surface and, like the head, is not clearly demarcated from the rest of the body. A shallow longitudinal groove runs along the centre of the foot. The hump-shaped visceral mass is housed in the shell above the foot. It contains the digestive, reproductive, and respiratory organs.

The skin over the visceral hump secretes a large calcareous shell (98% of the shell is made up of calcium carbonate). In most species the shell



accounts for about a third of the body weight. It is the snail's protective casing. Whenever danger threatens, the snail withdraws its body into the shell.



*Figure 1: The main anatomical features of a typical snail*

Although snails are hermaphrodites (i.e. they have male and female parts), in most species the individuals mate with each other before laying eggs.

## 2.2 Suitable tropical snail species for farming

A list of edible snail species of African origin is provided below. Europe and North America have over 20 edible species, of which the most popular are petit-gris or the small grey snail, *Helix aspersa*, the Burgundy snail, *H. pomatia*, and escargot turc or the snail of Turkey, *H. lucorum*. Snail meat of these species is known as 'escargot' in France; snail meat of GALS is sometimes exported from Africa and sold as 'escargot achatine'.

The most popular edible snails in West Africa are the giant snail, *Achatina achatina*, and the big black, *Archachatina marginata*. Local names are given in the list below. Most studies on snails in West Africa have concentrated on these two species and on the garden snail, *Achatina fulica*. In Ghana *Achatina achatina* is considered the most prized species for eating, followed by *Archachatina marginata* and then *Achatina fulica*.

### Edible snail species of African origin

*Achatina achatina*. Common name: giant snail, tiger snail (Ghana)

Local names (corresponding language within parentheses):

Gambia: honuldu

Sierra Leone: konk

Liberia: dain (Nano), drainn (Gio)

Ghana: abobo (Ewe), elonkoe (Nzima), krekete (Hausa), nwapa (Akan), wa (Ga), weJle (Dagarti)

Nigeria: katantawa (Hausa), ilako, isan (Yoruba)

East Africa: konokono (Swahili)

*Achatina fulica*. Common name: garden snail, foolish snail (sometimes also called the giant African snail)

Ghana: nwa (Akan)

Northern tribes of Ghana, Burkina Faso, Togo, Nigeria: kreteke

Nigeria: eesan or ipere (Yoruba)

Kenya: ekhumuniu (Luhya), kamniyo (Luo)

East Africa: konokono (Swahili)

*Archachatina marginata*. Common name: big black snail, giant African land snail

Liberia: proli (Kepelle)

Ghana: pobere (Akan)

Nigeria: igbun (Yoruba), ejuna (Ibo)

Other edible species exist, but they are of minor, local importance. The local name usually refers to all edible snail species in the country. Figure 2 shows the distribution, in Africa, of the three species on which this booklet concentrates: *Achatina achatina*, *Archachatina marginata*, as well as the (reputed) original source area of *Achatina fulica* in East Africa.



Figure 2: Approximate original distribution of the 3 GALS species discussed in this ebook

To avoid confusion, this book refers to the three snail species discussed by their scientific (Latin) name.

## 2.3 *Achatina achatina*

*Achatina achatina* (giant snail, tiger snail), a widely distributed species in West Africa (particularly in Benin, Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone and Togo), can be considered a good candidate for snail farming in most areas of West Africa, although it requires higher humidity than the other two species and needs a longer growing time to reach sexual maturity.

### Description

*Achatina achatina* snails are reputedly the largest land snails in the world. Although usually much smaller, they can grow up to 30 cm in body length and 25 cm in shell height. Average adult shell length is 18 cm, with an average diameter of 9 cm. The conically shaped, fairly pointed shell is brownish with a characteristic stripe pattern (hence the name tiger snail).

### Distribution

*Achatina achatina* originates from the West African rainforest belt, from Guinea through Nigeria. Because *A. achatina* is the most prized species for consumption in Ghana it is becoming increasingly rare in the wild.

Several ecotypes (locally adapted populations of *A. achatina*) can be found, with differences in growth rates, size, aestivation (dormancy) patterns, colour and even flavour. The differences in size may be explained partly by differences in the length of the aestivation period; the shorter the aestivation period, the longer the feeding period and the larger, therefore, the ecotype.

A study of the three ecotypes in Ghana, known as donyina, apedwa and goaso, showed significant differences between them. The apedwa snails had the shortest aestivation periods, the donyina snails the long-

est. The apedwa snails were the largest of the three ecotypes; some were twice the size of *Donyina* snails. In Ghana, this ecotype would be recommended as the best candidate for snail farming.

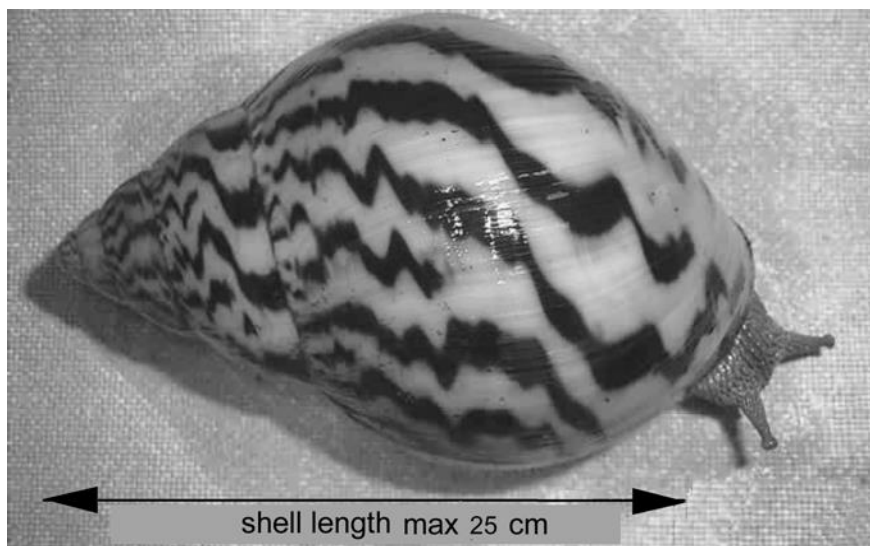


Figure 3: *Achatina achatina*

### Growing conditions

The species prefers warm conditions, 25-30 °C and a relative humidity of 80-95%. *A. achatina* is said not to be the easiest species to farm because of the very steady conditions it is used to in the wild: a practically constant 12/12 photoperiod, only extending to 13/11 for about 3 months, and a temperature difference between night and day of only 2-4 °C. Even in the most humid areas of West Africa the snail, in its natural habitat, buries itself for aestivation during the drier months.

### Life history

*Reproduction.* *Achatina achatina* reproduces by self-fertilisation. Unlike in many other species, reproduction is not preceded by coupling, although it is not unusual to find two snails in close proximity.

Studies (Hodasi, 1979) indicate that the species breeds in the main rainy season (April-July in Ghana).

*Laying.* Laying usually takes place in the late evening and night. Eggs are laid in clutches of 30-300 eggs. They are broadly oval, dirty yellowish, 8-9 mm long and 6-7 mm wide. Eggs are deposited in dug-out holes about 4 cm deep. When small clutches of eggs are laid, a second laying is indicated, and sometimes a third.

*Hatching.* Usually, the eggs hatch 2-3 weeks after laying, with a range of 10-31 days, depending on temperature. *A. achatina* has a high hatching rate of 90+%; even 100% hatchability is not uncommon.

*Hatchlings.* The baby snail has a thin shell membrane which calcifies progressively. Although this period is characterised by rapid growth, the snails are able to survive the first few days (5-10 days) after hatching without food.

*Juveniles.* The juvenile phase covers the period from 1 or 2 months to the stage of sexual maturity (14-20 months). During this period, the snail accepts a much wider range of food. At the end of the period, the shell is well formed and the snail weighs between 100 and 450 g. Differences in growth rates of the various ecotypes are very evident during this period.

*Adults.* The adult phase starts when the snail reaches sexual maturity. Not all adult snails lay eggs each season. An average life expectancy is 5 to 6 years, although there are reports of snails surviving up to 9 or 10 years.

## **2.4 *Achatina fulica***

### **Description**

*Achatina fulica* (garden snail, foolish snail) is a large snail, reaching 20 cm in length or occasionally more, with a shell length up to 20 cm and a maximum diameter of 12 cm. The conical, spiralled shell is pre-

dominantly brown with weak, darker banded markings across the spiral. Colouration is highly variable, depending on diet. A mature snail averages 250 g in weight.

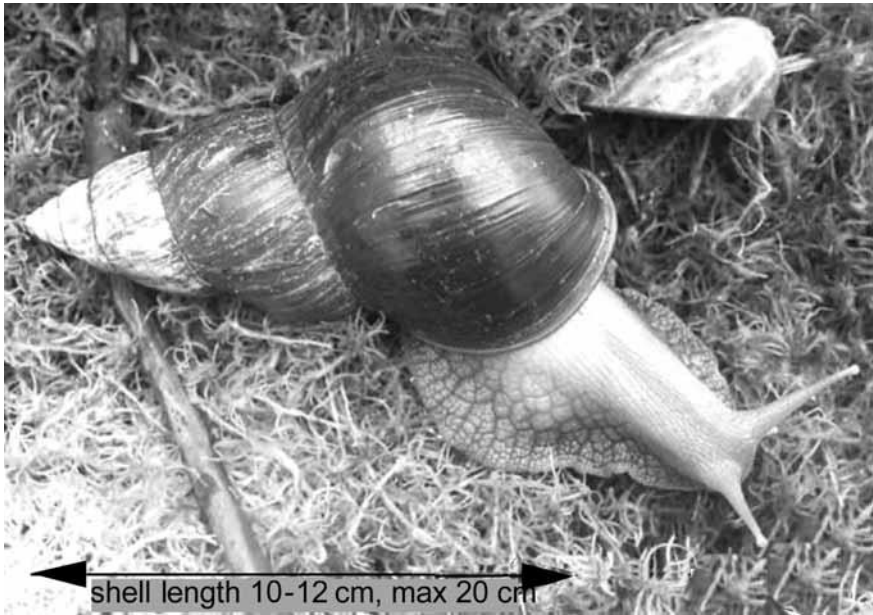


Figure 4: *Achatina fulica*

### **Distribution**

The species originated in the coastal regions of East Africa (Kenya, Tanzania), and spread by the 19<sup>th</sup> century into Southern Ethiopia, Southern Somalia, and Northern Mozambique. During the 19<sup>th</sup> century it was introduced into India and the Indian Ocean islands. During the 20<sup>th</sup> century it was introduced, sometimes intentionally, into South East Asia, East Asia (Taiwan, Korea, and Japan), Australasia and the Pacific, the USA (now eradicated in various states), the Caribbean, Central America and South America (Brazil).

### **Growing conditions**

The species is highly adaptable to a wide range of environments, modifying its life cycle to suit local conditions.

## **Life history**

*Reproduction.* Without delays because of aestivation or hibernation, snails will reach sexual maturity in less than a year (even as early as 5 months under laboratory conditions). Reciprocal copulation (6-8 hours) must occur to produce viable eggs.

*Laying.* The small (4 mm in diameter) yellowish-white eggs are laid in clutches of 10-400 eggs within 8-20 days of copulation, usually in nests excavated in the soil. Repeated layings may result from one copulation, as sperm is stored in each snail.

Egg laying frequency depends on climate, particularly on frequency and duration of the rainy seasons: up to 500 eggs per year in Sri Lanka, 300 per year in Hong Kong, and 1000 per year in Calcutta.

*Hatching, hatchlings.* Upon hatching, the hatchlings consume their eggshells (and unhatched siblings), remaining underground for 5-15 days and feeding on organic detritus. Eventually they feed primarily on plants at night, returning to roost before dawn.

*Juveniles.* Animals with shell lengths of 5-30 mm apparently cause the most damage to plants.

*Adults.* The snails may reach sexual maturity in less than a year. Larger snails continue to feed on plant materials, but feed increasingly on detritus as they age. Normally, they live for 3-5 years.

## **Significance as a pest**

The species causes considerable economic damage to a wide variety of commercial crops. In most parts of the world, the amount of damage is greatest when the species is first established; during this period, snails are usually very large and their populations can become immense. This is followed by a stable population phase, and then finally a period of decline.



## Parasitology

*Achatina fulica* is reported to be an intermediate vector of the rat lungworm *Angiostrongylus cantonensis*, which can cause eosinophilic meningoencephalitis in humans; as well as of a gram-negative bacterium, *Aeromonas hydrophila*, which can cause a wide variety of symptoms, especially in persons with compromised immune systems.

## 2.5 *Archachatina marginata*

### Description

*Archachatina marginata* (big black snail, giant African land snail) is a large snail, generally growing to about 20 cm and a live weight of 500 g. The shell is much less pointed than the *Achatina* species, the roundness being especially obvious in young animals. Striation on the shell may give the appearance of a 'woven' texture. The head of the snail is dark-grey; its foot is a lighter shade.

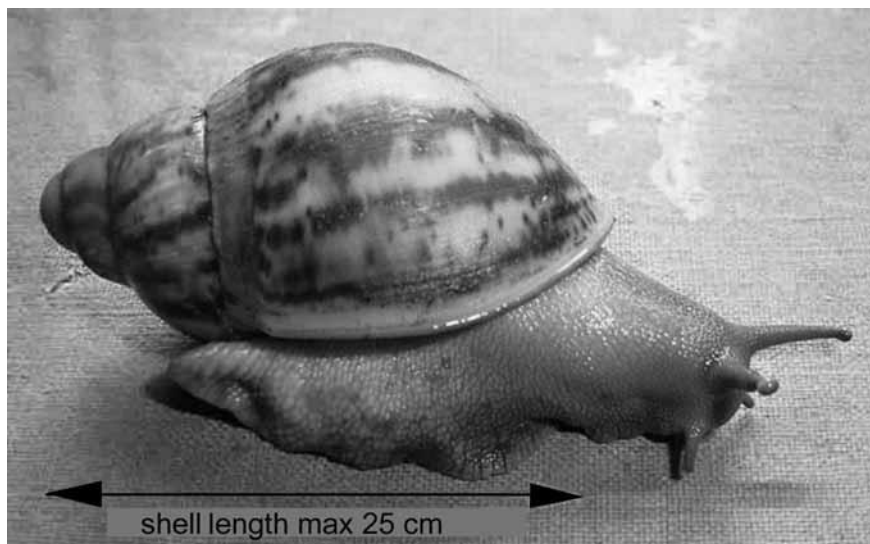


Figure 5: *Archachatina marginata*

This species has been the object of a series of stocking and feeding experiments in Nigeria (discussed in Chapter 5).

### **Distribution**

*Archachatina marginata* is native to the humid African rainforest belt, from Southern Nigeria to Congo, but is now found in other parts of the African rainforest zone.

### **Growing conditions**

In the Nigerian experiments, juvenile growth was found to be inversely proportional to temperature, falling sharply at temperatures > 30 °C, and directly proportional to rainfall and humidity. Body weight gain slows down significantly during the dry season (December to March in Southern Nigeria, where the breeding trials took place).

### **Life history**

*Reproduction.* The species reaches sexual maturity at an age of around one year, when the individuals reach a live weight of 100-125 g. Reciprocal copulation must occur to produce viable eggs.

*Laying, eggs.* The eggs are comparatively large at 17 × 12 mm, with an average weight of 4.8 g in a Nigerian stocking trial. For that reason the number of eggs per clutch is low, 4-18 eggs. Eggs are laid in the soil at a depth of about 10 cm.

*Hatching, hatchlings.* The incubation period, from egg to hatchling, is around 4 weeks. Hatchlings have a thin, transparent shell; they generally remain in the soil for 5 to 7 days before emerging, but sometimes wait even longer. Because of the relatively high weight of the eggs the number of hatchlings from a clutch is low compared to the other two species. During the first weeks after emerging, hatchlings repeatedly burrow into the soil.

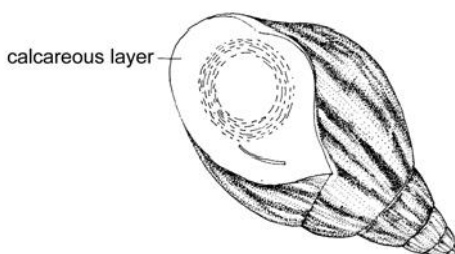
*Juveniles.* In laboratory trials shell length of the juvenile snails increased by an average of 0.33 mm/day for the first 8 months (c. 8 cm),

slowing down to 0.2 mm/day at 15 months. Shell length hardly increases after that time.

*Adults.* The snails reach sexual maturity at around 10-12 months (Plummer, 1975).

## 2.6 Climatic and environmental requirements and restrictions for raising snails

From the descriptions of the three major GALS species it is clear that snails, as cold-blooded animals, are sensitive to changes in atmospheric humidity and temperature. GALS, especially *Achatina fulica*, are able to put up with a range of conditions, but when temperature and/or humidity are not to their liking, they go into dormancy. The snail retracts its entire body inside its shell, sealing off the opening with a white, calcareous layer to prevent water loss from the body (see figure 6). This reaction is typical of all snail species.



*Figure 6: Aestivating snail sealed into its shell by a calcareous layer*

Snails aestivate if the *temperature* is too high, > c. 30 °C, or if *air humidity* is too low, < c. 70-75% relative humidity.

Snails hibernate if the *temperature* drops below c. 5 °C.

For the snail farmer the result is the same: his (or her) snails become inactive and stop growing, losing valuable growing time, while expenses for housing, tending and protection continue.

Consequently, it is in the snail farmer's interest to prevent, or at least reduce, dormancy

- by selecting the most favourable site for the snail farm (Chapter 3)
- by providing good housing for the snails (Chapter 4)
- by providing good feed and ensuring good snail farm management (Chapters 5, 6).

Obviously, it is possible to farm snails in a completely controlled environment, but this would require considerable investment costs, and is therefore presumably outside the scope of the farmers for whom this book is intended. Without artificial climate control, successful commercial snail farming is more or less restricted to areas with the following characteristics:

- Temperature: a steady year-round temperature of 25-30°C, and a low fluctuation between day-time and night-time temperatures.
- Day-length: a fairly constant 12/12-hour photoperiod throughout the year.
- Air humidity: a year-round relative air humidity of 75-95%.

These conditions correspond to the tropical rainforest climate zones – and they work best when there is no pronounced dry season or strong fluctuations.

## **2.7 Cultural and religious restrictions on handling and eating snails**

Certain religions, notably the Islamic and Jewish faiths, specifically prohibit eating snails or snail meat – a fact to be considered when planning a snail farming venture in regions where these religions are present or dominant.

Local customs or cultural preferences may prevent people from eating or even handling snails – again a factor to take into account before embarking on snail farming.

If you are ready to get the full copy of this goat farming ebook [pdf], pay #3,000 Naira to the bank account below, send an email to [info@livestocking.com](mailto:info@livestocking.com) or SMS +2348035428873 which should include your name, amount sent and deposit slip/transaction ID.

**Bank Name: Guaranty Trust Bank**

**Account No: 0140162207**

**Account Name: Akinbobola Akinwemoye**

If you are not in Nigeria and you want to pay, kindly send me an email to inform you on how to get the ebook.