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November 2024
volume XXXI
number 9

Greater City Aquarium Society - New York

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Series III Vol. XXXI, No. 9, November, 2024

ON THE COVER

Our cover photo this month is by Scott Peters, and features a *Laetacara araguaie* watching over its eggs.

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From the Editor

by Dan Radebaugh

This being the season of Thanksgiving, it seems to me that we, perhaps as individuals and certainly as a club, have a lot to be thankful for. Moving our meetings to the Alley Pond Environmental Center certainly seems to have been a positive decision. For a few of us it takes a bit longer to get to meetings, but for many others it seems to be rather easier! At any rate a lot more of us seem to be showing up at our meetings! We've also heard many positive comments about the facility, and especially about the parking!

In many ways of course we are all still feeling the effects of the Covid epidemic, both in terms of friends lost to the disease, as well as the effect on how we live our lives and make our decisions on what are safe things to do and what are perhaps not. A lot of the clubs that I am (or was) familiar with are having a pretty rough go. I try to keep up with the publications of other clubs around the country, and especially in our general vicinity. Many of these clubs used to send us exchange copies (electronically of course) of their publications, and we would publish what I considered to be interesting stories, and articles by our authors here would appear in other publications around the country.

These days I receive very few of these exchange publications (though there is one such article in this current issue), and many of the ones I do receive are mere shadows of their former selves, though the Missouri Aquarium Society this year has been consistently producing 80-page issues. Go figure!

What does this all mean, I wonder? And fishkeeping aside, what will be the consequences to society in general if we are all reluctant to meet with, or even talk with one another?

Remember, as always, we need articles! **Modern Aquarium** is produced by and for the members of Greater City Aquarium Society. Our members are our authors, and with ten issues per year, we always, *always* need more articles. I know several of you are keeping and/or breeding fish that I would like to know more about, and I'm certain other members would be interested

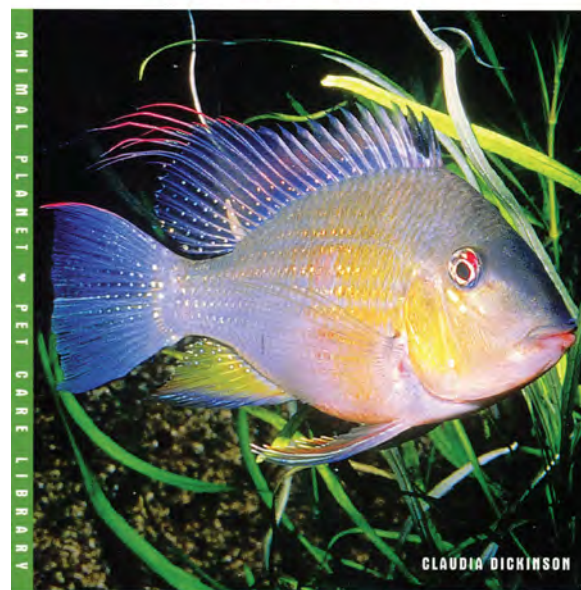


as well. Share your experiences with us. Write about it! If you're a little unsure about the state of your writing technique, don't worry—that's why editors were invented!

If you have an article, photo, or drawing that you'd like to submit for inclusion in **Modern Aquarium**, it's easy to do! You may fax it to me at (877) 299-0522, email it to gcas@earthlink.net, or just hand it to me at a meeting. However you get it to me, I'll be delighted to receive it! Enjoy!



Aquarium Care of Cichlids



by Greater City member Claudia Dickinson
(Animal Planet® Pet Care Library)

Hardcover — Also available on Amazon Kindle
<https://www.amazon.com/Aquarium-Cichlids-Animal-Planet-Library/dp/0793837774>



GCAS Programs

2024

March 6	Emperor Tetras
April 3	Inside Filters
May 1	Live Food Culture
June 5	Swordtails
July 3	Aquatic Plants
August 7	Night At The Auction
September 4	Breeding Corydoras
October 9	Fishrooms
November 6	Daphnia
December 4	Holiday Awards Party!

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The Greater City Aquarium Society meets every month except January and February. Members receive notice of meetings in the mail or by email. For more information, contact: Dan Radebaugh at (718) 458-8437, email to gcas@earthlink.net, or fax to (347) 379-4984. For more information about our club or to see previous issues of *Modern Aquarium*, you can also go to our Internet Home Page at <http://www.greatercity.net>, <http://www.greatercity.org>, or <http://www.greatercity.com>.

President's Message

Coffee!

by Horst Gerber

Here you have it! I admit it! I am addicted! Addicted like millions of Americans! After 80 Prez messages what do I write about? What would you do if you had to write a message to the membership every month? Do you want me to write only about fish? But no! I am the Prez, and I write what I want to! Hey! "It's my birthday, and I'll write what I want to!" I want to remember saying, "It's my Folger's and I'll drink if I want to!" But I probably ought to move on to another subject.



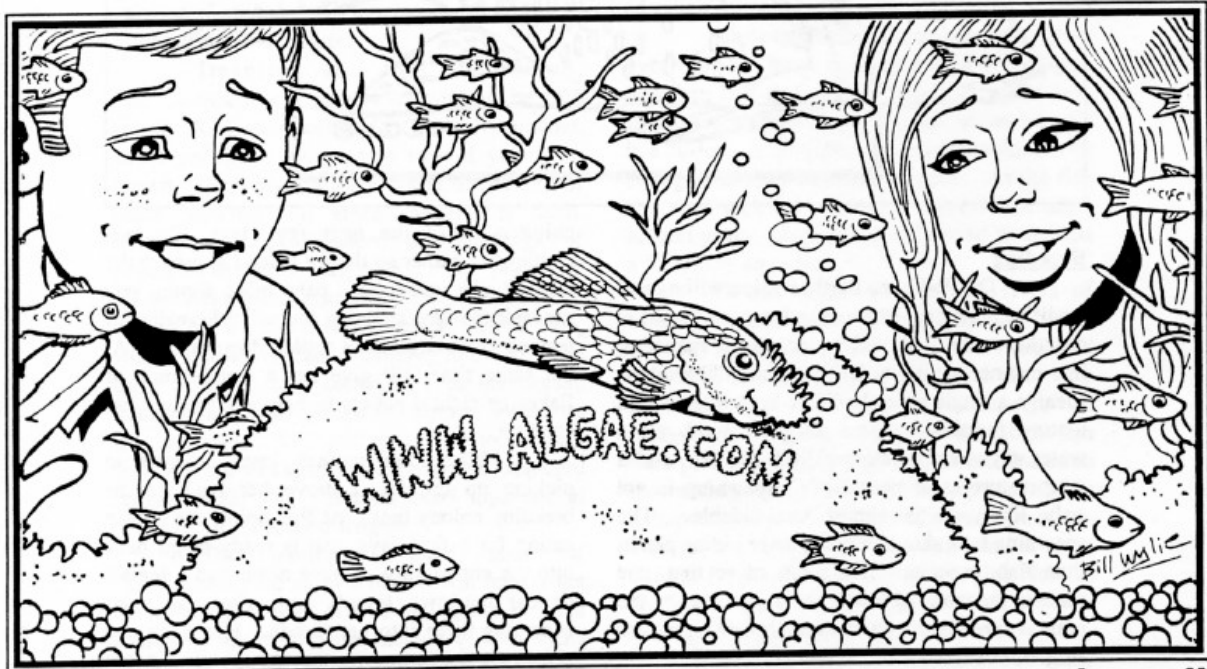
When I took over as President I had some pretty big shoes to fill. Joe Ferdenzi and Dan Radebaugh had done a fantastic job shepherding the club and **Modern Aquarium** for the previous 27 years or so. Following those two, I am honored to have been president of this fish club, with its legacy of 102 years of spreading knowledge from and to our wonderful membership. Now it's time for me to relax and enjoy life as a Board member, putting in my two cents worth every now and then. I'm eager to share and read stories with all of our members!

Horst



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"Look Charlie, everyone has a web site these days."



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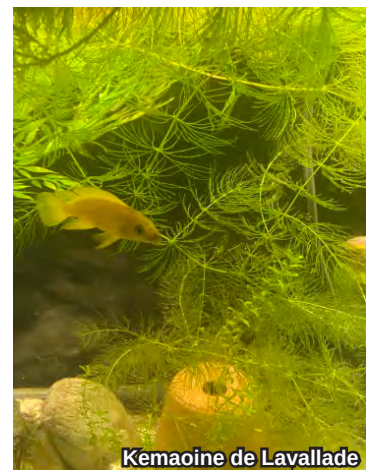
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Fishy Friends' Photos

by Greater City Aquarium Society Fishy Friends

***B**elow are photo submissions to our “Fishy Friends” Facebook group. I’ve left the subjects unnamed, but not the photographer. If you see a shot you like, and want more info, ask the photographer about it! I’m sure he or she will be delighted to tell you!*





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BOWL SHOW RULES

There is a Bowl Show at every GCAS meeting, except our Night at the Auction/ fleamarket meeting and our Holiday Party and Awards Banquet meeting. Bowl shows are open to all members of GCAS. Rules are as follows:

- Only current GCAS members may enter fish in the Bowl Show.
- There is a limit of 2 entries per member per meeting.
- Unlike some other clubs, every month is an “open” Bowl Show at the GCAS (i.e., there is no “theme,” such as that one month cichlids are judged, the next livebearers, the next anabantoids, etc.).
- Any fish that wins any prize (1st, 2nd, or 3rd) may not be entered again in the same meeting year.
- B.Y.O.B. (Bring Your Own Bowl!) Entrants are responsible for providing suitable containers and suitable water for their fish. These containers must be clear on at least three sides.
- Only one fish per container (i.e., no “pairs”).
- No plants, ornaments, or equipment (filters, airstones, etc.) are allowed in the judging tank (an external mirror, or opaque cards between containers is acceptable, as is a cover that does not obstruct side viewing).
- Points are awarded: 5 points for 1st Place, 3 for 2nd Place, and 1 for 3rd Place.
- Ribbons are awarded: blue for 1st Place, red for 2nd Place, and green for 3rd Place.
- The person with the most points at the end of the meeting season receives the Walter Hubel Bowl Show Champion trophy at the Awards Banquet.
- The decision of the judge(s) is final.
- A running UNOFFICIAL total of the points awarded is printed in **Modern Aquarium**. Only the tally of points maintained by the Bowl Show Coordinator is official.
- **In case of ties:**
 - 1st Tiebreaker – most 1st Places
 - 2nd Tiebreaker – most 2nd Places
 - 3rd Tiebreaker – most entries

The Japanese Trapdoor Snail

Story and Photos by Stephen Sica

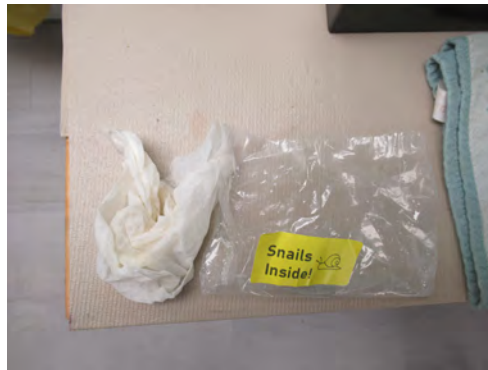
I like to watch snails in an aquarium. I enjoy observing them at work in a nice, neat fish tank. I have always thought that they keep that fish tank nice and neat, but recently I have been thinking that a snail is akin to a fish. Whatever it eats is going to generate a waste product. In one end and out the other. To keep it simple, one snail equals one fish. No? For this essay, I thought that I might term this idea my “Law of Wastes.” Rest assured that I do not desire to be an expert on waste. In fact, right now I could see myself having an ice cream cone. I enjoy eating ice cream so much! As for my lovely wife Donna, I know exactly what she would like to be doing—sipping a nice cool glass of white wine. I don’t even have to ask her! I know it!

I also really like Mystery snails. You can find them in various shades of white, black, and the color that I like most, gold. I like them so much that I researched methods to breed them. But of course, I was overtaken by a fit of laziness and have not made the attempt to date. I estimate that I had some of these snails living for about a year in my aquariums. More recently, other Mystery snails seemed to live for a lesser period. I don’t believe that they were old, so I wonder if they had sufficient food to survive. I always think that the primary reason an animal doesn’t survive is my fault.

Since I like to watch snails, it is so much easier to observe larger specimens. Until this writing, my aquariums had no

snails except for those small hitchhikers from plants. When I decided to purchase a few fish from an online dealer back in April, I saw that they also carried a selection of snails. Some snails to which I was attracted were in the “out of stock” category. This motivated me to learn a few more things about snails. In all my years as a GCAS member, I cannot recall meeting a snail expert. I do not even remember reading an article about snails. Maybe it’s because snails are not fish. I questioned myself, “How can a progressive snail watcher like me be ignorant about these creatures?” I barely glossed over these fascinating animals during my prior snail watching. Was I too busy just watching?

I began studying the scant information that the online merchant had about the snails that were in stock, until I came upon the Japanese Trapdoor snail. What





an interesting name! I studied the photos and decided that it was “cute.” I hurriedly did some computer research and saw somewhere that they can live five years. I decided to order two, since the online dealer sold them in lots of two for \$2.50 per snail, for \$5.00 total. Then I decided to buy four. What’s a few dollars more?

When the snails arrived after two days of traveling cross-country, I eagerly opened their box. I checked out the live fish first since the snails did not smell. A few online reviewers of four or five day delivery delays knew their snails were not alive via the smell. Anyway, I put two snails in a thirty gallon aquarium and the remaining two in a fifteen gallon tank. Both were well-planted. These snails are different from Mystery snails; their outer shell has a “distressed” or worn appearance. For this article I did more research; I discovered that these snails could live from one to five years, and perhaps a little longer. I thought that it was a given as to their long lifespan. They seem to enjoy a pH of 7 or higher, 72-80 degree temperature, regular lighting and minerals in the water. New York City water is full of minerals. The ones that I have look greenish to me. They supposedly are shades of brown and black also. The size of the snail is related to its age. These snails have a relatively wide aperture, as well as an operculum that closes the aperture shut if the snail is bothered by a tank mate. I saw a baby molly curiously pick at the

snail on the tank glass. The snail quickly retracted its eye stalks and snout. When you purchase this snail, it is usually about one inch in length but sometimes smaller. A few hobbyists claim that their trapdoor snails grew to between two to three inches. Now that’s a big snail!

While good at cleaning the algae in your tank, these snails should have supplemental feedings of bottom feeder tablets, such as algae wafers, and other foods rich in calcium. Dead plant matter and algae on plants is a food source. Snails may also eat live plants with soft leaves, if hungry enough. Like many other aquatic animals, hungry snails are often trapped in filter intakes while grazing for food. This often inhibits breeding.

While Japanese trapdoor snails can breed in a freshwater aquarium, they are not prolific breeders and will not overrun an aquarium. They are livebearers. They don’t lay eggs on surfaces like some snails do. They are compatible with practically all sorts of community fish, catfish, shrimp and other types of snails.



If you have an opportunity to purchase or possess this snail, I suggest that you give it a try. After all, its name alone will give an air of exotica to any aquarium!



The Evolution of Fishes

by Jason Gold



I'm a bundle of obsessions. I was like that as a kid, and I'm still like that today. Some of these obsessions, like fish and plants and food and weather, have been part of me since childhood. Others have grown out of the fish/plants/food/weather thing, and still others have come entirely out of left field. And so it was when I picked up a copy of John McPhee's **Annals of the Former World** at Barnes & Noble a few years back. Oh, did I mention I'm also a reader? One wall of my living room is aquariums, the opposite wall is books, every window is full of plants, and the refrigerator is always full of food. My mother once called that wall of books "a collage of your life." And she's not wrong about that.

Over the years, I'd read a few other books by McPhee, master of literary non-fiction. He has an uncanny knack for bringing arcane subjects to life through his spare, clean prose and his engagement with one or two primary tour guides through whatever cultural or intellectual hinterland he's traversing. For instance, in **Encounters with the Archdruid** he hikes the Sierras with the president of the Sierra Club, revealing in the process the entire history of the conservation movement in the US.

Oranges is about the Florida concentrated orange juice industry. Yes, McPhee finds what's fascinating in that, too. He's so good it's almost embarrassing. And

in **Annals**, he tackles geology, the neglected child of the science family, the one major science you don't have to take in high school. McPhee travels the breadth of I-80, from the George Washington Bridge to San Francisco, accompanied, in turn, by four eminent geologists. Why I-80? Because the road cuts reveal the geology of the continent, coast to coast. The geologists are there to explain what it all means, and McPhee is there to translate it all into exquisite prose. It sent me hurtling down the geology rabbit hole. I haven't hit, um, rock-bottom yet. And, surprise, surprise, geology has a lot to tell us about fish. A whole lot.

Maybe you're into South American corys, or maybe you're into Rift Lake cichlids. Maybe you've got a huge tank housing one monster gar, or maybe you've got a tiny tank where you dote on your nano-rasboras. Whatever your niche in the hobby, the fish we keep have their own niches too in their natural habitats. Large or small, bold or shy, voracious or picky, through evolution and natural selection they all have the tools they need to survive, thrive, and reproduce in whatever natural niche they occupy. Like a road cut, there's a lot of history in a Cardinal Tetra.

Looking at the history of life, organisms are often described as evolving new traits to adapt to their environment. That's true, but it's not the whole picture. That's just

the part about slow, random, incremental change—microevolution. However, the big innovations in the history of life—macroevolution—happen differently.

Those are the innovations that define a new geological stratum and a new geological era. All living populations accumulate new traits generation by generation. Some of these might give certain individuals a bit of an advantage in the niche they already occupy and the lifestyle they already lead. But others may not demonstrate their worth until a selective event comes along. Those selective events can take many forms—from subtle shifts in weather patterns, or food supplies, or predators, to the global devastation wrought by a supervolcano or meteorite.

For example, we all know that if you put a saltwater fish in fresh water, it will die. It does not develop the ability to osmoregulate—to maintain its saline body chemistry despite being immersed in fresh water—just because you put it in a new environment. But let's say that within a population of saltwater fish some individuals do develop osmotic regulation. That may have no impact on their lives for thousands of years until, say, a new predator drives that population to take refuge in a shallow freshwater river delta, leaving the osmosis regulators as the only local survivors: a selective event. And thus, very suddenly in geological terms, a hidden innovation proves its worth, and a new species begins its evolutionary journey. In fact, it's postulated that photosynthesis itself followed this route, first developing in bacteria inhabiting lightless deep-sea hydrothermal vents as a chemotrophic metabolic pathway—using chemistry to derive energy—and only proving its value as a phototrophic energy source—deriving energy from light—when some of these creatures found their way close enough to the surface for sunlight to be a factor.

Likewise, genetic mutation is often seen as reflected primarily in easily visible characteristics, each encoded by a single gene. Darwin's great example of this—though he didn't know about genes—were the finches of the Galapagos. But the discovery

of genetics has revealed that that's a shallow take on what's really going on. If we had to wait for each of these zillions of individual characteristics to arise and vary one mutation at a time, the entire age of the universe would not yet have engendered complex life. Even in our large and complex human genome, there aren't enough individual genes to correspond to every one of our individual physical attributes or even to every one of the proteins our own bodies produce.

In **The Beak of the Finch**, Jonathan Weiner describes the work of Princeton evolutionary biologists Peter and Rosemary Grant, who studied the various populations of Darwin's Galapagos finches. Their work revealed that whole populations can shift in their beak morphology due to a single unusually wet or dry season, or even a single violent storm. So much for slow and steady. It's not that any individual finch changes—they either live or die—but that the population as a whole shifts as conditions cause possessors of one set of attributes to succeed and another to fail. The late Stephen Jay Gould, a paleontologist at the AMNH and Harvard and a prolific popular science writer, dubbed this start-and-stop evolutionary mechanism “punctuated equilibrium.” In evolutionary terms, this is when the big stuff happens.

But long before we open our green eyes or comb out our auburn hair, each of us—every plant and every animal—was a single fertilized cell, dividing and differentiating into our myriad tissues and organs. And a single change to a single gene involved in that microscopic, early developmental process can have far-reaching impacts on the resulting organism. A simple change in any complex process can have complex implications.

Most such changes mean death. But once in a long while, what Richard Goldschmidt in 1963 called a “hopeful monster” not only survives, but thrives. (I first encountered the idea of the hopeful monster reading Richard Dawkins.) Using this principle, S. J. Gould, in “A Short Way to Corn,” solves the riddle of how modern cultivated corn derives from

its wild progenitor teosinte with a single gene mutation—despite the fact that the two plants appear wildly different in form and structure. And he makes a similarly compelling case in *Ontogeny and Phylogeny* for a way humans and chimps may have initially differentiated from their common ancestor with a single shift in a developmental process. In both cases, a simple change in a crucial and complex developmental pathway may have had enormous implications for not only an individual or a species, but for the entire future of life on Earth.

But let's go back even farther, to pre-life Earth, down, down, down the geology rabbit hole. On a YouTube channel called "Geo Girl," our tour guide to the wonders of geoscience is Dr. Rachel Phillips. During the course of her 303 (and counting) posted videos, she goes from being a PhD candidate to a bona fide PhD to a postdoc and professor. With a winning manner and a ton of serious science, she roped me in—as in I've watched them all. Evolution, it turns out, isn't limited to life. The Earth is 4.55 billion years old and has evolved in its own right. It accreted from a disc of matter revolving around the proto-star that is now our sun. Once the Sun had become large and dense enough to ignite nuclear fusion, its heat and solar wind drove lighter and more volatile elements, gases, and minerals to the outer reaches of the swirling disc, coalescing into the gas and ice giants we call Jupiter, Saturn, Uranus, and Neptune. That left heavier elements like iron, nickel, and silicon to coalesce into the inner, rocky planets Mercury, Venus, Earth, and Mars.

Initially, the Earth was a molten hellscape. Within the molten mass, the planet's growing gravity mimicked the processes that were creating the solar system as a whole. Heavier elements like iron and nickel were drawn to its center, leaving the lighter silicate minerals closer to the surface. And as these silicate magmas began to cool, minerals started to crystallize. First those enriched with heavy metals such as iron and magnesium and with the highest melting points, crystallized out of the magma and sank, leaving behind

the silicates enriched with lighter elements such as aluminum and sodium. Lighter and relatively more buoyant, these rose to the surface of the magma or were brought there by convection and vulcanism and other tectonic forces, creating Earth's granitic continental crust and setting the stage for the later development of plate tectonics.

These processes also released water vapor from hydrated minerals. Additional water arrived from comets, asteroids, and other smaller objects within the solar system as each of the growing planets drew in anything that crossed their orbits. This water vapor was held in Earth's mostly nitrogen and carbon dioxide atmosphere by gravity and, at some point, by the magnetic field generated by the planet's spinning iron-nickel core. To this day, Earth's magnetic field deflects the solar wind that drove most of the water off our sibling rocky planets. As the Earth's surface and atmosphere continued to cool below the boiling point of water, that vapor condensed into liquid water—clouds and rain—and began to fill the uneven contours of the solidifying rocky surface, creating the first rivers and seas and oceans. The waters reacted with the rocks and the rains washed across the incipient continents, weathering the stone and transporting sands and soluble salts and minerals into the ocean basins to create a rich mineral soup. And about 4 billion years ago, from what we can tell, life began.

That first life probably took hold either at the shallow margins of the salty oceans or at deep-sea hydrothermal vents, places where the heat and minerals to fuel life's energy-producing chemical reactions were abundant. The first signatures of life on Earth are not physical fossils, because these first simple organisms were tiny, soft, and fragile, and didn't preserve in the geological record. But their chemical traces—their proxies—are preserved. For when life is building its biomass, then as now, it prefers to incorporate the lighter Carbon-12 isotope over the heavier Carbon-13 and radioactive Carbon-14. 4.1-billion-year-old zircon from

the Jack Hills formation in western Australia retains this biotic carbon signature—too high a proportion of Carbon-12 to have been generated by anything but...life. So that's why we think that life was present on Earth by the time the minerals in those rocks were being deposited over four billion years ago.

We also know that for at least two billion years, earthly life was anaerobic—it didn't breathe oxygen. The simple reason is that almost no gaseous oxygen, O₂, was present on Earth, neither in the atmosphere nor dissolved in the water. But that changed with the evolution and smashing success of the cyanobacteria, the first to develop the chlorophyll-based, oxygen-producing photosynthetic metabolism that they and all green algae and plants on earth use to this day. O₂ is the waste product of aerobic photosynthesis, and it is a very, very reactive molecule.

As the growing blooms of cyanobacteria began to spread through the shallow, sunlit ocean margins, they released ever-increasing amounts of O₂, first oxidizing any reactive metals on the land and in the water, then accumulating in the atmosphere. This is known as the Great Oxidation Event, or GOE, and not only altered the planet's chemistry forever, but also killed off many of the anaerobes that had ruled the planet in the 2 billion years since the origin of life.

For the anaerobes, not only was oxygen not necessary, it was toxic. This was perhaps the first major punctuation in life's equilibrium, the first giant, global selective event. Aerobic life took over after the GOE and still dominates Earth's biosphere today.

And then, 1.5 billion or so years later, it happened again. This time, plants—mosses and bryophytes at this point—didn't just bloom in the shallow ocean waters, but blazed a photosynthetic path across any part of the land with access to water, raising oxygen levels again in what's called the Neoproterozoic Oxygenation Event, or NOE. (The spread of terrestrial plants was not the only cause of the NOE, but it was an important contributor to it.) The NOE also

coincides with the appearance of complex, multicellular aerobic animal life, food webs, and ecologies—first the Ediacaran Biota, then the more famous Cambrian Explosion. There seems to be little to no direct connection between the weird Ediacaran creatures and any type of life present on Earth today—scientists consider it a failed evolutionary experiment. But the Cambrian Explosion laid the groundwork and established most of the lifeforms and body plans we still see on our planet—all those animal phyla we had to memorize in high school biology—including the first chordates, direct precursors of the vertebrates including mammals, birds, reptiles, amphibians, and of course, fish.

The first fish-like creatures appeared in the Cambrian, about 530 million years ago. The proto-fish such as *Pikaia* and *Haikuichthys* were small, eel-like and soft-bodied without much in the way of bones or cartilage, but they did have a dorsal notochord—a primitive spinal cord. Note that this is about 4 billion years into the history of the Earth and more than 3.5 billion years after the first life appeared. So, yeah, something that seems as basic to us as having a spinal cord took a long while to happen. Or rather, we don't know how many times hopeful monsters with notochords might have shown up prior to the Cambrian and disappeared without a trace. But we do know that the environmental conditions of the Cambrian suddenly made a notochord a huge advantage. In other words, during those 3.5 billion years, single-celled life was accumulating internal complexity and much of the genetic tool kit that life still uses today. Many genes involved in embryonic development are broadly conserved across all eukaryotes, all animals, or all bilaterally symmetrical animals, for example. Minor changes in these genes can generate the hopeful monsters that account for many major developmental differences in embryos and the final adult organisms.

For example, both chlorophyll and hemoglobin arise from a common, conserved genetic pathway. Then there are the 'hox' group of genes, present in all animals except

sponges, that are responsible for both the segmentation of arthropod exoskeletons and the segmentation of vertebrate endoskeletons. Or the ‘hedgehog’ genes, present in all bilaterally symmetrical animals, which produce embryonic protein gradients that differentiate tissues and forms in a number of animal systems, ranging from the nervous system to our five different fingers on each hand. In his excellent book **Your Inner Fish**, University of Chicago’s Neil Shubin talks about how the hedgehog genes in a shark and in a mouse are not just similar, they are literally interchangeable. These sorts of genes are so basal, powerful, and crucial that it doesn’t take much of a mutation to turn a hippo’s rear legs into a whale’s flukes. For a fully terrestrial animal, such a change would be fatal. But for an animal already living a semi-aquatic life, it could be a crucial transformation that allows that beach-dweller to become a sea-dweller, opening up new lifestyles and new ecological niches and whole new evolutionary possibilities. So once the conditions were right in the early Cambrian, including oxygen levels close to today’s thanks to the NOE, these tools allowed various populations to succeed in various environments, exploding in a global cascade of experimentation and diversification and radiation.

As complex food webs developed and giant arthropods with exoskeletal armor such as *Anomalocaris* and *Eurypterus* established themselves as the top predators (think huge, ravenously carnivorous shrimp and nightmarish aquatic scorpions), animal life’s equilibrium got punctuated. Everything else in the seas that didn’t hit upon some means of defense was hunted to a speedy extinction. Armored creatures were the primary survivors, and shell and exoskeleton fossils seem to appear out of nowhere. It doesn’t necessarily mean they weren’t there before, but it does mean that they weren’t prevalent before. And, you see, those biomineralized hard parts not only served as armor while their owners were alive, they also fossilize much better than all the soft and squishy stuff

that came before them once their occupants die. They left a suddenly profuse geological record.

At the same time, terrestrial plants were developing better ways of living away from the water. With the Devonian (419-359 million years ago) rise of the vascular plants and the spread of the first forests, the massive increase in global photosynthesis finally brought oxygen levels in both the air and the water to their modern levels. And with plenty of oxygen to build their high-energy bodies and fuel their high-energy lifestyles, fish took off. In fact, the Devonian is often called the Age of Fish. No Cardinal Tetras yet, but we’re getting there.

The fish that could survive this evolutionary arms race were those that could see sharper, swim faster, hide better. Ones that could feed and breed more effectively. Or ones that could develop armor of their own such as bony external head plates and scales and internal skeletons of cartilage (mostly the protein collagen) or bone (still mostly collagen, but hardened with calcium phosphate), or become predators themselves with jaws and teeth. A few basal jawless fish still survive to this day, the lampreys and hagfish. But jaws, an embryonic developmental change of the ‘hopeful monster’ type repurposing the first two gill arches, gave the fish that possessed them a huge evolutionary advantage. The jawed fish radiated into four groups, the spiny sharks, the armored placoderms, the cartilaginous fish, and the bony-skeleton ray-finned fish.

In the Devonian, the placoderms, a group of fish with huge armored heads and razor-sharp jaws, displaced the giant arthropods to dominate the seas. But like all apex predators, they were the first to go when environmental conditions shifted and food chains collapsed in the Late Devonian. This was the first of Earth’s five great mass extinctions. Such mass extinctions are the largest selective punctuations in the evolution of life. (Many scientists believe that anthropogenic environmental change is currently driving a sixth mass extinction.

Today's apex predator—man—might want to keep in mind that this actually puts us in the *most* vulnerable position in a changing environment because we require the most resources to thrive.) Only the small, agile, efficient, and adaptable cartilaginous and ray-finned fish survived the Late Devonian extinction. And although the cartilaginous sharks and rays have remained successful to the present day, it is the ray-finned fish that have come to dominate almost all aquatic habitats and constitute nearly all the fishes we keep in our aquariums today. And yes, that includes our tetras and our corys, our cichlids and our gouramis, our loaches and our gars, and just about everything else we keep in our tanks and talk about at our GCAS meetings.

So the next time you look at your aquarium, maybe take a moment to travel down the rabbit hole of geological time. The fish we keep, just like we keepers ourselves and the planet on which we all live, are the products of 4.55 billion years of chemistry and physics, innovation and extinction, crisis and change, adaptation and survival. Or as Charles Darwin himself put it in **The Origin of Species**: “There is grandeur in this view of life, ... [that] from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.” In other words, there's a lot of history in a Cardinal Tetra. A whole lot.



Artwork from Istock



Photos From The Keystone Clash

from Joseph Ferdenzi



Three GCAS members having fun (L to R) John "Buzz" Buzzetti, Joe Ferdenzi, and Warren Feuer.



One of the many vendors



GCAS Vice President Ed Vukich with his awards for Best Cichlid In Show and Reserve Of Show!



John "Buzz" Buzzetti certainly won more than his fair share of medals at the fish show!



One of the tanks in the aquascaping contest.



Joe Ferdenzi (left) with renowned Austrian aquarist Anton Lamboj.



The Ultimate Nano Fish

Dario dario ~ the Scarlet Badis

by ALEXANDER A PRIEST - photo by the author

Calling them “fads” will likely get quite a few people upset, so I’m going to call them “trends.” There is/was the trend of the “natural” aquarium, the “Dutch” aquarium, the “biotope” aquarium, The “planted” aquarium (as opposed to an aquarium with a few plants), the “high-tech” aquarium (you know, automated feeders, automated water changes, UV sterilization, carbon dioxide infusion, LED lighting, etc.), and so on. One of the most popular current trends in the aquarium hobby is the “nano” aquarium, generally understood to mean a very small tank. One obvious factor (at least I HOPE it’s obvious to anyone reading this), is that a “nano” aquarium needs “nano-sized” fish. Well, what about the smallest species in the largest order of fish? (For anyone who needs a refresher in taxonomy, individual *species* are members of a *genus*; several genera belong to a *family*, and several families constitute an *order*, so the smallest species in the largest order means a **really** small fish!)

The species I’m going to introduce you to in this article has the common name of “scarlet badis.” Despite that common name, it is not a member of the genus *Badis*, although it is a

member of the family *Badidae*, which is in the order *Perciformes* (perch-like fish), the largest order of fishes. Members of the *Badidae* family (which include the genera *Badis* and *Dario*, are often grouped with the “labyrinth fish” (along with gouramis, bettas, paradise fish, and snakeheads), even though they lack a labyrinth organ (the maze-like structure in the head allowing labyrinth fish to take in oxygen directly from the air, instead of taking it from the water through their gills).

Before describing, and getting into the husbandry of the Scarlet Badis, I’d like to clear up a few things about its scientific name, which is *Dario dario*. Once, there was a fish with the scientific name of *Labrus badis*. That fish was later renamed *Badis buchhanani* and then renamed again to *Badis badis*. It was, for a time, the only member of its genus (by the way, a scientific name in which the genus and species names are the same is called a tautonym). Further discoveries and investigations resulted in the placing of additional species in the genus *Badis*, including the “scarlet badis” which was named *Badis bengalensis*.

This article originally appeared in the September, 2013 issue of Modern Aquarium.



Their natural environment is heavily planted, and they lay their eggs in plants, so a layer of Java moss (*Vesicularia dubyana*) or another hardy aquatic moss is the best choice for a substrate. I prefer tanks without gravel, and with fish this small, using a gravel-cleaning syphon without sucking up the fish themselves is a real challenge! A heavily planted tank also keeps aggression down if you have more than one male in the tank (although I have never witnessed, or seen any evidence of, aggression among my colony of mixed sexes). I'd also throw in several small caves. Even though *Dario dario* are not cave spawners, I've found caves also help reduce aggression.

On some Internet fish forums I've visited, hobbyists have claimed success in having *Dario dario* eat dry fish flakes. However, the general consensus is that these fish rarely eat anything that is not "live," although floating pellets or thawed frozen morsels that "move" due to water current might be accepted. I feed my *Dario dario* live microworms, live brineshrimp, and chopped live blackworms. They are hearty eaters!

I have never been lucky enough to witness *Dario dario* spawning, but here is a description I found on the Internet.⁵

"As they come into breeding condition males will begin to form territories and display courtship behaviour towards females swimming nearby. During this process they display some intense changes in patterning with the body intensifying in colour.

Courtship can go on for days with the female often being chased away then courted again minutes later. The male will make a non-aggressive approach towards the female and appear to 'invite' her into the centre of his territory – if ready to spawn she will follow.

The act itself is over in just a few seconds with eggs being scattered in a random fashion on the underside of a solid surface such as a plant leaf.

Post-spawning the female is ejected and the male takes sole responsibility for the territory. If you want to maximise the numbers of fry raised now is the time to either remove the medium to a container containing water from the spawning tank or the adults as the fry will be preyed upon once hatched.

The incubation period is 2-3 days after which the fry may need up to a week to fully absorb the yolk sac. They are very small indeed and will require an infusoria-type diet until large enough to accept microworm and/or *Artemia* nauplii."

Of course, when fish are under an inch long, newly hatched fry are almost microscopic in size. Here's where that Java moss and sponge filter really help. As a tank matures, microorganisms naturally build up on the surface of filter sponges and within the moss. Fry will readily feed on those microorganisms. Note the mention in the above quoted section to an "infusoria-type diet"—this is how to achieve that! If you remove the fry to a "grow-out" tank, include some of the moss from the original tank, and use the same sponge (one of the reasons I like the "dual sponge" arrangement is that it allows me to keep one mature sponge in the adult tank and still have one for a fry tank). Newly hatched brine shrimp, daphnia, and microworms can also be fed to fry as they mature.

There you have it — a scarlet badis that isn't a *Badis* and that lacks a labyrinth organ, but is grouped with labyrinth fishes. Well, it IS scarlet (the males at least), and in any event, it is a tiny jewel of a fish I would recommend to intermediate or experienced fish keeping hobbyists (the live food requirements being perhaps a bit more difficult than a beginner can handle).



References

- ¹ Schindler, Ingo and Linke, Horst (2010) *Badis juergenschmidtii* – a new species of the Indo-Burmese fish family Badidae (Teleostei: Perciformes) from Myanmar. *Vertebrate Zoology*, 60 (3): 209-216. ISSN 1864-5755, 21.12.2010
- ² <https://en.wikipedia.org/wiki/Badidae>
- ³ https://en.wikipedia.org/wiki/Scarlet_badis
- ⁴ Barlow, G. W., Liem, K. F. and Wickler, W. (1968), *Badidae*, a new fish family—behavioural, osteological, and developmental evidence. *Journal of Zoology*, 156: 415–447. doi: 10.1111/j.1469-7998.1968.tb04363.x
- ⁵ <http://www.seriouslyfish.com/species/dario-dario/>

Hemiodontichthys acipenserinus

A U.S. First?

by Charlie Mueller



Credit: <http://www.ucs.louisiana.edu/~jxa4003/Siluriformes6-15-2010mh.html>

I get very excited whenever the opportunity to acquire any of the mouth brooding whiptails comes knocking at my door! To my elation this happened in the late spring of 2014, and I requested them as quickly as I could pick up my phone! I was only able to acquire 6 of them, as they were in high demand by others also. After verifying my order for them, I ran to my computer to do what every good fish keeper does after they find a fish they have wanted but have not seen—started researching about its living requirements.

When it comes to catfish, there is only one site I trust, and that is planetcatfish.com. Where I found information on diet, habitat, and temperature range from which I could determine how to prepare a tank for them. I decided on a 10 gallon with a fine sand substrate and a few oak leaves. The size of the tank was mostly determined by that was the largest size I had available at the time, and from past experiences, whiptails can tend to be lazy to the aquarist and only move around at night. This allowed me to be confident that the size of the tank would be enough space for them, as long as water changes were kept up with.

Fast forward one week later, to the day the fish were scheduled to arrive. I received a text while I was working that the fish were in, and that they, and I quote, “Look Awesome!”

Naturally, I could not wait for the work day to be over, and to get the little buggers in my possession! Upon getting the fish home and acclimated to the water temperature of their new tank, they immediately buried themselves in the sand with only their “knobnose” and eyes protruding. Over the next 3-4 days, the



fish settled in well, and starting spending more time on top of the sand and not buried in it. They could be seen feeding on live baby brine shrimp as they would dig a pit in the shape of a half moon with their mouth, and just let the brine shrimp collect in the pit, and then suck them up. This to this day, ranks to me, as one of the most intelligent feeding behaviors of any fish! Black worms were also made available to them at all times.

Time seems to pass way to quickly these days, especially when looking forward to events such as PVAS’s CatfishCon, and the OCA Extravaganza always in October

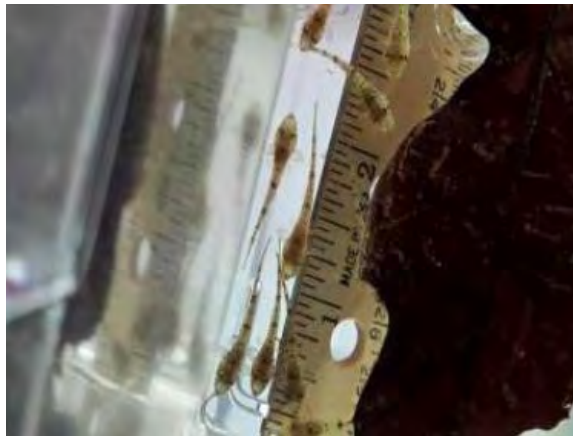
This article originally appeared in the November-December, 2015 issue of the Greater Pittsburgh Aquarium Society's *Finformation*.

and November respectively. While time approached closer and closer to these events, nothing seemed to change in activity level or amount of food being eaten.

Convention season and the holidays came and passed, and work on the new, larger fish room inched closer and closer to completion. As this was happening, the water changes in the old fish room got cut down a little, as did the amount of food. During this period I noticed that the population of black worms in the knobnose tank seemed to be dwindling, despite the fact that I never saw any of the lazy fish eat one!

Construction was finally completed, and I planned on doing larger water changes twice during this week to allow the following week to be dedicated to prepping and filling tanks in the new room. Wednesday, January 14 ended up being day one of large water changes, and Sunday, January 18 was the second that week. Sunday's water change was around 70% in total volume in the tank. It took the tank until Tuesday, January 20 to get back up to normal temperature, as I do not heat tanks individually, only use a space heater to keep the room warm.

Before leaving for work the following morning, I popped in to turn the lights on in all the tanks, and was shocked to see what looked like a male holding something in his mouth! I



grabbed my camera and my glasses, and went back in to get pictures to verify that it wasn't just wishful thinking! I snapped a few pictures and ran out the door to go to work. Upon arriving home, I affixed a Marina breeder box to the outside of the tank, added two oak leaves to it, and planned on moving the male holding the

eggs into it after a few days. This would allow for better observation of egg development, and allow the box to become seasoned along with the leaves.



The eggs are hatched by the male during the night, and on the morning of February 9th the male had an empty mouth and there were 21 small (8mm- 10mm) fry. I moved dad back into the main tank, took a few pictures of the recently hatched fry, then off to work. I did not make any foods available to the fry for their first 36 hours after, and then it was only microworms, as they stay alive for longer periods of time than live baby brine shrimp. The fry were fed new microworms three times a day for the next four days. On the fourth day, in the evening I added live baby brine shrimp to their diet and cut back the microworms to once per day. They grew quickly, and on March 1st the fry were just shy of 3 cm long. The fry can be a pain to raise, as missing one or two feedings may not yield any die off immediately, but within two weeks fry will start being found dead for no apparent reason. Making food constantly available to them is far and away the most important thing. Aside from that, it is relatively easy to rear the fry. These are true oddball fish that are rather undemanding and have some very unique spawning habits!



WET LEAVES



a Series On Books For The Hobbyist
by SUSAN PRIEST

This is not so much a review as it is a report on an individual article from **Popular Science** magazine which I hope you will find to be of particular interest. Please take an extra moment to read the title box to your right.

Every fishkeeper is familiar with the zebra danio (*Danio rerio*), AKA the zebrafish. If you have never actually kept any zebrafish, you have surely seen them for sale in pet shops, and/or read about them in hobby magazines. They have been among the standard bearers of the tropical fish hobby for very many years. Now they have a new claim to fame.

In 1988 scientists learned to selectively mutate the DNA of zebrafish. What does this mean? I don't really know. What I do know from reading this article is that because of this, growing numbers of genetic researchers are choosing zebrafish over rodents for use in their research. "The field is on fire," says Leonard Zon of Harvard Medical School. He uses zebrafish in his laboratory to study skin cancer, blood diseases, and stem cells.

The three major advantages of using zebrafish over rodents for medical research are:

- 1) A female zebrafish spawns hundreds of embryos just three days after fertilization, whereas a female mouse takes three weeks to produce ten pups.
- 2) One tank with a few dozen zebrafish in it can be maintained for 6½ cents per day, whereas five mice in a cage cost 90 cents per day.
- 3) In their larval stage Zebrafish are transparent.

A particular advantage of this transparency feature is that it can dramatically speed up research results when exceptionally rare illnesses are being studied. (This is not to say that the process isn't still a very lengthy one.) It can also be used as a diagnostic tool for babies with mysterious health

problems. Also, "Zebrafish are great for screening molecules to identify promising drugs. Researchers simply put the compound into the water, and the fish absorb it through their skin." The aforementioned laboratory at Harvard University was the first in the world to develop a drug through research using zebrafish.

The photo of the *Danio rerio* which you see here is the same one which accompanied this article in **Popular Science** magazine. It is a long-finned variety, quite possibly developed via selective breeding by a hobbyist such as yourself, and is not typical of the short-finned danios used by medical researchers. The article also has a mightily magnified photo of the brain of a three day

old zebrafish which has been stained to show detail. Very cool! (Photo credits not found.)

Trivia: In 2004 a fluorescent zebrafish, most often called a "Glofish," became the first genetically modified animal to be sold as a pet in the U.S.

This article has given me a new perspective as I look around at my aquariums. Maybe a cure for A.L.S or Parkinson's disease is lurking among

those *Anubias* plants!

Popular Science, February 2013
"Will This Fish Transform Medicine?"
by Virginia Hughes



Science Geeks Take Note

Popular Science magazine has been around since 1872. (Yes folks, that's an 8!) Its founder, Edward L. Youmans, intended for it to "disseminate scientific knowledge to the educated layman." It became an outlet for the writing of such authors as Charles Darwin, Louis Pasteur, and Thomas Edison. It has undergone many name changes over the years, and has remained a monthly publication throughout. Today it is translated into 30 languages, and goes out to 45 countries. As of March 2010, all issues, including May 1872, which was the first, are available for free on GOOGLE books. There is a one year delay on recent issues.



This article originally appeared in the April 2013 issue of *Modern Aquarium*.

Pictures From Our Last Meeting

Photos by Marsha Radebaugh and Jason Kerner



Marsha & Dan Radebaugh, ready for duty!
Photo by JK



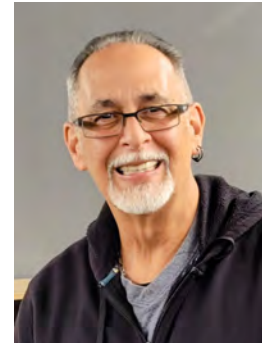
Things get busier!
Photo by JK



Getting Ready for the Auction!



Seungo Wie



Jaime Febus



Jeff Bolbach & Joe Ferdenzi



**Donita Maynard with
President Horst**



**Donna Ansari & Son
Nadim**



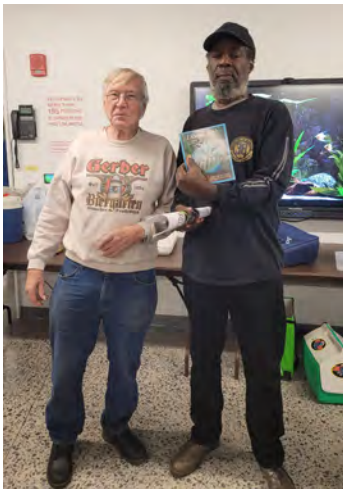
Donita & Son Jeffery



Cristos Tsavtarides



Paul Halvatzis



Denver Lettman receives congratulations from President Horst on winning the Door Prize!



Bill Amely presents October Bowl Show Winner, 1st & 2nd Places: Richie Waizman (MR)



GCAS Happenings November

A WARM WELCOME BACK TO RENEWING GCAS MEMBER LITA GOLDBERG, AND WELCOME TO OUR NEW MEMBERS PAUL HALVATZIS, CHRISTOS TSAVTARIDES, JAIME FEBUS, AND SEUNGHOO WIE!

October's Bowl Show Winners:

1ST PLACE RICHIE WAIZMAN
2ND PLACE RICHIE WAIZMAN

UNOFFICIAL 2024 BOWL SHOW TOTALS TO DATE:

RICHIE WAIZMAN 16 BILL AMELY 3 STEPHEN SICA 3 JOHN "BUZZ" BUZZETTI 3

Here are some aquarium societies in the Metropolitan New York area:

GREATER CITY AQUARIUM SOCIETY

Next Meeting: December 4, 2024

Holiday Awards Banquet -- See Page 28 for details!

GCAS Usually Meets the first Wednesday of the month
(This October meeting will be on **Oct 9**) at 7:30pm:
Alley Pond Environmental Center
22465 76th Ave, Oakland Gardens, NY 11364

Contact: Joseph Ferdenzi (516) 484-0944

E-mail: GCAS@Earthlink.net

Website: <http://www.greatercity.net>

BROOKLYN AQUARIUM SOCIETY

Meets the 2nd Friday of the month (except July and August) at 7:30pm: New York Aquarium - Education Hall, Brooklyn, NY 11229

Call: BAS Events Hotline: (718) 837-4455

Website: <http://www.brooklynaquariumsociety.org>

LONG ISLAND AQUARIUM SOCIETY

Meets: 2nd Fridays (except July and August) 8:00pm.

Meetings are held at AMVETS Post 48, 660 Hawkins Avenue, Ronkoncoma, NY 11779

Website: <https://ncasweb.thechinesequest.com/>

NASSAU COUNTY AQUARIUM SOCIETY

Meets: 2nd Tuesday of the month (except July and August) at 7:30 PM. Meetings are held at:

Molloy University - 1000 Hempstead Ave, Rockville Center, NY, Barbara H. Hagan Center for Nursing, Room 239

Contact: Mike Foran (516) 798-6766

Website: <https://www.nassaucountyaquariumsociety.org/>

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An Aquarist's Journey

Rosario La Corte is one of the world's leading authorities on breeding fish and he has written numerous articles and books, contributing greatly to our understanding of fish and their habits.

Now, for the first time, here is a compilation of his travels, adventures, successes (and, very occasional failures) all relating to collecting, keeping, and breeding fish, and in his own words (and edited by **Modern Aquarium's** Editor, Dan Radebaugh).

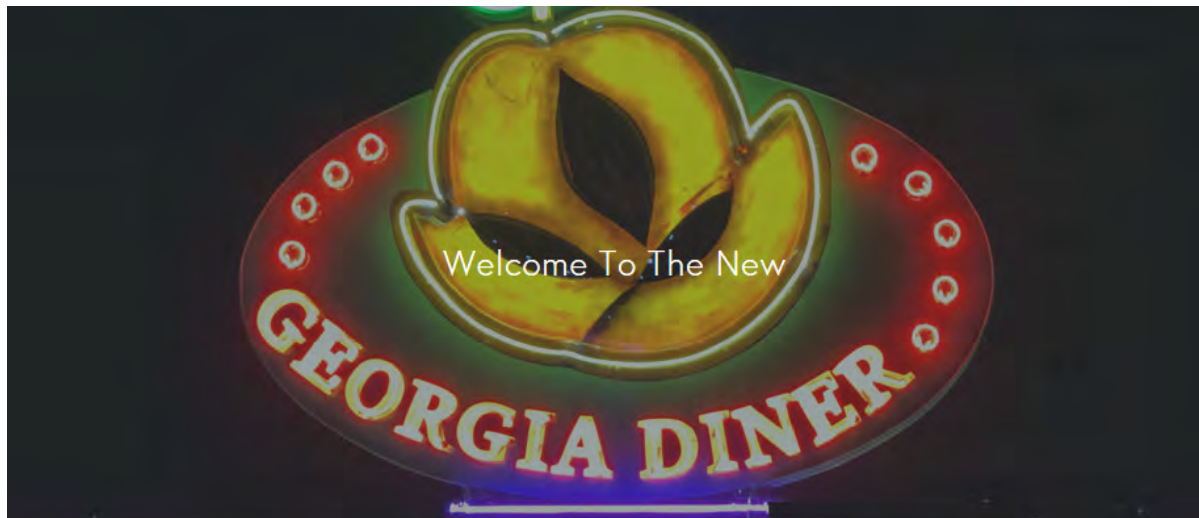
Available in softcover at [Amazon.com](https://www.amazon.com)



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The Tragic and All-Too-Predictable Demise of the Bed-Stuy Goldfish Pond

A series by the Undergravel Reporter

In spite of popular demand to the contrary, this humor and information column continues. As usual, it does NOT necessarily represent the opinions of the Editor, or of the Greater City Aquarium Society.

The Bed-Stuy Goldfish Pond, located near the corner of Tompkins Avenue and Hancock Street in Brooklyn, is no more.

As detailed in the September issue of **Modern Aquarium**, the neighborhood of Bed-Stuy was both delighted and roiled this summer when local residents decided to add goldfish to a puddle that had formed on the sidewalk beneath a leaking fire hydrant. The Bed-Stuy Goldfish Pond attracted many fans, who were drawn to the creative attempt to beautify the neighborhood. The glorified puddle perhaps attracted even more critics, who felt the goldfish were being housed in cruel conditions that would inevitably lead to their suffering and death. Some particularly incensed critics removed some of the goldfish from the puddle (whether this was a defiant act of liberation or simple theft depends on your perspective).

In any event, the Bed-Stuy Goldfish Pond is no more, and will not return. It appears that sometime on October 22, the FDNY conducted a routine inspection of the fire hydrant and tightened the hydrant so that it stopped leaking. New York City officials had said for months that the leaking hydrant was a safety issue. With colder temperatures headed to New York City, firefighters warned that the leaking water could freeze during the winter and lead to frozen pipes, which would doom any firefighting efforts that relied on that hydrant. Once the FDNY stopped the leak that was constantly replenishing the puddle—which appeared to be less than two inches deep—the puddle quickly dried out. By the morning of October 23, all of the fish had died.

The local residents responsible for the Bed-Stuy Goldfish Pond raged at the firefighters who turned off the hydrant, though the unfortunate demise for the goldfish was quite predictable. The firefighters who fixed the leaking hydrant are responsible for protecting the safety of the people in that neighborhood and could not allow a pet project

of a few residents to risk lives, especially when the residents had months to remove the goldfish to a more appropriate habitat. Even if the firefighters had done nothing to the pond, the managers of the pond had never presented any viable plan to prevent the extremely shallow pond from freezing entirely during the winter and killing the goldfish. The residents behind the Bed-Stuy Goldfish Pond had months to rehome the goldfish but appear to have ignored all of the concerns raised about the wellbeing of those goldfish.

Incredibly, the residents refused to let the Bed-Stuy Goldfish Pond go after their decisions led to the deaths of dozens of goldfish. Instead, they lined the hole beneath the fire hydrant with a waterproof liner and vowed to restart Brooklyn's most-famous puddle. New York City was forced to end the saga once and for all, and on October 25th it filled in the area around the hydrant with fresh cement, leaving no space for water to collect whatsoever. All that remains of the Bed-Stuy Fish Pond are the words "Fish Pond," scrawled in the wet cement by one local.



This Just In! The Undergravel Reporter spoke too soon! After this article was written but prior to publication, reports have emerged that the fish pond is back! The Bed-Stuy residents behind the original pond appear to have moved the fish pond inside a tree planter next to the original hydrant. This story is not over yet...



Sources: <https://nypost.com/2024/10/25/us-news/bed-stuy-aquarium-wrecked-during-fdny-hydrant-inspection-covered-by-cement/>

<https://nypost.com/2024/10/23/us-news/bed-stuy-aquarium-wrecked-by-fdny-organizers-already-rebuilding/>

Early 1980s magazine ad when the famous Metaframe brand was owned by the Mattel toy company.



**Take Home the World of Fish and Water.
The LIVING WORLD Complete Aquarium.**



Journal Added Worksheet

We've got everything you need to enjoy the beautiful city. We'll get you fully and safely acquainted with our beautiful surroundings and our friendly, experienced staff.

What You See Is What You Get

There is one important difference between these two measurements, however. Your own observations are subjective and may vary from day to day. The measurements made by the computer are objective and do not vary from day to day. As a result, the measurements made by the computer are more reliable than the measurements made by you.

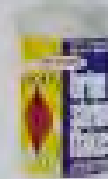
gender pay gap issues. This wouldn't happen unless there were no significant social agreement procedures.

Throughout the world, freshwater lakes, rivers and streams are home to many bright-colored, incredibly beautiful fish. The waters are warm and alive. The gentle flowing keeps the waters fresh. The plant-life provides oxygen.

In point LIVING, BEANED™ Aquascapes, a filter keeps the water fresh, so fresh you never have to change it. A fully automatic timer keeps the water airtight. And because this uses natural aquariums, it has no chlorine, no chemicals, no pumps.

Feeding Your Fish

By Steve Karpach, *Executive Director, Safe and Sound*
 following trends. But there
 more involvement in providing
 Time-Sharing is one of the
 most popular sources of pro-
 perty. And our new Florida
 Fund is the "Time-Sharing
 where it counts" company of your
 own kind. For more Complete
 Information on how this will
 increase your return.



Selecting Your Fish

College Park, Md.: American Psychological Association, 1980.

Formal. Never Toss Away the Quiver. The
gun captures the mood.

With *with Common Dictionary* (Harc's a full-size book to the front of the book and back). It shows the job as a command to start your *COMMON DICTIONARY* Aquarium. (Some are given below.) We know that this is a fairly useful, even, and they put along well.



in a commutative expression. We mean that $\Delta(V) \cap \Delta(M) \cap \Delta(L)^n \neq \emptyset$. According to the algorithm for starting with the right link in a good way, we know we can find in many cases, the link are included in the slice of the complex. In addition,

Let's Be Honest. How Easy Is It?

You can drive your equipment safely, operating without a hitch. But it's never "set it and forget it." You're dealing with living conditions in a living environment. An environment you can control. A challenge? Not that much, we can help you meet every challenge.

There's a specially written booklet in each Columbia Aquarium that tells you everything you need to know. It's plain, simple, fun! We want to share our life years of experience with you. So that you can enjoy the excitement of your own World of Fish and Water. It's World we'll help you master!

We want to hear from you about your experience with your LIVING WORLD® Amusement. You will have fun on

**Now You Can Give
A Living World Complete Aquarium.**

Because the LIVING MORGAN™ Apartment is complete in one package, it's perfect to take home to your family. And it makes a perfect gift. What not start today? Our promise: You won't want to stand still. Call Chatterbox.

METAFRAME
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COMPLETE AQUARIUM



Koi Organisation International

Can You Be a Better Koi Keeper, and Do It At Your Leisure?

Q: What if there was a source right in your home, available 24/7/365, that could provide the information you want and need about Koi keeping? Wouldn't that be nice, not to mention convenient?

A: Good News! There is just such a source and it's only a click away on your own computer. Water Quality course suitable for ALL fish keepers! Learn something new today!

Current. Accurate. Useful.

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