

## Ornamental Fish Farming

- **Growth rates.** Within ranges of tolerance for the species, growth is faster at warmer temperatures.
- **General well-being.** Fish kept out of their preferred temperature range for prolonged periods are more susceptible to disease.
- **Willingness of fish to spawn.** Generally, willingness to spawn decreases as temperatures move away from preferred ranges, especially if temperatures are too low, though a small overnight drop can actually help in a few cases. A sustained increase of around two degrees in water temperature may encourage spawning in some species, while for others, notably some corydoras and goldfish, a drop of 3° to 4°C (5.4° to 7.2°F) overnight can induce spawning. Significantly, for most egg-scatterers, a change to fresh water and a good spawning environment is so conducive to spawning that a drop or increase of a degree or two in temperature makes little if any difference, and the change may even be helpful.
- **Hatching time for eggs.** Within their range of tolerance, eggs hatch faster at higher temperatures than lower.
- **Hatch rate of eggs** (the percentage that hatches). All fishes' eggs are sensitive to temperature to some degree, but characins' eggs in particular are inclined to be detrimentally affected by high temperatures. This means that the optimum temperature range for hatching most characins' eggs is somewhat lower than for most other tropical species. More specific information is given later.
- **Higher temperatures increase the proliferation of fungus, bacteria and protozoa** which can be very detrimental to eggs and larvae.
- The **effect of some toxins**, such as ammonia, is influenced by temperature (and other factors.)
- **Dissolved oxygen levels** are affected by temperature – the warmer the water, the lower the levels of oxygen that will remain in solution and available to fish.
- **Fish are more easily stressed as temperatures approach the higher or lower limits of their tolerance. Handling fish in these circumstances can be difficult.** In particular it is advisable to delay harvesting if temperatures are unfavourable. At high temperatures reduced oxygen levels can worsen the problem.
- **Chemical and biochemical processes are accelerated by warmth.** This includes the metabolism of fish, which is said to double for every 10°C rise in temperature within their normal living range. Oxygen is essential to many biochemical processes, and its availability in water declines as temperature rises. For this reason, deterioration in water quality tends to occur more easily and very much faster at higher temperatures than lower.

**Later in the book, if actual temperatures are not given, the following categories of temperature are used:**

|                  |                           |
|------------------|---------------------------|
| <b>Cold</b>      | – below 22°C (72°F)       |
| <b>Cool</b>      | – 22° – 24°C (72° – 75°F) |
| <b>Mid-range</b> | – 25° – 26°C (77° – 79°F) |
| <b>Warm</b>      | – 27° – 29°C (81° – 84°F) |
| <b>Very warm</b> | – 30°C (86°F) and above   |

Because the acceptable temperature range for grow-out is generally wider than for breeding, unless otherwise stated, when temperatures are suggested for individual species, unless otherwise specified these are given as an acceptable or preferred **breeding** range. It is in any case generally impossible and unnecessary to provide optimum temperatures for each stage of production for each species when working with multiple species in one facility.

See following page for **Temperature Conversion Table**.

Temperatures can also be converted arithmetically. To convert Fahrenheit to Centigrade, subtract 32, multiply by 5, and divide by 9. To convert Centigrade to Fahrenheit, multiply by 9, divide by 5, and add 32. For practical purposes, at sea level freshwater freezes at 0°C (32°F) and boils at 100°C (212°F).