

## Aquarium Water Chemistry for Goldfish

**Exact numbers are not particularly important when measuring aquarium water chemistry.**

*By Stephen M. Meyer*

Q. I would like to see more advanced articles on fancy goldfish, and especially more specific information on water quality requirements. For example, these are delicate fish that need high levels of dissolved oxygen — but what is high? Does anybody out there besides me test for dissolved oxygen?

What is the optimum pH level? Above 6.0 and below 8.0 is not what I want to hear. What about carbon dioxide — what is a safe level? (Yes, I test for that too.) Soft water or hard water — I don't want to hear a range, I want specifics. I have been testing my water and guessing at the appropriate levels, so please help.

A. Your frustration with the "generalities" offered in many goldfish books is entirely understandable. The water testing you mention clearly indicates that you are a very rare goldfish keeper. Actually, most of the books that are commonly available are intended for casual hobbyists. These are people who may measure pH when they first set up the aquarium or pond, but rarely ever again. They are not really interested in the chemical properties of the water they keep their fish in. Thus, authors tend to give general water quality characteristics and leave it at that.

That said, you need to understand that the ranges given for various water quality characteristics such as pH, dissolved oxygen and hardness are specifics! The physical and chemical properties of all bodies of water vary continuously — albeit, sometimes in very small amounts. The dissolved oxygen level in a pond or aquarium, for instance, varies during the course of a day as a function of sunlight. A reading in the early morning before the aquatic plants have begun photosynthesis may be 6 parts per million (ppm), whereas a reading in late afternoon may be more than 11 ppm. Likewise, carbon dioxide levels and pH levels will vary.

Of necessity, fish are adaptable creatures and can live comfortably within reasonable ranges of values, especially if the changes are gradual. Therefore, I cannot tell you that the optimum dissolved oxygen level is 7.2 ppm because a healthy goldfish would not really be able to perceive whether it is living in water with 7.0 or 7.4 ppm of dissolved oxygen.

Then too, some varieties of fancy goldfish may have slightly different requirements than other varieties. And even individual fish within a variety may have different demands. For example, an oranda with very heavy head growth around the opercula (gill covers) may need higher levels of dissolved oxygen than less well-developed orandas because of the difficulty of moving sufficient water over the gills. In other words, one should not be fooled by the false precision implied when specifying a single number for water quality parameters.

There are really two types of ranges worth considering: survival ranges and what I call thriving ranges. Most books and articles talk about survival ranges. So, when you read that goldfish can live in water with a pH of 6.0 to 8.0, it really means that a goldfish can survive within this range by adapting. Unfortunately, too many hobbyists have a hard time maintaining water quality even within these broad boundaries!

Thriving ranges, which reflect the ranges of optimal values for various water characteristics, are, by definition, narrower than survival ranges. The thriving ranges that I consider appropriate for fancy goldfish are shown in the accompanying sidebar. Of course, levels of ammonia and nitrite should be unmeasurable with ordinary hobbyist test kits — and always below 0.1 ppm. Nitrate levels should be maintained below 50 ppm.

Now, what should you do with this information? Probably nothing. As I noted earlier, goldfish are very adaptable. If the pH of your water falls naturally around 7.6, the alkalinity around 300 and the hardness around 225, I would strongly advise you to leave it alone. Never make minor adjustments in water chemistry with the mistaken belief that such changes matter — they do not.

Your fish are far more sensitive to sudden, erratic shifts in water chemistry. They can become stressed if water characteristics to which they have become accustomed change too quickly. For this reason, a fancy goldfish living in water with a consistent water pH of 6.5 will be better off than one living in water where the pH moves rapidly between 6.8 and 7.4 as the fishkeeper constantly tries to adjust the pH higher.

In fact, you should undertake significant changes in any water quality parameter only if 1) it is currently on the border or



outside of the survival range, or 2) it is far beyond the thriving range of the fish and you can confidently and reliably maintain the new water characteristic in a stable manner. In either case, any change must be made slowly over a period of at least one week.

If you want up-to-date, detailed information on rearing fancy goldfish, I suggest you join the Goldfish Society of America (P.O. Box 54502, Tulsa, OK 74155). As a member, you will receive their wonderful monthly publication, The Goldfish Report.