

THE KEEPING OF AMPHIBIA

By N. WHITE

General environment. The frogs and toads are kept in a small brick outhouse, 10 feet by 9 feet, facing north. The average temperature through the year is 65-70° by day, although this tends to drop at night. These conditions are ideal for all species as the temperature is not too high for temperate or too low for tropical creatures. Paraffin heating is used throughout the winter, but in summer this is abandoned: the temperature then occasionally drops to about 60° and sometimes goes above 70°F., but never gets hotter than the outside temperature, owing to the north aspect. This means that abnormally high temperatures are never sustained for any length of time.

All tank covers are of glass, since use of netting very rapidly results in the interior of the tanks becoming very heavily filmed over with paraffin. The use of glass also means that moisture condenses inside the tanks, so that there is a very much greater humidity, while heat is also retained inside any tanks requiring individual heating. All frogs of the genus *Rana* seem to keep better under more humid conditions, as also do *Discoglossus*, *Bombina*, *Pelobates* and toads of the genus *Bufo*. Tree frogs of the genus *Hyla*, however, seem to do less well under these conditions.

The conditions are very crude, the outhouse being badly ventilated, with fixed windows, so that the odour of paraffin is always present. Sunlight is never available, and the position of their tanks means that many species are kept permanently in a half light. The tanks are very rarely cleaned out, and the diet given is monotonous. Success in keeping the various species is felt to be due to strict adherence to the following rules:—

1. Temperature is never allowed to drop below the standard minimum.
2. Feeding is regular and plentiful.
3. Tanks must never be overcrowded. A minimum of 50 square inches of space is allowed for specimens 2-3½ inches in body length, this being modified for smaller or larger specimens.
4. Different species are kept separately, where possible, even if this may mean devoting a whole tank to one worthwhile specimen.
5. Once a new specimen becomes settled and content in any environment, it is kept permanently in that tank under these some conditions. Until it is happy, experimentation with the environment must be tried; but once it is happy, needless changes may completely undo good results.
6. All newly acquired specimens are quarantined for 6 weeks, and are only then placed in any tank containing good stock if they

2. BLOWFLIES. All creatures which will not take worms (*Hylidæ*, etc.), are fed twice a week on flies, and all those which receive worms once a week are given flies once a week, midway between their meals of worms. Flies are not given to *Rana adspersa*, *catesbeiana* and *tigrina* at all, owing to fear of their injuring themselves while leaping after flies.

3. GENTLES. All those animals which take neither worms nor flies are fed on gentles twice a week, of which a regular supply is obtained weekly. A small quantity of very little gentles is supplied with the others each week, and these change into very small flies, which prove an invaluable food for very small species which would otherwise require the labour of breeding fruitflies.

Flies are bred from the gentles in about $3\frac{1}{2}$ weeks from the time of receiving them. After taking the gentles required for immediate feeding each week, the rest are shared out between a set of 15 jam-jars and left to pupate. The jars have cloth covers, so as to prevent the flies from being too moist on emergence. Four sets of jars are used in rotation.

Consumption of paraffin during the winter, with one large and four small stoves in use, should be about six gallons of paraffin per week, and much less in mild spells.

FEEDING

New arrivals are given as much food as they can possibly take for two or three weeks, until they are in good "fat" condition. They are then treated in the same way as old stock.

Virtually only three forms of food are ever used—worms, blowflies and gentles.

1. WORMS. All frogs and toads (other than bullfrogs) which will take worms readily are fed one or two every week. Bullfrogs (*Rana catesbeiana*, *adspersa*, *tigrina*, *grylio* and *heckscheri*) are fed an average of one worm a day. Worms are never just dropped into the cage and left (since such worms merely find their way down to the bottom and remain there until the tank is cleaned out), but care is taken that each creature eats its worm. In cases of refusal, the worms are removed.

Worms are usually available throughout the year when collected at night by flashlight. They are usually present in profusion at any time of year when the ground is wet from recent rain, and especially on a fairly windless evening about an hour after dusk, at around 45°—50°C. A weak light should be used. After long spells of drought, it may take two or three days before the worms reach the surface after rain. Close-cropped lawns are the easiest to work, and the nearest large public one or verge should be used.

In either drought or frost, worms should never be unobtainable for longer than a month. Surplus ones can be stored for weeks in cans containing completely dry old leaves and a piece of dry moss; the moisture of newly-caught worms will keep this damp enough. No earth should be used. Always divide your stock amongst a number of tins in case of disaster to some. Only entire and undamaged healthy worms should be stored. These should be sorted from the others one day after catching, all doubtful ones being used immediately as food. Examine the cans every few days for dead worms, which can be detected by their smell.

If the stock of worms is completely exhausted and there is little chance of replacement, then (and only then) will snails have to be used for bullfrogs and *Bufo marinus*, which will only take these when shelled. The best method is to hit them against a brick, and then peel off the pieces under water in a small bowl. Care should be taken to remove the small jagged bit of shell which often remains at the centre of the snail. In the event of neither worms nor snails being available, the large species can be fed on strips of fish or raw meat, which can be dropped in front of them and agitated with a stick. Fish (especially fresh water ones) are preferable to meat: strips should be on the small side, as frogs often get into difficulties with larger pieces.

are still in as good condition (or better) as when received. This is of extreme importance.

The furnishing of tanks is kept down to a bare minimum. Deaths can thus be readily noticed in time to remove the corpse before decay has started. Tanks are made up with varying proportions of land and water (50-50, 75-25, 25-75) the land being made from gravel sloping into the water, or with 2 inches of water over a level gravel bottom, or divided so as to give equal proportions of mud and water. Hideouts may or may not be present, according to the species. Water and moss are changed every month or every three months, according to type of cage, while water bowls are changed every two weeks. Entire cages are cleaned out every six or twelve months. All this cleaning is done by rota. Paraffin is wiped from the outside glass of all tanks every month.

HEATING

Points about the use of paraffin are :—

1. The odour, if disliked, can be minimised by putting mothballs into the store can.
2. By using glass covers to tanks, the entry of paraffin is very slight.
3. Effect of paraffin on the livestock is negligible. Frogs have survived two winters of this heating.
4. The humidity of the air is not affected by this fuel, unlike others which tend to dry it out.
5. The fuel is reliable, comparatively cheap, and not subject to power cuts.
6. Various temperatures can be used, by adjusting the rate of burning.
7. Only comparatively little light is given out (which does not affect the depth of darkness at night).
8. A reserve stove can always be ready in case of a failure of the one in use.

Two stoves of the "Valour" type are used, the second one being lit only if the outside temperature is below 37°F. Temperature can be controlled by variation of the height of the flame according to the weather. With the flame full on, a newly-filled stove burns for some 15 hours, so that one regular filling at 8 a.m. and another at 8 p.m. will keep it running day and night through the winter. If the flame be blown out instead of turned off when refilling is taking place, the wick will very rarely need trimming.

If additional heat is required for tropical creatures, small round flat "Buffam" lamps are placed beneath their tank. These burn for seven days on one filling of two pints, and will produce additional heat up to 80°F. on even the coldest day. A sheet of slate or asbestos should be placed directly below the tank, with the lamp turned low about 2 inches below this.