

Acclimating Animals to Aquariums

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Introduction to acclimation techniques

Most beginning aquarists hear that they must “acclimate” any new animals they add to their aquarium. Acclimation (sometimes termed “acclimatization”) is simply the process of gradually adapting an animal to a new environment. There are a variety of methods to do achieve this goal, some work better than others. Many aquarists mistakenly believe that acclimation is just the specific procedure of mixing the fish’s transport water with water from the aquarium. Actually, in a broader sense, the acclimation process begins when the animal is removed from the wild (or its previous aquarium if captive raised) and ends once it has properly quarantined and settled down in its new home – and the entire process can take weeks to months.

Aquarium animals usually experience two types of stress during the acclimation period; chronic and acute. In general terms, chronic stress is a lower-level stress occurring over a long period. Acute stress takes place when there is a high level of stress occurring over a short period. There are actually two other levels; peracute, when the stress level is extremely high, and the duration is very short (usually because the animal succumbs to the stress before much time has elapsed). Subclinical stress can be any duration, but is so minimal as to not outwardly change the animal’s health. Since some stress is unavoidable during the acclimation period, aquarists must strive to reduce as much of it as possible to the subclinical category.

Just what is acutely stressful to fish regarding environmental changes? It may not be what you imagine. Think of the example of fish in the wild that are seen swimming directly through different temperatures of water (stratified layers called thermoclines). These fish undergo 10-degree temperature changes in a matter of seconds with no signs of stress at all. One damselfish was observed having laid its eggs right at the edge of the thermocline. Each wave passing overhead caused the thermocline boundary to move up and down a few inches. Both the fish and its eggs were exposed to constantly changing temperatures – with absolutely no ill effect (Hemdal 2006). Some fisheries biologists only choose to acclimate their fish if the temperature difference is greater than 8 degrees Fahrenheit (D. Sweet, personal Communication.). Two other identified water parameters that are actually more important to acclimate for are pH and salinity/specific gravity (for marine fish).

Much of the following information is based on opinion. This does not mean that it can simply be discounted as, “Oh, that’s just his personal opinion”. Remember that stress in aquarium animals cannot be easily measured (because the simple act of restraining the fish to test for stress chemicals in the blood will increase the levels of these compounds due to the acute stress of capture). Because of this fact, little scientific research can be done to measure stress caused by various acclimation methods. Relying on an opinion, based on extensive experience, while not as defensible as the proof of a scientific hypothesis, is still better than relying on “feelings” or conclusions drawn from a

more limited experience base. In addition, this article calculates acclimation rates mathematically, supporting much of information presented here. Still, personal opinions abound when it comes to acclimation techniques. If your dealer suggests a method different than that outlined here, ask them why. If their explanation makes sense, then you should probably follow their advice, especially if their fish guarantee is tied to the acclimation method used.

Basic acclimation process

The following step-by-step method covers a wide variety of acclimation cases, with a few exceptions noted at the end. Follow this procedure carefully with all new acquisitions, and problems will be minimized. Of course, exceptions do arise, so aquarists need to be mindful of this, and be prepared to modify this procedure if warranted.

Before You Even Buy a New Animal:

There is one very simple step you can take to ensure a smooth acclimation process, before you even buy an animal! First, simply ask about the water chemistry values of the tank housing the animal you intend to acquire. Then, adjust your aquarium's value to more closely match that. Simply put – if the differences between tanks are minimal, then acclimation becomes less stressful!

Prior to arrival: For animals that are shipped to the recipient, there is little that the aquarist can do for them prior to their arrival. For animals transported by the aquarist themselves, some steps can be taken to minimize transport stress:

- 1) Always transport fish in the dark, avoid the urge to constantly open the shipping container to “check on them”.
- 2) For transport times longer than 45 minutes, supplemental aeration or oxygen should be used.
- 3) Depending on the length of time the animals will be transported, and the time of the year, heat or cool packs may be needed to maintain a proper water temperature.
- 4) It should go without saying, but avoid any sudden movements of the transport container. Not only can this stress the fish, physical injury can occur as the fish bumps into the side of the container as the water sloshes back and forth.
- 5) Remember that mortality of fish during a shipment is not constant through the transport time; it is actually highly skewed to the very end of the shipping time. This means that any delay can dramatically increase animal loss. It's important that you get your new animals home as quickly as possible.

Physical acclimation: Once the fish arrive at their destination, they should then be acclimated to an appropriate quarantine tank. The best general acclimation procedure is as follows:

Step 1. In as dim of a light as feasible, remove any outer bags, paper layers and the like, and float the still sealed inner plastic bag in the receiving tank until the temperatures of the tank and bag are within one or two degrees of each other. This usually takes only ten to fifteen minutes. Fish that have been chilled during shipment need to be acclimated back up to a proper temperature at same the 10 to 15 minute rate, there is absolutely no justification for taking longer than this.

Step 2. Sample the water in each bag for pH and specific gravity (if marine). If the transport time has been greater than 36 hours, you can presume the pH will be low and the ammonia level will be very high. Acclimating for these long duration shipments will be covered in the second part of this article. If the specific gravity of the shipping bag is .004 or more lower than the quarantine tank, special care must also be taken; and this also is addressed in the second part of the article.

Step 3. Open each bag, and turn the top down to form a floatation collar. Remove as much of the shipping water as you can while still keeping the fish in a comfortable volume of water. This step is very important, as it directly affects how much aquarium water will be need to be used during the rest of the process. Begin the water mixing process:

- a. Add **25%** tank water to the bag (water is now 20% equilibrated). Wait five minutes.
- b. Remove water from bag to reduce it back to its starting volume, add **50%** tank water to the bag (water is now 47% equilibrated). Wait five minutes.
- c. Remove water from the bag to again reduce to starting volume and add **100%** tank water (bag is now 73% equilibrated). Wait five minutes.

These addition amounts creates a relatively stable 25% change between steps and only uses 175% of the original bag volume in water. The time interval chosen is the way to control the overall acclimation rate. For routine acclimations, an interval of five minutes between steps is appropriate. To slow down the acclimation rate, a time interval of ten minutes could be used (but supplementary aeration would be necessary). Adding more steps to this process (by say, starting with a 20% addition and doubling that each time) ends up using 300% tank water, for very little added benefit.

Step 4. Prepare to release the specimen into tank.

Check the acclimation water parameters to ensure they are close to that of the destination tank (pH within .2 units, temperature within 1 degree and specific gravity within .0005 units. If parameters within that range, the animals can now be released into

the quarantine tank. Most aquarists avoid letting any of the acclimation water enter their tank.

If the animal has been released into a tank housing other fish, the next 24 hours are critical concerning compatibility. Watch the animal for at least 15 minutes after its release for any problems. Continue to check in on the animal at least every hour for signs of incompatibility (if other fish are in the tank with it) during the first day. If you notice any sign of aggression, be sure to adjust your monitoring schedule accordingly, and separate the animals promptly if the problem becomes serious as shown by ripped fins or missing scales.

Floatation Collars

Rolling down the top of the fish bag in on itself and trapping air inside to form a floatation collar is a technique familiar to most aquarists. However, failure of this technique is a primary cause of problems during routine acclimations. Seemingly simple, if this technique is not properly performed, the bags can tip over or sink, releasing the fish (and its shipping water) into the aquarium sooner than expected.

First, if the bag has any leaks in it, do not use this method, acclimate the fish in a bucket, or move it to a new plastic bag instead. Untie the bag seal and roll the top of the bag loosely in on itself to trap air as evenly as possible and open the “ring” to allow the bag to float properly. Any water pumps that might tip over or flood the bag need to be turned off. A plastic clip or clothespin can be used to hold the edge of the bag in place, next to the side of the aquarium.

Preliminary quarantine phase: The next 24 to 72 hours serve as a period of adaptation for the new fish. Various foods are offered it, and a proper diet is assessed. The fish should be evaluated at least daily for the following points:

- a. Is the fish eating well, and maintaining its body mass?
- b. Is its behavior appropriate for that species, excessive shyness and boldness can be symptoms of problems.
- c. The fish's respiration rate should be taken daily. If it is noted to be excessive either in terms of the rate you noted for the fish prior to its acquisition, or if it seems greater than you would suspect is normal for that species, you should make every attempt to determine the cause, and treat accordingly. As a general rule, smaller fish respire more rapidly than larger ones, and fish in warmer water respire faster than those in cooler water. For the majority of small tropical fish, a respiration rate less than 110 beats per minute is usually considered normal, while faster than 120 BPM may indicate problems.

- d. If the fish is being quarantined with other animals, assess how it is acclimating to any new social conditions. Even small rips appearing on the new fish can be a sign of impending problems.
- e. After this adaptation/assessment period has been successfully passed, the formal quarantine procedure can continue. If the fish have been diagnosed as having a specific disease during the preliminary phase, a proper treatment should be started as soon as possible.

A Fish in the Hand....

There is a disturbing trend in some online forums for people to tell others to avoid using nets to transfer fish, and instead, use their bare hands. While some nets are indeed rough on a fish's skin, and some fish have spines that can get caught in net material, catching a fish with your bare hand is very tricky. There are fish out there that have venomous spines, but not everyone is aware that they do. Fish are wiggly and slippery, often escaping from a person's hand unless they are grasped tightly – something obviously to be avoided in the first place.

The safest way to transfer a fish is with a non-snag net, held low to the ground in case the fish does manage to jump.

Sometimes aquarists try to take “stress reduction” to the extreme – using acclimation times much longer than necessary. This actually increases stress in fish, especially if the dissolved oxygen level of the water is not properly maintained. Floating a sealed fish bag longer than 15 minutes (all it takes for temperatures to equalize), or drip acclimating fish for hours and hours without actually measuring the rate of inflowing water and the differences in water chemistry are two common errors.

Drip Acclimation

Setting up a line siphoning water from the main tank to an acclimation container is a common practice at many aquarium wholesale companies. These “acclimation tables” can assimilate huge numbers of fish into quarantine systems, dealing with high ammonia levels and other issues in assembly line fashion. Some home aquarists have attempted to emulate this in their home, but there are issues that must be addressed. First of all, the name “drip acclimation” is a misnomer. It should be termed “flow acclimation”, as the rate must be faster than a drip. If one were to set up a drip line at one drop of water per second (as many home aquarists have assumed would be an appropriate rate) it would take FIFTY hours to equilibrate the difference in water parameters between one liter of shipping water and the receiving tank to within 90% of each other! Obviously, the flow rate must be faster than that. A flow of one milliliter per second would result in one liter of shipping water reaching 90% equilibration in 2 1/2 hours

Aquarists must monitor the changing water chemistry values in the acclimation container throughout the process, and adjust the flow rate accordingly. One trick is to

place a few drops of methylene blue liquid per gallon of water in the acclimation container. Not only does this have some antibiotic affect, and can help with oxygen transfer, as new water flows into the acclimation container, the aquarist can judge the amount of mixing by the dilution of the blue color over time.

Just as with regular acclimation methods, as the water quality values between the aquarium and the container get closer, the rate of change slows down, unless you increase the water mixing rate.

Flow acclimation systems may require adjunct aeration and heating to maintain better water quality in the acclimation container during the longer acclimation time. It also helps to use rectangular acclimation containers as the volume can be measured using a ruler (length in inches * width * depth of water / 231= gallons).

To Acclimate or Not - A Case History

A 3" Garibaldi arrived in a shipment that had been lost for 24 hours by the shipping company. The total time the fish had spent in the box exceeded 55 hours. The fish arrived moribund, on its back in the bag, but still breathing. As the shipping bag was carried to the quarantine tank, the fish stopped breathing. Unresponsive, it looked dead. Instead of tossing it out, I decided on a last-ditch effort and moved it from the shipping bag directly into the tank and held its mouth open in the effluent of a water pump. After a few minutes, it began breathing, but soon stopped again. This happened two more times, but then it finally kept breathing on its own. After about four days, the fish was essentially normal.

My conclusion is this: if dumping this fish directly into a tank with a ten-degree temperature change and a 2 pH unit change is so stressful, why did the fish recover? It was clinically dead in its shipping water before the bag was even opened. If I had tried to acclimate it, it would have stayed dead. Makes one wonder!

Special Acclimation Cases

- 1) If animals are shipped during the winter and arrive severely chilled, open the shipping box and remove any double or triple bags. Then lay the inner bags holding the animals on their sides in a dimly lit room. Do not open the bags or float them in water, as these actions will greatly affect proper gas exchange (primarily by trapping carbon dioxide). Once the water has warmed to close to room temperature, (Usually within 30 minutes or so) place the bags into the receiving aquarium and proceed with the normal acclimation process. Remember, if a tropical animal is chilled, it is being severely stressed. Acclimating it too slowly out of this condition simply adds to that stress. The stress of warming them quickly is always less than the added stress of remaining chilled.
- 2) Fish or invertebrates may arrive in shipping bags that have lost most of their water. In other cases, they are purposefully shipped damp (anemones, corals and some crustaceans). In these instances, the only recourse is to add the animal directly to the aquarium, as there is no "acclimation procedure" that can move an animal from air to water.
- 3) Fish that have been in transport for less than four hours, and where there is less than a four degree Fahrenheit temperature change, 0.2 pH unit difference or .0015 difference in specific gravity do not need to be acclimated at all, simply remove them from the transport water and add them to a dimly lit aquarium (preferably a quarantine system).
- 4) Any animal that arrives in a moribund condition (motionless, upside-down, not breathing, etc. should be removed from the shipping water and added directly to the aquarium. As mentioned, fish in this condition have been revived by gently holding their mouth open and moving them back and forth through the water to help ventilate their gills.
- 5) Echinoderms (starfish and their kin) cephalopods and some crustaceans are very sensitive to changes in water chemistry, particularly pH and specific gravity.
- 6) There is a theory that smaller animals, with their correspondingly high surface area to volume ration, are more sensitive to some environmental changes. This certainly seems borne out by larval marine fishes that experience a fatal shock if too much of their water is changed at one time.
- 7) Specific Gravity Rises: Marine fish do not tolerate rises in specific gravity very well. If the difference is .0040 or greater, consideration should be given to lowering the specific gravity of the quarantine receiving tank to more closely match that of the shipping water. Conversely, most fish handle a reduction in specific gravity very well, so moving them from high to low specific gravity can be accomplished through the normal acclimation process.

Long duration shipments

Animals that have been in shipping bags longer than 36 hours build up huge amounts of metabolic waste in the form of ammonia. At the same time, the animal has been releasing carbon dioxide into the shipping water. The combined result is that the carbon dioxide lowers the pH of the water, which in turn neutralizes the relative toxicity of the ammonia. Levels of ammonia at 2 or 3 parts per million and a pH of 6.0 are not unheard of. If you acclimate these animals in the normal manner, the process will drive off the carbon dioxide faster than the ammonia is being diluted. As the pH of the water rises, the ammonia becomes toxic, often killing the animals right in the acclimation container. The key is to measure the shipping water's pH, temperature and specific gravity (If marine). Then, using water from the tank (not freshly mixed water) create water that closely matches all of these parameters and carefully move the animals directly into it. This is done by adjusting the specific gravity and lowering the pH with the addition of a proper amount of acid (Sodium phosphate monobasic, carbon dioxide or other acids have been used). From this point, the animals can be drip acclimated.

Always cover the acclimation container to calm the animals and keep them from jumping out. Many people simply use the Styrofoam shipping boxes the fish arrived in. These are soft, and help keep the fish from bruising their snouts on the container sides, but they need to be rinsed well before use (their porous surfaces attracts dirt and bacteria) and some people feel that their white coloration adds to light stress for the fish. A dedicated black plastic tub made from inert polypropylene would be a better vessel to use. Set up a good aeration device in the acclimation container. Next, start a siphon through a length of plastic tubing (3/16" diameter airline tubing works for most cases) from the quarantine tank into the acclimation container. Throw an overhand knot in the airline, and adjust the tension so the water flows at the proper rate. Another option is to install an inline plastic valve and adjust the water flow that way.

To Dump or Not to Dump?

Since I was a child, I was always taught NEVER allow ANY of a fish's transport water to enter the aquarium during acclimation. The idea that this shipping water is polluted with both organic wastes and fish parasites is common knowledge to everyone, isn't it? Knowing this to be true, I parroted that advice to thousands of people during my subsequent career in the pet trade and public aquariums. I never thought much about it, it became dogma for me.

What is the truth though? Certainly, animals produce waste, and while they are contained in a shipping bag, these wastes do build up. However, the amount the fish produces is relative to the shipping time, and if they had been in the operating aquarium for that same time, they would have produced the same amount of waste, yet the biological filter would have dealt with it in short order. If the addition this shipping water, with even an extra day's build-up of wastes would harm the aquarium, then that system has much bigger problems with its biological filtration system that needs to be corrected.

What about the potential for disease introduction? Since the fish is being moved into the tank, it will be carrying any parasites with it anyway, so this is not as big of an issue as one might think. There is one theory though, that promotes the idea that during shipping, many parasites may become dislodged from their host fish, and that by adding shipping water to the tank, you are in effect, adding extra parasites. The issue with this is that it has not been microscopically substantiated, nor is there any proof that such dislodged parasites can return and re-infect fish. Finally, if the fish had an infection, it is impossible that ALL parasites were dislodged into the shipping water, so the fish will still need to be medicated.

There are only two valid concerns regarding not adding shipping water to the aquarium; first, if the fish had been shipped with chemicals added to the water (including copper, methylene blue or antibiotics) and secondly, the possibility that the water contains higher than normal levels of heterotrophic bacteria. Neither of these are major issues, especially since the first step of the acclimation process outlined here is to remove most of the original shipping water before the process begins.

Go ahead and let the small original volume of shipping water to return to the aquarium. You can then recover all of the tank water you had added during additions, plus it is easier to just slide the fish out of the plastic bag. Most of us have had this happen: you struggle to net a fish out of the shipping bag, and you fumble for it as the fish flips out and hits the floor. Fish can be injured by net frames or caught in the net material itself. Some aquarists advocate transferring the fish by hand, but don't try that with a rabbitfish or some other venomous species! Human hands are not adept at holding struggling fish – so in the end, it may be best to just tip the bag over and slide them out, water and all!

Acclimation is an important technique necessary to the adaptation of new fish to your aquarium. Done properly it takes very little time and effort. The most common mistake seen is when people begin to think, “If acclimation is important, then really long acclimation times will be even better”. Stick to reasonable acclimation rates and your fish will respond well, and will thank you by thriving in their new home.

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