Tampa Bay Aquarium Society

27 Years

St. Pete/Tampa Florida

THE FILTER

KILIFISH ISSUE 2

Fish Shown:

Nothobranchius rubripinnis

November 2019
Volume 29 Issue 4

Photo Mike Jacobs . . . 2014

TBAS . . . Since 1992

TAMPA BAY AQUARIUM SOCIETY

"THE FILTER"

Tampa/St. Pete, Florida

TBAS

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Hi guys . . . OK, OK, it's ANOTHER Killifish bulletin! Like I told you in the last bulletin the local killifish club got together and decided to "BLITZ" our readers with "killifish stuff". Now that we did that we hope you all have a million questions for all of us **KILLIFISH NUTS**!!!

As you can see in the photos included, killifish are really very, very pretty. They are smallish, and are not that hard to keep and spawn. Normally you can't just throw them in a tank and walk away and they will spawn and raise their fry without you doing much for them but they aren't some of the "horror stories" you have heard about killifish.

GOOGLE killifish and take a look and read a bit . . . all you need is a spare 5-10 gallon tank and a place to get some killifish - **SKS** (the local killifish club . . . **TBAS** has 4-5 members in **SKS**). Then come in and ask us some questions . . . we are really not some "crazy-nut-cases" . . . someone helped us a long time ago!!!

REMEMBER, THERE IS NO TBAS MEETING THIS MONTH!! THERE IS SOMETHING ABOUT THE BUILDING NOT BEING OPENED UP BECAUSE OF A HOLIDAY OF SOME SORT!!!

Mike

Mike Jacobs, Editor TBAS Filter

Melanotaenia parkinsoni
Parkinson's Rainbowfish
Photo by Mike Jacobs 2019

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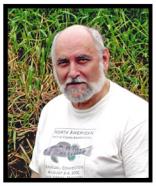
Annual Killifish: A Story of Survival



by Charles Nunziata

The term “annual killifish” refers to the unusual life and egg incubation cycle of a group of killifish that inhabit temporary bodies of water. These include pools and wetland areas that contain water only part of the year. In order to survive perhaps the most demanding and dynamic environment faced by any aquatic vertebrate, this marvelous group of animals have developed an extraordinary and complex web of inter-related and mutually supportive survival adaptations. These include extremely rapid growth, early sexual maturation, high fecundity and the ability to survive in an extreme and dangerous environment. The eggs of these species face equally unique and demanding conditions, and they too express adaptations that are unmatched among vertebrates.

Annual killifish are found throughout eastern coastal Africa and some interior countries as well. They also range throughout South America from the northern limits of the continent to Argentina. The genus Nothobranchius is the only annual killifish from Africa. There are presently thirteen recognized genera of annual species from South America. These geographical regions share a common characteristic. They experience one or two rather short periods of major rainfall, interspersed with long periods of little or no rain. Indentations and low lying areas fill during the rainy seasons forming pools and wetlands, and then slowly evaporate after the rainfall ends, remaining completely dry for the balance of the dry season. All annual species all lay their eggs in the substrate; some deposit them just below the surface, while others completely submerge to spawn.

Nothobranchius cardinalis

These habitats are both dynamic and unreliable. In any given year, the rainy season may start earlier or later than expected, and is sometimes preceded by rain events that last a day or two. The resulting pools do not last very long, and typically dry before the onset of the rainy season. With the rain comes all manner of wildlife to share the water, roiling and contaminating it. These are

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joined by predators, primarily birds, insects and amphibians that pick off the colorful killifish.

This isolated habitat has the potential of limiting genetic diversity in addition to the obvious physical challenges it presents. The killifish embryos must survive incubation in a hot and desiccated media, and hatch at a time that guarantees survival. In the aggregate, the most creative set of survival strategies are challenged by this difficult environment, yet, annual killifish have survived here for millennium. This article is the story of that survival system, and it is one that continues to amaze the layman and professional alike.

As in all fish, annual killifish require the maintenance and nutrition requirements required by its kind and an environment that induces breeding. But egg care is an additional dimension to this list of common requirements. With most of the species kept in the general hobby, egg care only involves whether the breeders are allowed to care for the eggs or the hobbyist instead employs artificial hatching methods. Annual killifishes however require the hobbyist to provide an appropriate environment for embryo development, and to correctly determine when to initiate the hatching process. This is an important skill as improper egg care often foils attempts to propagate this group.

Let's arbitrarily use the hatching event as a starting point in our discussion of the survival processes. When the rains become continuous, the ponds and wetlands fill quickly. Most eggs will complete their developmental cycle and hatch a few days later. (Watters, 1996). Annual killifish fry are able to fend for themselves upon reaching the free-swimming stage, typically a few hours after hatching. At about the same time fry hatching begins, food sources in the form of microscopic organisms and insect larvae become available. Although the fry are relatively small, they are equipped with a set of teeth that allow them to bite off pieces of food items that may be too large for whole consumption.

Growth is very rapid, with some individuals within the group able to spawn in as little as three weeks. (Watters, 1996) There are two major reasons for this. The pool may dry in a matter of weeks if the rain that filled it is not part of the main rainy season. Rapid maturation allows the species to begin reproducing within weeks of hatching, assuring that even if the pool is short lived, the species will survive. The second reason is thought to relate to the role of subservient males and their contribution to the overall genetic pool. There are several interrelated survival mechanisms in play relating to male coloration, predation, size and lifespan.

The turbidity of the water and other water qualities appear to dictate the color schemes the individual species employ. Recalling that many of these habitats are roiled, the consistency of the bottom substrate will determine how much material is put into suspension, and hence the degree of turbidity. This matters

because studies show that females locate suitable males and initiate spawning. (Haas, 1969) Females approach the selected male and when he perceives her presence, drives her to the substrate and commences to spawn. Females of these species are olive to brown and virtually disappear in the turbid water. Males can't select females because they cannot locate them.

In turbid conditions, male visibility is determined by coloration. Since the color red transmits more efficiently in turbid water than other colors, (Kinney, 1967) males of many species in the genus Nothobranchius have intense red colors, especially in their large caudal fins, but minimal body markings and patterns. Body patterns do not enhance visibility in turbid conditions. Although we cannot know what females actually see, other studies confirm that females of these species select males with the most intense red color and with the largest caudal fins. (Haas, 1976a).

In less turbid waters we find annual killifish employing elaborate patterns not found in red finned species. These patterns of green, blue and yellow presumably facilitate mate recognition and/or serve as camouflage, but this supposition has not been definitively studied.

Paradoxically, the colorful males are also more visible to predators, and are dispatched much more quickly than their less colorful brethren. At first this might appear to be counterintuitive to the survival process. But it turns out to be a most elegant solution to quite another issue, genetic diversity. Only some males develop quickly, the balance do not develop at the same rate and in fact remain relatively undeveloped with little color, looking more like females, and likewise less visible to dominant males or to predators.

As the larg colorful males are removed by predation, some subservient males are somehow cued to quickly increase in size and coloration. They quickly assume the role of the dominant, breeding males and after some time are in turn predated, causing the next group of subservient males to quickly take their place. Although this replacement system is not well studied, we breeders see this effect in the aquarium environment, and if we do not remove dominant males from the group, subservient males will never fully develop.

Austrolebias nigripinnis

This ingenious mechanism seems to allow most males in the population to eventually breed, and since females are not as extensively predated upon as males, most of the available females have the opportunity to breed with a larger group of males. This would seem to enhance the preservation of the widest genetic pool possible in the limited and isolated environment.

As a corollary to this, it has been shown that the fastest growing males are

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also the shortest lived, and will not reach the eventual size of their longer living but slower growing brothers.(Markofsky, 1972, 1973) This makes perfect sense. The fast growing males breed first and if not predated, will die earlier, making way for the slower developing and longer lived males that follow.

The annual killifish embryo has its own set of survival challenges. There are primarily two: To survive months in a hot and desiccated environment, and to hatch at a time where its survival is secure. The survival strategies in play here are may be even more amazing that those employed by living fish.

The substrate of the annual killifish habitats must be of the correct constituents and consistency to support reproduction. The bottom of African habitats of the genus Nothobranchius is a fine sticky black mud into which the fish deposit their eggs. (Watters). Nothobranchius tuck their eggs just below the surface, but many deep diving South American species completely submerge into the substrate to spawn. Their substrate is sufficiently loose and soft to allow this behavior without damage to the fins or bodies of the fish. At a certain point in the incubation process the eggs require access to the surface, and as a result, it is important that after drying, the upper surface of the substrate cracks in a manner that allows gas exchange to regions below the surface where the eggs are deposited.

Depending on temperature, oxygen levels and many other factors too complex to properly treat in this article, annual eggs do not develop at uniform rates, but rather develop to certain structural stages, then cease further development until one or more environmental cues trigger development to resume. There are three points in the embryonic process where development is suspended, designated as Diapause I, II, and III, (Leibel, 1977) hereafter referred to as DI, DII and DIII respectively. DI occurs immediately after fertilization and initial cell division. DII occurs at an intermediate stage after major body structures are developed, and the heart is beating. DIII occurs at the end of the developmental cycle and immediately before hatching. When the embryo reaches DIII all life functions are fully developed and the clock is ticking. If hatching does not occur within a matter of days or weeks, the embryo will consume the available nutrition and die within the egg.

Simpsonichthys picturatus

Most eggs will reach DIII when the normal rainfall occurs at the expected time. When these factors are all in place, the majority of the embryos will hatch. As previously noted, although in most years once the rains start they more or less continue unabated throughout the rainy season, it is not always so. Isolated rainfalls can fill a pond outside the rainy season, and thereafter dry out, killing

any fry that hatched. There may also be droughts with no rain at all that last more than a year, killing off any eggs that reach DIII.

In one of the most striking examples of the persistence of life on our planet, the eggs of annual killifish do not all develop to these diapause stages at the same rate. Embryos at DI and DII may persist there for a few weeks to many months, or some suspect, even years. As a result, at almost any point in time, there will be embryos at DI, DII or DIII present in a dried out substrate. By employing this delayed developmental strategy, some eggs will always be ready to hatch whenever the rains actually occur, be it months or years out of the normal sequence. This is a stunning survival process and a testament to the complexity that nature develops to assure the persistence of the species.

In a last twist to the process, all annual killifish can experience all three diapause stages, but not all stages are required for proper development. When a stage is necessary, it is designated as “obligate”, when it is not required to assure proper development, it is designated as “facultative.” Obligate and facultative diapauses are thought to vary with specific species (Murphy, 1997). As incubation temperatures vary so does the developmental rate, (Leibel 1982) and this possibly with variances in oxygen levels under which the eggs incubate can have the effect of minimizing the time the embryo spends at one or more diapause stages. This additional variable assures once again that there will always be some eggs ready to hatch whenever the rains come, and some that will be ready to hatch at some time in the future.

There may be no bigger thrill in the killifish hobby than to witness dozens of fry hatch from a lump of peat moss. To see those little creatures emerging, so small yet so completely ready to thrive is seductive, awe-inspiring and to me, an affirmation of life on this planet. Observing embryo development; seeing the heart pump and the details of the body structures as they develop is a sight that will both inspires and awes the observer. Observing life at this level has a special quality and one that confirms what I think motivates many of us that have spent the better part of our adult life in the presence of fishes.

The killifish hobby in the U.S. is nearly 50 years old, and during that time, members of the American Killifish Association (www.aka.org) and others have shown how the adaptability represented by the complex survival system of annual killifish can be utilized by the hobbyist. As a result, it affords the killifish breeder with many options in propagating these species, including the unique potential to manage of their embryonic developmental cycle.

The future will no doubt bring an even deeper understanding of this amazing

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process. I think we can all look forward to that.

Currently recognized annual killifish genera

Continent	Genus	D1	D2	D3
South America	Austrofundulus	F	O	O
	Cynolebias	F	F	O
	Campellolebias	F	F	O
	Cynopoecilus	F	F	O
	Leptolebias	F	F	O
	Plesiolebias	F	F	O
	Moema	?	F	?

Continent	Genus	D1	D2	D3
South America	Neofundulus	?	?	?
	Pituna	?	?	?
	Pterolebias	F	O	O
	Rachovia	F	O	O
	Terranatos	F	O	O
	Trigonectes	?	?	?
Africa	Nothobranchius	F	F	O

Key: D1-3, diapause stages 1-3, F = facultative, O = obligate, ? = Unknown

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Nothobranchius flagrans

Rachovia* aff *brevis

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MEMBERSHIP DUES!!!!

Membership Dues for TBAS are due on the anniversary of your sign-up date every year. Please make sure you check the "sign-in" list on the table at every meeting to check your "Dues-Date" . . . Thanks!!!

USE PAYPAL ON THE TBAS WEBSITE . . . TBAS1.COM . . . !!!!!

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Let's All Take A Look At Some Killifish!!! #2

all photos by Mike Jacobs

Folks . . . thank you for taking a look at the killifish for the second month in a row . . . many many people would like to look at killifish almost daily . . . ☺ ☺ !! Hopefully the articles and photos will spur you to ask some questions!!!

Jordanella floridae

Pseudepiplatys annulatus

Nothobranchius oestergaardi

Fundulus chrysotus

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Austrofundulus leohoignei

Epiplatys sexfasciatus

Lucania goodei

Aphyosemion gabunense

Renova oscari

Aphyosemion striatum

http://www.sks1.com

Did you ever think of KILLIFISH??? Come find out about them at the SKS meetings!!! See the ad to the left!

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This One Will Make You Scream!

It happened again! I was chatting with the new receptionist at the office while I worked on her tank and she was telling me about the 20 gallon tank that she and her husband had just set up. When I asked her what kind of fish they got she told me "two small Oscars." I winced and asked her why they bought fish that get so large for such a small tank. She answered that the fish only grow to the size of the tank. I groaned and explained to her that it is a myth that fish only grow to the size of the tank and that she would need a larger tank in a few months. I think the guy who came up with the idea that fish only grow to the size of the tank should be locked up on a closet with a bucket for a toilet that never gets emptied! Does that sound to harsh? Well that is how a fish is living if it is not growing!

The idea that fish grow to the size of the tank was developed in the early years of aquarium keeping when hobbyist didn't do water changes. Often hobbyists would find that fish died after a water change. Little did they know then that they were waiting too long between water changes and changing too much of it (like all of it!). Water quality parameters such as pH and ammonia may have been radically different after the water change, because all the fish waste that had built up from not doing a water change was removed. That level of detoxification severely shocks the fish, often leading to death. Now hobbyists have learned that partial water changes on a regular basis is the way to go. Typically, fish secrete a hormone that stunts the growth rate of like species. When water changes are not made the hormone builds up (as well as fish wastes and ammonia) and stunts the fish. However, this does not completely stop the growth of a fish, but does slow it down. Large fish kept in small tanks also develop deformed spines and fins from not having the proper room to move about or from an improper diet (but that is an article for another time). I have seen fish that could not turn around in the tanks they were kept in. One of these was an Oscar raised in a 10 gallon tank for three years. When the water changes for the Oscar go to be once a week, the owner decided to trade in the fish. I put the humpbacked fish in a 200 gallon pond. The fins were kinked and the tail was short, giving the body a squashed appearance. I kept the Oscar in the pond and fed it a good diet loaded with vitamins and minerals. It took about a year, but finally the body did straighten out. The fins and tail also repaired themselves to a more normal appearance.

Of all the myths about fish keeping, this one makes me cringe every time I hear it. This is a major cause of fish death and of new hobbyists giving up. Always find out how big a fish will get and remember that the larger fish often live a long time, 10 years or more. Until next month, keep those fish happy and healthy!

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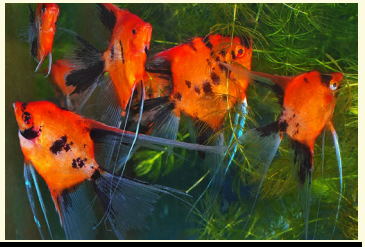
Angels Plus
www.angelsplus.com

Click on the

to See Video



THE BEST KOI ANGELFISH IN THE UNIVERSE

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WHEN: Saturday, November 16, 2019

WHERE:

Plant City High School Community Center
605 N Collins St
Plant City, FL 33563

Old red brick 3 story
1914 Plant City High School Building.

see www.tbasauction.com complete for directions

TIME: Doors Open 8:00am

AUCTION TIME: 10:00am - 5:00pm

INFORMATION: www.tbasauction.com

TBAS WEBSITE: www.tbas1.com

No new or used dry goods by participants. All species of plants and fish but no more than 3 bags per species with the exception of varieties.

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***Parancistrus aurantiacus* . . . Chubby Pleco**

photo: Mike Jacobs 2019

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Tampa Bay Wholesalers: Tropical Fish

alphabetical order

1) 5D Tropical Fish
2) Segrest Farms

Tampa Bay Tropical Fish Farmers:

alphabetical order

1) Amazon Exotics
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6) Imperial Tropicals
7) Lile's Tropical Fish
8) V-W Tropicals

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