

TOWARDS A SUSTAINABLE AQUARIUM POLYCULTURE -Conservation and the Aquarist

by Andrew Boyd

This is not intended to be a scientific paper because I am not a scientist, but is just a slightly different way of looking at our hobby, in the light of the recent wave of environmental concern.

What is meant by sustainable? Basically, it is to cut reliance on external energy use (such as electricity) and prepared fish-foods, and to create a lasting aquarium that is pleasant for the inhabitants as well as for the viewers. Low maintenance and low energy consumption, with a high sustainable output, is ideal. And polyculture? Well let's compare it to the alternative monoculture. The wheat crop is a classic example of the latter. It requires massive amounts of energy to prepare the ground (remove native plants, rocks, etc.) and fertilize it (Australian soils are very deficient in phosphates), to plant the seed, to counter pests and to harvest the crop. In a sense, it is a war against the environment, for nature is a polyculture.

In the aquatic environment for example, the insect larva is eaten by the rainbowfish, which in turn is eaten by the barramundi or perch, which may ultimately provide food for us. All return fertiliser, in one form or another, to the billabong, where it is utilised by the algae and higher plants that support the insects, and so on. Everything interacts for the benefit of the whole system.

The long-term aim of a sustainable aquarium is to minimise energy use in the hobby. To achieve this we can pay attention to efficient aquarium siting and polyculture. Unfortunately, some species do not easily lend themselves to polyculture; these include the delicate killifishes and discus (*Symphysodon* spp.) but even they managed to support themselves quite nicely in the wild, before we showed up, so maybe someone can devise a system that suits them.

The biggest energy input in our hobby would have to be electricity. Unfortunately, we in Australia have now outstripped the productivity of our hydro-electric scheme and have needed to turn to coal-fired generating stations to meet increasing needs, despite their deleterious environmental effects. So there is a lot to be said for economy in the fishroom on all accounts. Rene Jez's excellent article "How to build a Fishroom" (Tank Talk, vol 12, no. 3) shows how to achieve this through a northerly-facing lean-to glasshouse, with double glazing and glass-wall angles adjusted to suit our local climate. To this I would add only that the fishroom should, if possible, be placed against the house, to economise on winter heating.

I haven't set myself up a Jez fishroom yet, but when I do, there are two experiments that I shall be carrying out:

A. the 'Severum System'. Aquarium contains an adult pair of *Cichlasoma severum*, several adult pairs of Red-tailed Goodeids (*Xenotoca eiseni*), several different species of plants, a species or two of snails (Malaysian Burrowing or Golden Mystery) and some freshwater shrimp, in a large tank. Severums eat plants, young snails and Goodeid babies. Goodeids eat plants and shrimp and snails eat algae and other plants. If set up correctly, the only external input needed should be water changes, via gravity feed from a rainwater tank (where permitted) and regulation of inhabitant numbers by the aquarist. Most important would be choice of plant species and numbers, for severums can be quite destructive with soft-leaved or delicate plants. There should be some floating plants as hiding places for the shrimp and enough of all kinds to complete the nitrogen cycle for all animals present. Such a system could be applied to quite a number of the larger cichlids, other than those that are overly territorial or that like to kill for the sake of it (such as *Cichlasoma dovii*). If properly cared for, the system should yield excess plants and baby severums as a side benefit and the fishes should be healthier from their natural diet. Care should be taken over choice of substrate as unduly coarse gravel would allow too much mulm to accumulate.

B. the 'Tanganyikan System'. Tank contains *Tropheus* species, *Julidochromis* (one species only, as they could interbreed), *Neolamprologus* (of different 'complexes' or they may interbreed), plus some Bristlenoses (*Ancistrus temmincki*), plenty of shell-grit in the gravel, Java Ferns (*Microsorium pteropus* - to be wedged in cracks in the rocks, not planted), Foxtail (*Limnophila* sp., used as a floating refuge), freshwater shrimp and one species of Molly (*Poecilia latipinna* or *P. sphenops*). *Julidochromis*/*Neolamprologus* eat shrimp, baby Mollies and one another (a supplement of cultured daphnia and cyclops may be provided periodically), *Tropheus* eat shrimp, baby Mollies and the occasional baby of the other cichlids, together with plants. With all of the cichlids, conspecific aggression will ensure no overcrowding, but excess fry may need to be removed when young, and raised separately. The fish would benefit from an occasional feed of spinach or zucchini from the garden and the system should yield a wide variety of fishes and plants.

In the above examples I am envisaging very large aquariums, i.e., in the 80+-gallon range. Although they reflect my long-standing obsession with cichlids, other valuable interplays to suit other aquarists should be equally viable. These could be based on the ability of freshwater Puffers to eat snails, or of Dwarf Gouramis to eat Hydra. If you have some species that breeds like rabbits, then use it as food for something else. Or if it has high conspecific aggression, then use this to prevent overcrowding, thereby converting a problem into a solution.

Further design considerations may be gleaned from Bill Mollison's masterpiece "Permaculture: a Designer's Manual" (Tagari Press, 1988), from which came some of the ideas outlined above.

Mine is by no means an all or nothing proposal. Average two-tank aquarists can help by not overheating their tanks and by directing power-filter outlets to create oxygenation, thereby reducing reliance on airpumps. Other ideas might include use of more efficient box-filters, rather than under-gravel types and the devotion of one or two tanks to the breeding of local native species that require little if any heating. Use as many aquarium plants as possible, so as to fill the tanks and grow as many of your own foods (cyclops, maggots, spinach, whiteworms and mealworms being favourites of my particular fish). Swat houseflies, rather than spray them and you can feed the carcasses to your fish. Perhaps you have some other ideas to share with the rest of us.

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