FROG FARMING IN THAILAND

Putsatee Pariyanonth

Assistant Professor, Department of Biology, Faculty of Science, Chulalongkom University, Bangkok 10330, Thailand.

Veerote Daorerk

Lecturer, Department of Geology, Faculty of Science, Chulalongkom University, Bangkok 10330, Thailand.

ABSTRACT

Frog farming has become quite popular in Thailand in the last decade. Three species, *Rana tigerina*, *R. rugolusa* and *R. catesbeiana*, are commonly farmed in many parts of the country. Various techniques have been applied to the farming systems so that frog meat can be supplied to the markets all year round. Many types of frog pellets are produced which make frog culture more convenient. In addition, induced spawning has been successfully experimented with resulting in a rapid increase in reproduction of frogs. With the advances in biotechnology, frog farming can certainly be raised to the agro-industry level in the near future.

INTRODUCTION

One common source of food that has great potential for development in a country like Thailand is frog farming. The demand for food to feed the rapidly increasing human population could help to raise farming to a commercial scale in the foreseeable future. Frog meat is very popular in Southeast Asia. It is also a delicacy in many Western countries where it is served in high class restaurants at expensive prices.

Frog farming in Thailand started 20 years ago. Traditionally, the farmers obtained froglets from the wild during the rainy season. Rearing was done in mud ponds which were very near to the natural condition, but they were difficult to clean and drain. The frogs were easily exposed to predators and diseases and were difficult to harvest for sale. Lately, however, farming techniques have been developed in a more scientific manner.

The frogs commonly found and farmed in Thailand are the local species *Rana tigerina* and *Rana rugulosa*. The imported bullfrog, *Rana catesbeiana*, was first introduced in 1980, and has become popular in the northern part of the country.

Rana tigerina which is about 15 cm long when full grown, is olive brown in colour with numerous small black spots. Its nostrils are much nearer the tip of the snout than to the eyes. Its lips have dark spots separated by cream. The adult weighs about 300 g. The species is distributed all over Thailand.

R. rugulosa, the other local species, is olive brown in colour with a darker head. The nostrils are much nearer the eyes than the median tip of the snout. It is about 13 cm long when full grown and weighs about 270 g. It is also distributed all over Thailand.

The introduced species, *R. catesbeiana*, is about 17 cm long when full grown with a weight of about 450 g. Its upper parts are olive brown to green, rarely black with dark spots; the underparts have a few black markings. Its natural distribution range is southeast Canada and eastern and central USA. The tympanum of this species is clear and rounded, particularly in the male, where it is larger than the eye. In the female, the tympanum is similar in size to the eye.

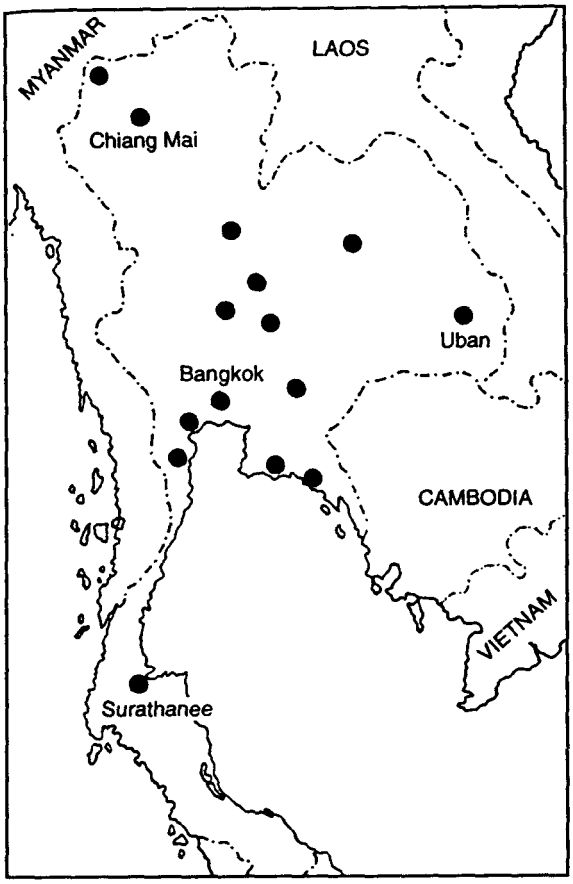
The life history of frogs is strongly influenced by the abundance of water in the form of rain. They belong to the class Amphibia and are poikilothermic (cold-blooded) animals. The females lay their eggs in water and the larvae spend their life in water.

FARMING

Concrete ponds were introduced into the farming system in the last decade. They are now accepted as a successful method of raising frogs and are widely employed by farmers. A recent random survey around the country found that there are more than 300 frog farms operating on a commercial basis (Figure 1). Most of them prefer raising the local species to the imported ones.

For the local frogs, the cement ponds used are normally 3 x 4 m in dimension and 1.2 m high, with water maintained at 20-30 cm depth. Platforms are provided so that the animals can get out of the water from time to time and food can be placed on these platforms (Figure 2). For the local species, the stocking capacity

Figure 1: Location of frog farms in Thailand



of the pond is about 80-100 full grown frogs per m^2.

The bullfrogs are less aquatic than the local frogs. They do not like to stay in the water all day long. Permanent platforms are, therefore, needed. The rearing ponds are around 2 x 3 m and 1.2 m high or proportionally bigger. However, only a small amount of water, to a depth of 5-7 cm, is needed. The stocking capacity of the pond is around 50-80 full grown frogs per m^2.

BREEDING

In nature, ovulation in the local species of frogs is triggered by rains at various times during the year except in the winter months (December-February). Mating and breeding of both local and imported frogs in confined semi-natural conditions, as well as in concrete ponds, are quite successful. It has also been found that the mature male and female frogs will copulate under water temperature conditions ranging from 25-30°C.

Controlled reproduction of the three species of frogs in the breeding season has also been successfully carried out by using GnRH analogue to induce spermiation, ovulation and mating. Spermiation was successfully induced by the intraperitonial injection of a single daily dose of GnRH over three consecutive days; the dosage used was 5µg/kg body weight on the first day, 10 µg/kg on the second, and 20 µg/kg on the third. For inducing ovulation, a double daily dose of GnRH was injected: 2.5 and 5 µg/kg body weight on the first day, 5 and 10 µg/kg on the second, and 10 and 20 µg/kg on the third. The time interval between the two injections each day was 4-5 hours.

Induced mating can also be done by treating only the female frogs with the proper males in the breeding season (May-August). Positive results show that two doses of 2 and 3 µg/kg body weight GnRH analogue injected in the female could induce 100% ovulation and 92% fertilisation. In another treatment, however, three injections of 2, 3 and 3 µg/kg body weight GnRH in the female could induce 100% ovulation and 80-90% fertilisation. The interesting results obtained using GnRH analogue with the doses and treatments mentioned, can be used to extend the mating period considerably.

Fertilised eggs of the local frogs, normally develop into tadpoles within 18-38 hours; the tadpoles later metamorphose into froglets within 28-36 days at 30-34°C. The fertilised eggs of the bullfrogs, on the other hand, have a more variable development. As the temperature ranges from 12-37°C, metamorphosis is 100 percent complete at the age of 75-90 days in warmer areas. In the cooler areas, metamorphosis is 100 percent completed at the age of 6-17 months.

FEEDING ACTIVITIES

Food pellets of the same type can be used for both the local frogs and the imported bullfrogs. When they are tadpoles, pellets of 30-40% protein content are used. The local tadpoles are first fed at the age of 3 days while the bullfrogs are fed at 5 days. When they become froglets, pellets with a protein content of 28-40% are used until they reach market size. The local frogs will, then, weigh about 300-400 g; they take 4-5 months from the larval stage to reach this size. However, for the bullfrogs, a longer time, up to 6-8 months, is needed (Figure 3). The Food Conversion Ratio (FCR) is 1:1.2-1.5 for the local species of frogs and 1:1.5-2.0 for the bullfrogs.

The traditional method of feeding is still employed in many areas where fresh fish can easily be obtained. Small fish are ground for the tadpoles and are chopped up to fit the size the frog's mouth for the froglets and the fully grown frogs. However, due to the scarcity and high price of the fish and many other inconveniences, pellet frog foods are now

Figure 2: Concrete ponds used for rearing frogs

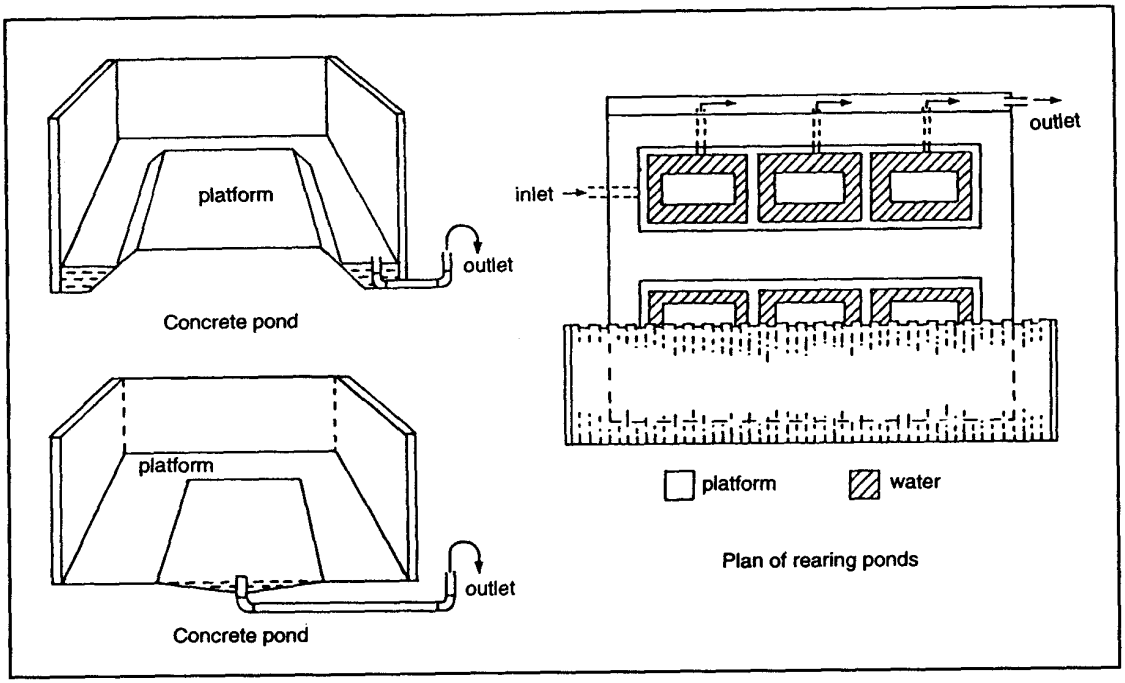
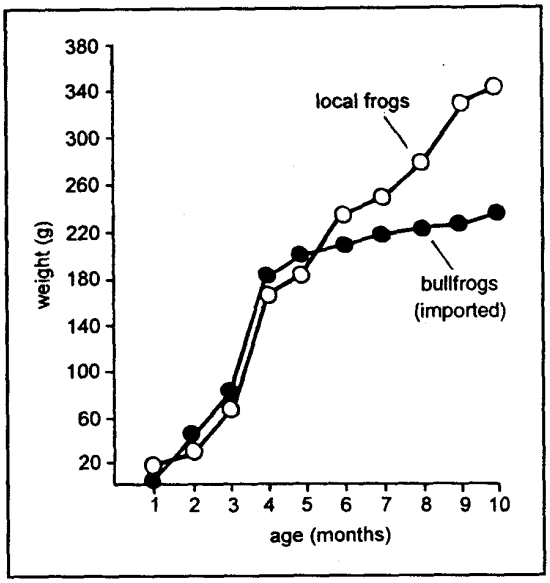


Figure 3: Growth rates of the local and imported frogs fed pelleted feeds



getting more popular.

DISEASES

Red leg disease is the most common disease in frog culture. It is caused by the bacteria *Aeromonas hydrophilla*. This bacteria can easily attack when frogs are particularly weak due to environmental stress, such as caused by polluted water, sudden climatic change or other contamination. Treatment for at least 4-5 days with antibiotics administered via the feed is needed. The sick frogs should also be isolated. However, more frequent change of water to reduce bacterial growth can be of great help.

Various kinds of worms are frequently found in the intestinal system, muscles and skins of frogs. They can seriously reduce the growth rate of the animals. The causes of the worm diseases must be quickly identified and anti-worm drugs should be administered.

Skin wounds caused by fungi are also serious problems in frog farming. The particular fungi are mainly found in water, and enter the skin through pre-existing wounds, consequently enlarging the wounds. Isolation of sick frogs has to be done as quickly as possible and anti-fungal drugs, together with antibiotics, are needed.

MARKETING

At present, frogs can be sold easily on the local markets. They can also be exported to countries such as Hong Kong, Singapore, Malaysia and

Western countries. They are normally exported in either of two conditions: alive or slaughtered. It has been reported that, currently, at least 50 mt per month are exported. This amount is increasing each year.

RESEARCH ACTIVITIES

In order to develop the biotechnology of frog farming, a laboratory and research centre was established by Chulalongkorn University in 1984. During the first few years, the focus of research was on local frogs; later, the imported bullfrog was also worked on. Basic studies are carried out in many fields such as ecology, taxonomy, growth and development, reproductive physiology, genetics, culturing, selective breeding, diseases and farm management.

Although the laboratory studies are mainly performed in the Department of Biology, there are, at present, two other experimental centres in the country along with the main research unit. These two centres, one in Petchaburi province and the other in Chiang Mai, were set up in cooperation with the Royal Development Study Centre Programme. They are aimed at enhancing research on frog culture and providing technical know-how to the local frog farmers. Advanced biotechno-logical studies are still under way. Techniques for selecting better strains are being developed gradually at each centre. Certainly, this will lead to future large scale farming of frogs as an agroindustry.

The research is funded mainly by Chulalongkorn University and the Royal Development Study Centre.

THE FUTURE

Frog culture has been proved to be successful in many parts of Thailand because of low investment and relative ease of farm management. With advances in biotechnology, many different types of food are available in the market adding to the convenience of local farmers. As a result, the production of frog meat is gradually increasing. At present frog meat is being produced out of season by local farmers economically. Frog skins are not only good as food, but can also be developed into many forms of handicrafts, such as purses and souvenirs. There are quite a few countries where frog meat is popular which means that the outlook for export of frog meat is bright. With good farm management, frog culture in Thailand can be raised to the agroindustry scale in the near future.

Acknowledgement

The authors wish to express their sincere gratitude to the Chulalongkorn University for providing funds for the continuing frog research studies. The Royal Development Study Centre has helped greatly in the success of the research by providing funds, facilities and field stations. The Department of Biology of Chulalongkorn University is also thanked for allowing the research team to undertake the studies both in the laboratories and in the experimental stations. Special thanks are due to those contributors and private organisations who have offered much help to the team in the course of the research activities.

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