Name: _____ Date: _____

Built for Puddles, Bred for Beauty

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The first thing I did with Marlow's tank was to put a thermometer in it. It read 78 degrees Fahrenheit, which matches the ideal that a fish veterinarian at Washington State University gave, and sits inside the 76 to 81 range recommended by another vet. Then I read a survey of a wild betta habitat in Thailand and discovered that the water there averaged 29.9 degrees Celsius, close to 86 Fahrenheit, and was only about five centimeters deep. A thermometer, I decided, is really a question about which world you are copying. Marlow's tank was a reasonable copy of the wrong place. The wild fish lives in a warmer, shallower, much stranger world than the one I had built for him.

The survey's most striking number was not the temperature. Dissolved oxygen in those waters averaged about 3.8 milligrams per liter, a measure of how much oxygen is dissolved in the water, and it swung from zero to about 7.4 over the course of a day. At the low end, a fish that could only use its gills would have been breathing almost nothing. A betta habitat, in the authors' summary, is heavy vegetation, shallow water, low oxygen, high temperature and acid water. The standard explanation for the betta's anatomy starts here. Life in low-oxygen environments appears to have been the driving force behind the diversification of the labyrinth fishes, a group that formed roughly sixty million years ago.

The labyrinth organ is the solution. Labyrinth fishes have paired chambers above the gills, extensions of the first gill arch, and the chambers are lined with folded bony structures that let the fish absorb oxygen from air. The group is named for that structure, the labyrinth organ. Their gills are relatively small and mainly get rid of waste, ammonia and carbon dioxide. Many labyrinth fishes are obligate air breathers, meaning that they must reach the surface to survive. There are about 137 of them in three families, and Betta splendens belongs to Osphronemidae, the largest. This is why surface area matters more than tank volume, and why a tall vase is a poor home.

The same adaptation seems to have shaped how bettas reproduce. The male builds a nest of bubbles, picks up the eggs in his mouth as they fall through the water, places them in the nest, and adds bubbles when needed. The authors of the Florida extension paper link bubble nest building to the same low-oxygen adaptation as the labyrinth organ. Once the larvae hatch, the male keeps tending them and makes sure they stay in the nest. I find it hard to look at Marlow's fins, which he spreads whenever his own reflection moves, and not think of this male whose entire strategy depends on defending a patch of floating foam.

The bright animal in my tank is the product of human choices. The modern betta comes from almost a hundred years of selective breeding. Early on, males were chosen for aggression,

because fights between two males were popular in Thailand as a gambling spectacle. Today the choice has changed: breeders select for bright colors and elaborate fins, though male aggression remains. The wild fish, by comparison, is dull brown or green. Thailand has since named the betta its national aquatic animal. What looks like natural splendor is a historical record of what people wanted to look at, and the fish in my tank is about a century of that record away from the dull one in the survey.

The choices have costs, and the RSPCA names one. Selective breeding can harm welfare, and it singles out the rose-tailed betta, whose very heavy tail can cause health problems. A second cost is in the supply chain. An estimated 100,000 male bettas are shipped by air each week, mostly from Thailand. Males are separated at three to four months old because of aggression, and at retail they are typically kept in small plastic cups. FishBase says that holding males in very small containers should be discouraged. A pet's origin is part of the pet, even when the person selling it does not mention it, and it is one more reason to choose with care.

The part of the research I trust least is the part everyone wants most: the minimum tank size. A veterinarian at the University of Illinois recommends ideally a five-gallon glass or plastic tank or larger, so that the fish can move normally and toxins build up less. The Florida paper makes a subtler point, that water quality does not depend on the size of the container but on management, and that small tanks with little filtration need frequent water changes. Both statements can be true. A bigger volume forgives mistakes, and a careful owner can sometimes make up the difference. Where the sources differ, the cautious choice is the larger tank.

Filtration shows the same pattern. Research that used flow as a stressor found that bettas prefer calm water, so heavy filtration may actually harm a betta's health and welfare. The Illinois vet prefers a low-flow filter, which protects delicate fins from suction. The WSU vet says bettas do not always need filters at all. Yet the RSPCA says no fish should be kept in a tank without a well set up and maintained filter. These sources are not careless, and they are not describing the same thing: one is about fish in general, and the rest are about a species that evolved in still water. I would ask a fish vet before buying anything.

Water chemistry is the least glamorous topic and the one that kills the most fish. Tap water contains chlorine and chloramine, and sometimes heavy metals, which the Illinois vet says can suppress immunity or make the fish very sick. Distilled water is not the answer, because it lacks minerals that matter for health. Feeding follows the same logic: the portion is what the fish can eat in three to five minutes, and since leftovers foul the water, even underfeeding is safer than overfeeding. My own hands stay clean by following the CDC advice to wash after touching the fish, feeding it or cleaning the tank, and children under five should not handle aquarium items.

The RSPCA admits that fish can't show their feelings as clearly as other animals do, which is why a careful owner relies on a short list of observable facts. Marlow eats quickly, swims around, and comes to the glass when I walk up. His fins are held away from his body. Lethargy is the sign to watch: a betta without a heater may simply be cold, and a betta that stays inactive may need a fish veterinarian. I will not guess which. A grown-up decides whether a family can do all this, and a rehoming center is one of the places the RSPCA suggests looking. Ask a grown-up to look at Peabody Pets with you. You will find it at pet.peabody.kids.

Questions

1. Why does the author say that the thermometer reading belongs to 'a different world'?

A. The tank was too hot
B. The thermometer was broken
C. A Thailand betta habitat was warmer and shallower than the tank

2. What does the labyrinth organ let a betta do?

A. Build bubbles from sand
B. Absorb oxygen from air
C. See in the dark

3. Why does the author trust the tank-size minimum least?

A. The sources measure different things and do not agree exactly
B. No source mentions tank size
C. Every source says the same number

4. In this book, what does 'obligate' mean in 'obligate air breathers'?

A. Sometimes
B. Required to
C. Able to avoid

5. According to the book, what did early breeders select for?

A. Dull color
B. Aggression
C. Small size

6. Why might a filter be a problem for a betta?

A. Filters add chlorine
B. Filters make fish colder
C. Strong flow stresses a fish that evolved in still water

Words to know

labyrinth: air-breathing organ
obligate: required
dissolved: oxygen in water
breeding: choosing parents
lethargy: tired sluggishness

Answer key: Built for Puddles, Bred for Beauty

1. C. A Thailand betta habitat was warmer and shallower than the tank
2. B. Absorb oxygen from air
3. A. The sources measure different things and do not agree exactly
4. B. Required to
5. B. Aggression
6. C. Strong flow stresses a fish that evolved in still water