

# POND HYGIENE

A garden pool is a confined space. Its biological equilibrium can be established on a scientific basis, but it will always be very much influenced by environmental conditions. For this reason, a regular check of a number of parameters is essential for preventing accidental imbalance, and correcting it if the need arises.

## THE WATER

### Sun

About 1/3-1/2 of the surface of the pool must be exposed to sunlight (1/3 is sufficient in very sunny climates).

When there is insufficient sunlight, the water does not heat up sufficiently, the fishes' metabolism is slowed down, and oxygenating plants cannot develop properly.

- Keep surfacing and floating plants under control by cutting back or removing parts of the most invasive species (*Azolla*, *Callitriche*, *Nymphoides*, *Potamogeton*, *Nymphaea*, *Lemna*, etc.)

- Prune (or move) plants on the banks which cast too much shadow over the water.

- If there is too much organic matter in suspension, the water will become cloudy. Water lilies, oxygenating plants, and fresh-water mussels will help to solve this problem.

Excessive sunlight encourages the development of filamentous algae and animals will suffer in over-heated and poorly-oxygenated water.

- Introduce plants with floating foliage : water lilies, potamogeton, azolla, lemna, etc.

- Plant trees and shrubs on the banks, but not too near the pool.

### Water level

There may be considerable loss from evaporation, especially in summer, depending on climatic conditions. Although rainfall will compensate to a certain extent, the best means of avoiding too great fluctuations in level is a level control device with a float.

- Failing that, add water regularly, in small quantities, to avoid a sudden drop in the water temperature.

A sudden fall in the water level may be caused by :

- the roots of plants on the banks (shrubs, grass);

- the collapse of the pond margin, if a flexible liner has been used (people walking over an area which has been incorrectly laid);

- a leak in the liner, which may be perforated by tools or damaged by burrowing animals. In this case, allow the water level to stabilize, then locate and repair the damage.

### Temperature

Water temperature could be regularly measured and recorded (once a week) during the first year. After that, special attention might be needed only during extremely hot or cold weather, although regular measurements would be necessary if the pool is particularly sensitive to weather conditions because it is shallow, less than 60 cm (24 in), or small in volume, less than 3.5 m<sup>3</sup> (125 ft<sup>3</sup>). Measurements should be made in the morning and late afternoon, on the surface and at the deepest point. Use a maximum and minimum thermometer.

- In autumn, when the temperature drops towards 10 °C (50 °F), start protecting the pool against frost. In winter, check that the temperature in the deepest area does not fall below 3-4 °C (37-39 °F).

- In summer, when the temperature rises above 25 °C (77 °F), oxygenate the water by means of pumps, fountains, etc. If the pool is small, a gradual regular addition of fresh water, in the middle of the day, will help prevent

the temperature from rising too high. The temperature of the water has a direct influence on oxygen content.

### Oxygen content

It may be necessary to measure the oxygen content of the water in order to determine what species of fish can be introduced. This content varies from 50 to 100%, according to season, time of day and pool position, and diminishes as water temperature rises. Observe the behaviour of the fish after a period of several days of hot weather, when the water temperature has risen to 25 °C (77 °F) or more. If they come to the surface gulping for air and leaving a trail of frothy bubbles, the oxygen content is insufficient. Breathing is laboured and rapid.

This lack of oxygen may be due to a number of factors :

- heating up of the water, caused by : excessive sun, insufficient depth, transparent water, absence of floating plants or shade from plants on the banks;

- pollution of the water (silting up, decomposition). A large quantity of oxygen is used by the decomposition of organic material;

- over-population of oxygen-consuming animals (fish);

- excessive planting of oxygenating pond plants, which causes excessive production of carbon dioxide on a hot summer night; the proliferation of thread algae (which consume quantities of oxygen at night);

#### DISSOLVED OXYGEN CONTENT IN RELATION TO WATER TEMPERATURE

| TEMPERATURE   | DISSOLVED OXYGEN |
|---------------|------------------|
| 5 °C (41 °F)  | 12.74 mg/l       |
| 10 °C (50 °F) | 11.26 mg/l       |
| 15 °C (59 °F) | 10.08 mg/l       |
| 20 °C (68 °F) | 9.08 mg/l        |
| 25 °C (77 °F) | 8.25 mg/l        |
| 30 °C (86 °F) | 7.52 mg/l        |



The immediate remedy is to oxygenate the water by getting it moving by means of pumps, fountains, etc. Then examine other factors, and correct if required.

#### Acidity of the water

Acidity (or alkalinity) is measured with a pH-meter, on samples from the surface and from the bottom. Daytime pH can be 1-3 points higher than that measured at night, because of photosynthetic activity.

- Acid water (pH 4-5.5) is aggressive to fish (the mucus layer on their skins becomes thinner).
- Neutral or slightly alkaline water (pH 7-8.5), on the other hand, stimulates the development of fish and plancton.
- To maintain a normal pH, prevent leaves and pine-needles from falling into the water and accumulating. In autumn, cover the pool with a fine-meshed net to make removal easier. This will prevent the formation at the bottom of the pool of sludge. As soon as the temperature rises, this organic matter ferments, consuming quantities of oxygen and producing toxins.

#### Hard water

The presence of calcium salts in the water is essential for the formation of the skeleton or the shell of certain animals. Consult your local water authorities for an analysis of the calcium content.

For a favourable environment for aquatic life, the pond water should contain 15-120 mg of calcium salts per litre.

## MATERIAL AND EQUIPMENT

#### Preparing for winter

- Cascades and fountains should be turned off at the approach of the first frosts (October-November). Remove equipment such as submersible pumps, clean thoroughly, and store in a dry place.
- Filtration equipment (biological filter, pumps) and water supply pipes outside the pool should be designed for winter use and protected from freezing. Otherwise clean them and make them ready for installation in spring.

## INVASIVE PLANTS

In combating the spread of certain aquatic plants, the use of chemicals provides only a partial and temporary solution. The usual method is to use copper sulphate solution, 0.5 g per m<sup>3</sup> in acid water, and 1 g per m<sup>3</sup> in hard water. However, this does not attack the real cause of the problem, which will reappear once the effects of the treatment have worn off. Furthermore, it destroys unicellular algae, daphnia and midge larvae, which are the basis of the food chain. The natural balance of the pool may be even more seriously perturbed. Therefore, it is preferable to attack the cause of the imbalance.

#### Filamentous algae (Blanket weed)

These tend to proliferate when the pool is too exposed to sunlight, or when the phosphate content of the water is too high. There are a number of means of keeping numbers down.

- At the beginning of spring, remove the masses of filamentous algae which sometimes form over the planted areas of the pool. The algae will have no competition from the submerged plants which develop more slowly.

- In summer, the exposure to sunlight should not be too great. If necessary, increase the number of floating plants and aquatic plants whose leaves cover the water surface (*Azolla*, *Potamogeton*, *Nymphaea*, *Trapa natans*, etc.).

- Do not overfeed the fish as excess food, or fish excrement, is a nutrient source for algae.

- Make sure that the population of pond snails (*Limnacidæ*, *Planorbidae*, etc.) is sufficiently large. Check that their gelatinous spawn is present on the aquatic plants.

- If there is little chance that the natural balance of the pool will be achieved normally (for example if the fish population is too high, resulting in excessive production of organic waste), excess nutrient dissolved in the water, which feeds the algae, can be removed with a biological filter. An ultra violet light, sterilizing unit may also be installed.

- In small pools, some of the algae can be eliminated by using a charcoal or foam filter over the strainer of the pump used for fountains or water-courses, but the filter must be regularly cleaned or the pump will burn out.

#### Duckweed

The proliferation of duckweed (genus *Lemna*) can occur when the water is too rich in nutrients (organic matter or nitrates). There are several ways of dealing with it:

- using a garden fork covered with fine-meshed netting, remove the excess duckweed;
- introduce goldfish or Koi carp, which are very fond of duckweed, if the pool is sufficiently large;
- clean the pond in autumn, removing all dead stems and leaves. Certain dry leaves can be left in place for winter decoration (e.g. some semi-evergreen grasses, such as *Miscanthus*, *Spartina*, *Phalaris*, *Glyceria*, *Zizania latifolia*, etc.). They will provide shelter and food for a number of animals over winter, and can be cut back in spring.

## A change of habitat :

Any modification of the habitat creates a problem for the fish, depriving it of its usual points of reference (quality of water and food, cohabitation with other species whether friends or rivals, sleeping places). This causes considerable stress, expressed by lethargy and refusal to feed; normal behaviour gradually returns, after a few days' adaptation.

## INJURIES

Any injury must be closely examined, to determine the cause.

Avoid introducing into the pond any sharp-pointed stones or other objects.

When the water is clean, and the fish healthy, injuries usually heal spontaneously. Only serious wounds require attention to prevent infection.

Apply a product such as methylene blue to any wound.

## ALIMENTARY PROBLEMS

See that your fish receive a varied and balanced diet in appropriate quantities. Feeding problems produce a number of symptoms, such as swelling, bristling of scales, mucous excreta and retarded growth. They can be caused by :

- insufficient food, ill-adapted, monotonous or of poor quality, which can provoke vitamin deficiency or digestive troubles;
- prolonged fasting (more than three weeks) which weakens fish and makes them more vulnerable to disease and parasites;
- over-abundant food, which pollutes the water, or poorly-digested food which encourages the development of germs in the water and fishes' guts.

The total quantity of the ration of food distributed must be consumed within three minutes.

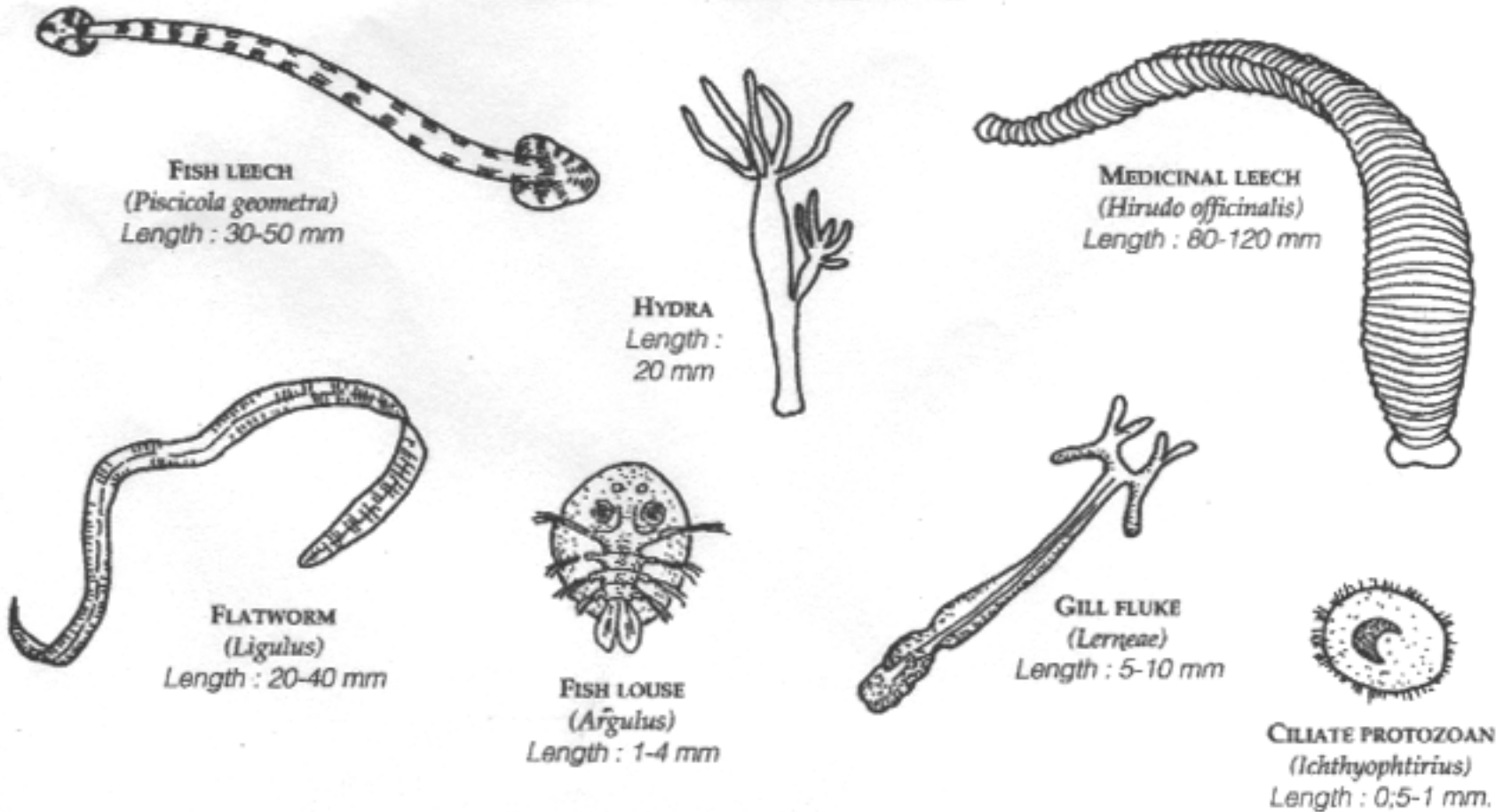
## VIRAL AND BACTERIAL INFECTIONS

**Viruses** are distinctive in that they infect a certain type of cell in a particular species of animal, but cannot spread to another species. A viral infection can be suspected when all the animals of a given species are affected, but no others.

**Bacteria** multiply more slowly than viruses, only by division. They can infect different, unrelated species. A healthy fish will resist attack by bacteria : its white blood cells will destroy them and antibodies will provide protection against renewed infection.

**Infectious dropsy** is a well-known disease caused by bacteria of the *Pseudomonas* genus. In the acute form, fish die rapidly, either individuals, or large groups, for no apparent reason. Latent dropsy produces very recognizable symptoms : lethargy, swollen belly, bristling scales, sunken or staring eyes. The animal takes days or even several weeks to die.

## PARASITES VISIBLE TO THE NAKED EYE





## HOW TO ADMINISTER MEDICATION

- Before starting any treatment, take the fish out of the pool with a net and put it in a container with an air circulator.
- The filtration system must be taken into account when dosage is estimated according to total water volume to be treated.
  - When treatment is completed, change half the water.

**Important :** if two or more treatment products are to be used together, be absolutely certain that they are compatible, or you may kill yourself.

• These bacteria are present in a latent state in all expanses of water. Healthy fish produce antibodies and resist familiar strains of microbe .

• If the fish loses condition or undergoes a change of habitat, or if a new strain of microbe is introduced, the fish may contract the disease.

*The fish should be placed in isolation and treated appropriately. Instructions must be followed scrupulously. Seek advice from a fish specialist*

## FUNGI OR MOULDS

Fungi grow on the damaged skin of weak fish, and on living or dead spawn, which they destroy. If no treatment is given, the organism is invaded by toxins and the fish dies.

**Saprolegniasis or fungus** is a mycosis caused by a parasitic fungus (*Saprolegnia ferax*). It takes the form of white, cotton-like patches.

**Bacterial fin rot** is caused by the *Achlya* fungus, which destroys the fins. This makes normal swimming, and consequently feeding, impossible. **Mouth fungus**, a bacteria, *Columaris* is treated in the same way as above. These infections have a number of causes :

- stress, sometimes of known origin : chilling, overcrowding, reproductive period in spring, recent handling of the fish, etc.,

- earlier infection,
- damage to the mucus, loss of scales or a skin wound.

All these ailments can be treated with malachite green, methylene blue, or a proprietary treatment administered by prolonged bathing, or in food. A spontaneous cure may be observed if environmental conditions are satisfactory : warmer water, elimination of causes of stress.

*If the case is serious, proprietary products may be used, or a solution of sodium chloride (sea salt) :*

- *Place the sick fish in a container without any vegetation.*

- *Every two hours, add a small quantity of sea salt to the water, until the proportion of 10 g per litre (half oz per gallon) is obtained.*

- *When the condition is cured, start replacing the salt water by fresh, at two-hourly intervals, starting with one third, then half, then another half. Use water which has been kept at room temperature, in jerricans, for example.*

*The use of methylene blue should be carried out with care, as it is acriflavine, sea salt and methylene blue. It is often necessary to use a combination of by prolonged immersion.*

*If the treatment is not a complete success, it is preferable to eliminate the affected fish to avoid contaminating healthy animals.*

## PARASITISM

These infections are caused principally by metazoa and metaphyta, protozoa and protophyta, protista. These develop in fish and also in plancton, but snails, tubifex and mud worms are also infested. The largest, such as leeches and fish lice, are visible to the naked eye or with a hand lens. They are worms or crustaceans which attach themselves to the skin or gills of the fish by means of hooks or suckers. Their mouth-parts pierce the skin and open the way to secondary bacterial or fungal infections. Symptoms of parasitism are :

- excitation, lethargy, partial or total loss of appetite, loss of weight, rubbing against the bottom of the pool;
- appearance, on the surface of the body and the fins, of fine, brownish spots visible under a certain angle of lighting or by transparency (on the fins). The back can take on a velvety appearance. The fins fray;
- the fish reacts by hypersecretion of mucus;
- this additional mucus perturbs the respiratory functions and exchanges which take place through the skin;
- progressive destruction of the fins, with haemorrhaging and ulceration.

**The fraying of the fins**, lethargy and erratic swimming, atypical movements and respiratory troubles, rubbing against different objects, are all indications of the presence of flukes of the *Dactylogyrus* genus which infest the gills, and *Gyrodactylus*, which attack the skin. Best results are obtained by treating the fluke with proprietary products used according to label. Results are obtained with potassium permanganate. *Results are obtained with potassium permanganate in 250 cm<sup>3</sup> (15 in<sup>3</sup>) of water. Then mix 40 g (1 oz) of this solution with 10 litres (3 gallons) of water. Bathe the fish in this*

## QUARANTINE : A NECESSARY PRECAUTION

- The appearance of a viral or parasitic infestation is often due to the introduction of animals, food items (zooplankton) or plants from a natural pond or contaminated pool.
- Before being introduced into your pool, fish should be placed for 3-6 weeks in an isolation tank equipped with aerator and filter. This is generally long enough to detect odd behaviour or the presence of parasites, and to eliminate to a large extent the risk of spreading a virulent disease. Each time you change the water of the holding tank, add a proportion of water from your pool, until a complete exchange has been made.
- If nothing abnormal has been observed, you can safely introduce the fish into your pool. Purchase of fish from a reputable supplier with their own quarantine facilities can save you the trouble of quarantining the fish yourself.
  - In spite of these precautions, it is possible for an apparently healthy fish to be a carrier of some disease in latent form, which could declare itself in case of stress or environmental imbalance. It is impossible to eliminate all element of risk.
  - If you collect live food in other wet zones, this zooplankton can also propagate certain diseases or parasites. Do not risk contaminating the pool you have created : the environment it offers is healthy but fragile, because of its confined nature.

solution for 20 minutes, and repeat 48 hours later, if necessary. The more resistant fish (carp, tench) will stand being immersed for 30 minutes.

Another treatment consists in bathing the fish for short or long periods in a solution of neutral water (pH 7.0) and copper sulphate  $\text{CuSO}_4$ , made up strictly according to the manufacturer's instructions.

Immersion of 30 to 60 minutes in a solution of formaldehyde (formol) at 40% concentration, in the proportion of 1 ml to 5 litres (1 gallon) of water also gives good results.

**N.B :** Always seek professional guidance with proprietary products.

**Ichthyophthiriosis**, commonly known as "white spot" (or "ich") is caused by the ichthyophthirius, a ciliated protozoan 0.5 mm (50th in) long. This appears as a result of stress or chilling, and takes the form of 4 or 5 clearly-marked white spots, most often on the caudal or dorsal fin. In the more serious forms of white spot, the spots are less regular in shape and appear on the body.

There are products available on the market which give excellent results. It is prudent to have them on hand, since the

sooner you treat the disease, the better the results will be. Be sure to check label dates for freshness

It is also possible to use a solution of 40% formaldehyde in the proportion of 1 ml for 5 litres (1 gallon) of water or a solution of malachite green made up strictly in accordance with instructions. Treatment is extended in cooler water.

**Oodinium** (velvet) is a serious illness caused by a phytoflagellate parasite of the *Amyloodinium* type. Like ichthyophthiriosis, with which it can easily be confused, oodinium shows as a complete dusting of white powder.

Treat as soon as possible. A number of products are available, some of which treat all forms of white spot disease.

The appearance on the back of the fish of a blue-grey film and reddish haematoma is a sign of the presence of a flagellate : *Ichthyobodo necatrix*.

Treat with a solution of 40 % formaldehyde as indicated above.

**Argulosis** is caused by the fish louse (*Argulus*), a parasitic crustacean which attaches itself with suckers to the scales or gills. It measures 1-4 mm (5th of an inch) in diameter and is easily visible.

The fish louse can be removed with tweezers.

Potassium permanganate can also be used. Prepare a solution of 1 g (0.03 oz) permanganate for 10 litres (3 gallons) of neutral water, mixing well with an aerator, and plunge the fish into the solution, in a net, for 5-10 mm (up to half an in). The permanganate will cover the gills of the louse and it will drop off. But if the fish is too weak it may die.

Your aquatic supplier can also recommend appropriate products, which are to be used according to the instructions.

**Lerneosis** (anchor worm) is caused by a worm-like crustacean (*Lerneae*) 5-10 mm (5th-2 5th in) long, which hooks itself on to the fish, causing the scales to lift and bleed. It is usually attached at the back of the dorsal fin.

These parasites can be removed with tweezers. Disinfect the wound with a suitable antiseptic.

If the infestation is serious, use a proprietary product. Follow the instructions carefully, since these products can be toxic.

The fish leech (*Piscicola* or *Hirudo medicinalis*) is a round worm-shaped parasite, 3-5 cm (1-2 in) long, which attaches itself to the side of the fish.

Leeches can be removed with tweezers. They can be caught with mutton or chicken bones put in a large-meshed net at the bottom of the pool for two or three hours. The leeches attach themselves to the bones and can be easily disposed of.