



# KILLI-DATA INTERNATIONAL

## *Killi-Data News*

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### What is new at Killi-data.org

A new Governing Board has been elected for KDI. Current Board members are: Jean Huber (France, co-founder), George Funkner (UK), Tyrone Genade (USA), Lars Kåre Grimsby (Norway), Stefano Valdesalici (Italy), and Frans Vermeulen (Aruba).

This is the first edition of a new publication for KDI: Killi-Data News. It offers a brief review of killifish research as well as a round up of interesting anecdotal reports by killifish hobbyists that may be of interest to professional scientists as well as other hobbyists. A Killi-Data News edition is planned for every 3 months depending on availability of content. The current format was chosen for easier on-screen reading. The font is legible when the document is printed 2-pages to a sheet of paper. Authors are encouraged to submit their own article summaries so as to best emphasize the significance of their work.

Several new collection grants have been proposed to the board and voted on. Three projects were given priority. The first is a collection trip to Nigeria to try to recollect *Fundulopanchax powelli* from the type locality (see figure, next page). In addition, attempts will be made to collect new populations of *Fp. obuduensis* and discover the location of *Fp. spoorenbergi* which could be in the same area based on aquarium records. This location is close to Benin City (the location of a uniquely colored form of *Aphyosemion bitaeniatum*) as well as Warri and Ughelli which are locations for *Fp.*

*sjoestedti* and *Fp. arnoldi*. The ranges of variation of these two species are not well known and understood.

The board also voted to explore the border region between Uruguay and Brazil where a species of *Cynopoecilus* is reported to occur. It is not known if this is a new species or a population of *Cynop. melanotaenia*.

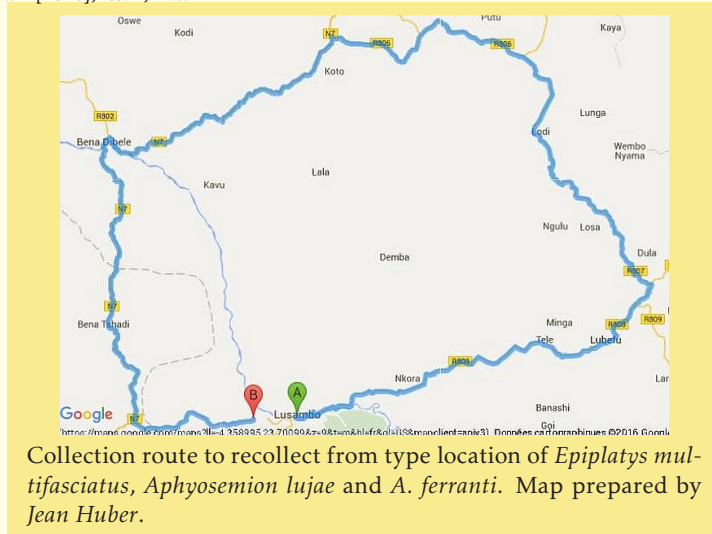
The Democratic Republic of the Congo is becoming more accessible and the board voted to support efforts to collect *Epiplatys multifasciatus*, *Aphyosemion lujae* and *ferranti* are all from the same type location. These species are unknown live from the type location. The collection route will go through unexplored territory and may yield new species, or new distribution data of known species.

Other projects were also put forward but voted lower priority. The other projects can be viewed at <http://www.killi-data.org/dossiercollecting.php>.

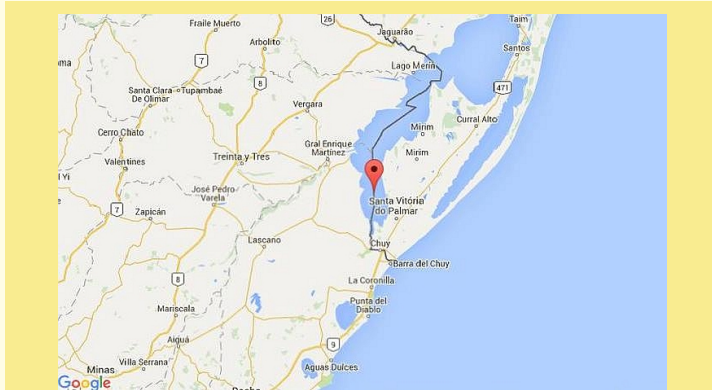
KDI has started a large molecular phylogeny project, collecting samples for DNA analysis. Read more at <http://www.killi-data.org/list-names-molecular.php>.



Type locality for *Fp. powelli*. It was caught with a fish that was identified as *Epiplatys grahami*. This location is close to Warri and Ughelli (of *Fp. sjoestedti* and *Fp. arnoldi*). Map prepared by Jean Huber.



Collection route to recollect from type location of *Epiplatys multifasciatus*, *Aphyosemion lujae* and *A. ferranti*. Map prepared by Jean Huber.



Proposed survey area for the unidentified *Cynopoecilus* species. As the trip would begin in Uruguay, the route to the collection site would go past known localities for *Austrolebias luteoflammulatus* and other annual species not seen in the hobby recently. Map prepared by Jean Huber.

## Announcements

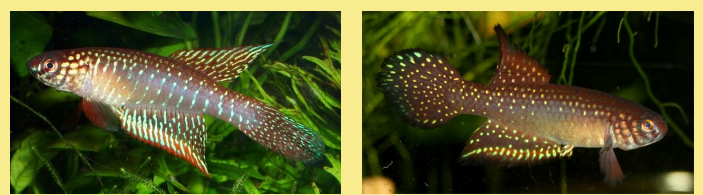
The 2nd *Nothobranchius* International Symposium, on June 2–4, 2016, at Leibniz Institute on Aging —Fritz Lipmann Institute (FLI), in Jena (Germany) about recent developments and outlook into future research on *Nothobranchius furzeri* which has been introduced as a model in biomedical research more than 10 years ago; now, with its genome having been published, it is fair to consider *N. furzeri* as well as other *Nothobranchius* species as well accepted models in the field of aging research but also in developmental biology, ecology and evolution; keynote speakers: John Postlethwait (University of Oregon, USA), Axel Meyer (University of Konstanz, Germany); organizers: Alessandro Cellerino, Christoph Englert, Matthias Platzer, Dario Valenzano; more details at [http://www.leibniz-fli.de/news/conferences/detailpage/?tx\\_news\\_pi1\[news\]=2363&cHash=656745eed06b63efb3f935b87955b5f7](http://www.leibniz-fli.de/news/conferences/detailpage/?tx_news_pi1[news]=2363&cHash=656745eed06b63efb3f935b87955b5f7).

## Internet Review

### *Nematolebias papilliferus* color polymorphisms?

On the **Killifish Breeding, Conservation, Maintenance** Facebook Group <https://www.facebook.com/groups/1585735854987933/permalink/1765151973712986/>, Petr Šupal writes “*Papilliferus* in low F generations have the dots in their body connected almost in lines and has stripes in the dorsal fin. The longer they stay in aquariums the more they resemble *whitei*. It was apparent in F1, F2... Inoa and recently in the strain from Itaipuacu.” Jeff Wasley commented that “Gary Greenwood has kept these and his have great coloration every time I visit the fishroom.” Scientists interested in epigenetics might find this subject interesting. Why color pattern should change so much over two generations is an interesting question. The fecundity of this species and its ease

of maintenance could make it an interesting research subject for epigenetics and pigmentation research.—*Tyrone Genade*



Fish shown above, left, is *Nematolebias papilliferus* and the fish to the right is *N. whitei*. The images conform to the diagnosis supplied by Costa, from <http://killi-data.org>: “slender and larger; overall body and fins of male, brownish with light blue (or gold) bars on lower sides of male and with flames on unpaired fins; female, fasciated, but with bars more set apart than in *whitei*.” Note the dark band in the anal fin of *N. whitei* compared to the iridescent flecks reaching from the submarginal band of *N. papilliferus* towards the body. Also the spots in the dorsal fin compared to streaks in *N. papilliferus*. Photos by Michael Schlüter (left) and Dieter Oberle (right).

### Interesting *Austrolebias* habitat

On the I Ragazzi dell’Acquario—IRDA Facebook group, <https://www.facebook.com/iragazzidellacquario/videos/957172440999417/?ref=nf>, there is an interesting video on collecting *Austrolebias alexandri* out of water-filled holes on a flood plain. The location is Provincia de Entre Rios and the collectors are Pablo Calviño, Ignacio Garcia and Felipe Alonso. Felipe reports that *A. nigripinnis* and *A. bellottii* were also present in this habitat. The survey was conducted in 2012. Alonso has other collection videos at [https://www.youtube.com/user/gpuffelipe/videos?shelf\\_id=0&view=0&sort=dd](https://www.youtube.com/user/gpuffelipe/videos?shelf_id=0&view=0&sort=dd).

### Video of *Rivulus* living among leaf litter

At <https://www.facebook.com/museudaamazonia/videos/1246072808741777/?fref=nf> there is a video on *Rivulus* habitat, where the fish are shown living in very shallow water (puddles) among leaf litter. The fish is identified as *Rivulus micropus* as well as by its popular name: “pula pula” (jump jump).

### Fish to fight Zika?

In a news report on USA Today (<http://www.usatoday.com/story/news/nation-now/2016/03/08/mosquito-eating-fish-could-halt-zika-virus-latin-america/81484784/>) it is reported that the charity, [Operation Blessing](#), intends to help fight the Zika virus by introducing fish into water bodies. The article doesn't give much details other than that it intends to release *Gambusia* in Mexico after a successful project in El Salvador where “Sambo” were introduced. These “Sambo” are native to El Salvadore, as are the *Gambusia* in all likelihood but there is no indication in the article that ecological impacts are being considered. Using indigenous species for this project would be prudent. This subject is especially interesting in the light of research by [Subramaniam et al](#), page 10.

### New collections in Cameroon

Joe Cutler is collecting many new and interesting killifish in Cameroon and is keeping Jouke van der Zee very busy trying to figure out just what they are: <https://www.facebook.com/photo.php?fbid=10103909928658453&set=p.10103909928658453&type=3&theater> and <https://www.facebook.com/photo.php?fbid=10104236003132593&set=p.10104236003132593&type=3&theater>.

### Breeding report: *Simpsonichthys mediopapillatus* Pindai

Gordon Temperley posted a video of *Simpsonichthys* (*Hypsolebias*) *mediopapillatus* Pindai at <https://>

[www.facebook.com/groups/578260898902510/permalink/1031113083617287/](http://www.facebook.com/groups/578260898902510/permalink/1031113083617287/). He reports breeding conditions as follows: incubation 2–3 months (depending on temperature). Adult and fry are kept at pH 7.2 with 50% weekly water changes. Fry are reared 15 fry to a shoe box. The shoe box has no filter, just Java moss and some ramshorn snails to consume uneaten food. Adults are fed tubifex, white worms and glassworms. Fry are fed brine shrimp nauplii from hatching. Males sex out earlier than females. They are 1.5 inches in length at 8 weeks.

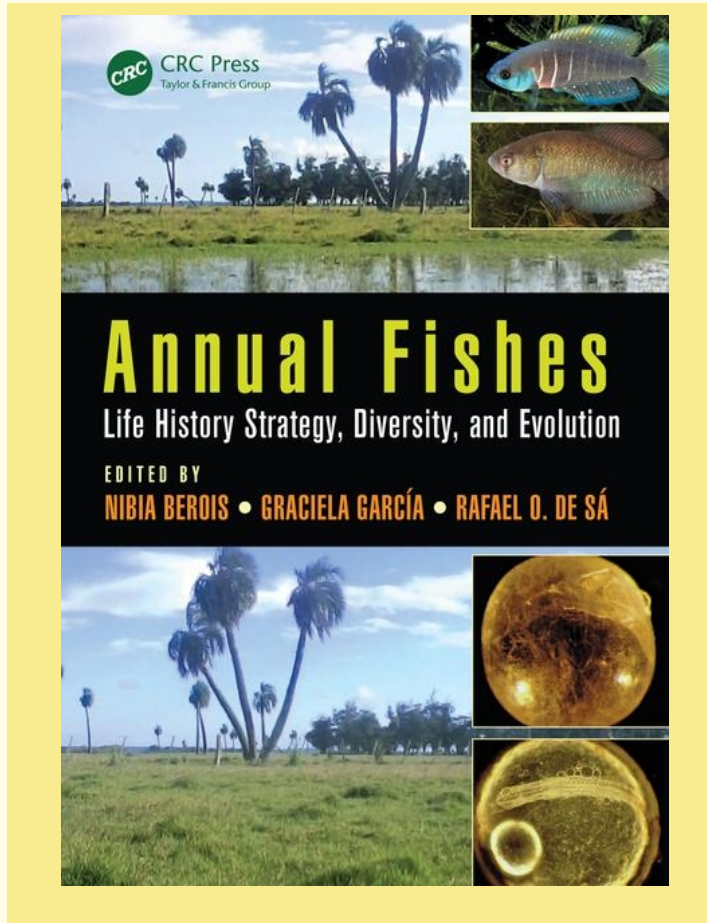
## New Books

### Annual Fishes: Life History Strategy, Diversity, and Evolution.

A new book on killifish is now on sale on the Internet at <https://www.crcpress.com/Annual-Fishes-Life-History-Strategy-Diversity-and-Evolution/Berois-Garcia-S/9781482299717> (unit price as print is 65 UK£, i.e. about 83€ or 92 US\$, today, also available as an e-book with a lesser price); the authors are renown South American researchers, Nibia Berois, Graciela Garcia, Rafael O. de Sa; the title is “Annual Fishes: Life History Strategy, Diversity, and Evolution”; it is a must buy for a serious killi-nut even if it is quite scientific focus (notably the life cycle, reproductive biology, evolutionary ecology, reproductive behavior); it concerns all annual killifishes (i.e. not only South Americans); it summarizes previous work and provides an overview of current research on annual fishes, it includes contributions from global experts in specialized areas of annual fishes research, it highlights the usefulness of annual fishes in developmental, evolutionary and experimental biology, it provides information about collecting, maintaining, and reproducing annual fishes in a laboratory, it points out promising areas



of research for future researchers in vertebrate biology, and it contains full-color illustrations to enhance understanding.  
*Jean Huber.*



**North American Freshwater Fishes: Natural History, Ecology, and Conservation.** Announcement of a new major reference book updating overall knowledge on ichthyology of North America to be published, hopefully, late this year 2016 or in 2017 ; actually it is the volume 2 of a series of 3 books on the topic (title is “Warren, M.L. Jr. and Burr, B.M. (Eds.), North American Freshwater Fishes: Natural History, Ecology, and Conservation” and info for volume 1, already published, can be viewed at <https://jhupbooks.press.jhu.edu/content/freshwater-fishes-north-america>); volume 2 should deal with chapters on, among others, cyprinodontiformes, i.e. killifish and livebearers and according to available data major US ichthyologists such as Ghedotti, M.J., Davis, M.P, Echelle A.A., are co-authoring those parts of interest for K-D : Fundulidae, Cyprinodontidae, Profundulidae, Goodeidae, and Poeciliidae. *Jean Huber*

## Review of new research

### Systematics & Taxonomy

**Phylogenetic relationships of *Simpsonichthys* subgenera (Cyprinodontiformes, Rivulidae), including a proposal for a new genus.** Ponzetto JM, Britzke R, Nielsen DTB, Parise-Maltempi PP, and Alves, AL. *Zoologica Scripta*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1111/zsc.12159>

This new molecular study involving 29 named or unnamed species is a major breakthrough in the systematics of *Simpsonichthys*, *Xenurolebias*, *Ophthalmolebias*, *Spectrolebias* and *Hypsolebias*, since the splitting by Costa in 2010 of *Simpsonichthys* s.s. and leveling of *Xenurolebias*, *Ophthalmolebias*, *Spectrolebias* and *Hypsolebias* as full genera.

You may remember that Killi-Data did not follow the move (like for the split of *Rivulus* in distinct genera, but for different reasons) because the work by Costa did not bring

something new, except a proposed explanation of biogeographical regions according to his new split genera, and Killi-Data kept *Simpsonichthys*, only as a genus and *Simpsonichthys* s.s., *Xenurolebias*, *Ophthalmolebias*, *Spectrolebias* and *Hypsolebias*, as subgenera (and was criticized by some people as not following any more automatically generic changes).

The present findings based on ATPase 8 and 6 gene sequences of 53 specimens, according to their authors, “the monophyletism of the genera *Simpsonichthys*, *Spectrolebias*, *Hypsolebias* and also of the *H. flammeus* group, as proposed by Costa (2010a,b) could not be recovered and the relationship observed by morphological data (Costa 2010a,b) within the *Hypsolebias* genus also could not be recovered in the present analysis”. The authors considers rather 2 clades: “the phylogenetic relationships between the species within the genus confirms the division of the western and eastern clades proposed by Costa (2006, 2007a, 2010a).”

My analysis of the work done by the alternative Brazilian team (with Britsky, Nielsen, and Alves whom I know, i.e. independent from the other team with Costa and Amorim) and notably their molecular tree shows that components of *Simpsonichthys* and *Spectrolebias* are mixed and little can be derived, apart from synonymizing *Spectrolebias* into *Simpsonichthys*, that *Ophthalmolebias* and the *heloplites*-group (which they name *antenori*-group) are related (within the *antenori-heloplites* group the species are extremely similar -also by male color pattern- and might not deserve a separate species rank for *igneus*, *coamazonicus*), that the remain bulk of *Hypsolebias* is related (*flammeus*-group, *notatus*-group, *magnificus*-group) and often very related, that several “species” which have been described in a given species group among those last 3 groups were wrongly allocated (e.g., *ocellatus*), that *virgulatus* and *auratus* are very related, with a population of *virgulatus* as paraphyletic, that the diagnoses of most names at the generic level in this lineages have to be

written again since they are not valid anymore, and finally that *Xenurolebias* is confirmed as the basal group (however the authors do not include any component of *Nematolebias* in their analysis).

However the alternative Brazilian team does not formally propose changes in the nomenclature of *Simpsonichthys* and do not formally name as a new generic taxon (as a subgenus of *Simpsonichthys*) the un-named branch (*Hypsolebias* being paraphyletic and split into 2 lineages, the supergroup with *flammeus*-group, *notatus*-group, *magnificus*-group is left un-named), pending further studies (with more species... the total number of named species in the genus is 74, vs. 27 herein studied as named), and probably pending a new molecular study by Costa and Amorim (who up to now only studied a few species of the genus but are rumored to aiming the full genus). *Jean Huber*

**Diabolical survival in Death Valley: recent pupfish colonization, gene flow and genetic assimilation in the smallest species range on earth.** Martin, CH and Crawford, JE and Turner, BJ and Simons, LH. *Proceedings of the Royal Society B*, 283:20152334, 2016. URL <http://dx.doi.org/10.1098/rspb.2015.2334>

This paper provides evidence for the *Cyprinodon diabolis* population diverging from the Death Valley pupfish (*C. nevadensis*) between 100 and 850 years ago. This recent divergence calls into question the idea of *diabolis* being a distinct species. Already, evidence exists of *nevadensis* exposed to Devil’s Hole-like habitat conditions (high temperature and starvation) developing a phenotype like that of *Cyprinodon diabolis* (reference: Lema & Nevitt, 2006, <http://jeb.biologists.org/content/209/18/3499>). Some of the consequences of *C. diabolis* and *nevadensis* were discussed in 2012 by Hillary Rosner of WIRED magazine: <http://www.wired.com/2012/11/mf-mutant-pupfish/>. *Tyrone Genade*

**Molecular phylogeny and evolution of internal fertilization in South American seasonal cynopoeciline killifishes.** Costa WJEM, Amorim PF, and Mattos JLO. *Molecular Phylogenetics and Evolution*, 95:94–99, 2016. URL <http://dx.doi.org/10.1016/j.ympev.2015.11.011>



From top to bottom: *Campellolebias brucei*, *Cynopoecilus melanotaenia* and a close-up of the modified anal fin of *Cynopoecilus melanotaenia*. Both species practice internal fertilization and the females deposit the eggs after mating. Photos by Frans Vermeulen.

This paper reports on anatomical specialization of the male reproductive organs of *Campellolebias* and *Cynopoecilus* and their evolution thereof. The authors conclude that while internal fertilization is the outcome of a single evolutionary event among these two genera each genus shows unique anatomical characters in male fin structure that evolved in-

dependently. Tyrone Genade

**Phylogenetic relationships and evolutionary history of the Mesoamerican endemic freshwater fish family Profundulidae (Cyprinodontiformes: Actinopterygii).** Morcillo, F, Ornelas-García CP, Alcaraz L, Matamoros WA, Doadrio I. *Molecular Phylogenetics and Evolution*, 94:242–251, 2015. URL <http://dx.doi.org/10.1016/j.ympev.2015.09.002>

The authors report a molecular phylogeny of the Profundulidae: *Profundulus* and *Tlaloc*. The analysis suggests a diversification event some 26 million years ago from other members of the Mesoamerican Cyprinodontiformes; and the two genera diverging 20 million years ago. The genetic analysis supports the two genera and the eight species but suggests as many as 12 species might exist in this family of fish. Tyrone Genade

**Moema kenwoodi.** Valdesalici S. *Journal of the American Killifish Association*, 48:66–72, 2016.



Photo of *Moema kenwoodi*. Photo by Brian Perkins.

*Moema kenwoodi*, new annual species, has been discovered by Brian Perkins and colleagues (the species is dedicated to his father, Kenwood) near Tambopata in S.E. Peru,



it is related to other "ex-Aphyolebias", such as *boticarioi*, *claudiae*, *obliquus*, *rubrocaudatus*, *schleseri* (but without black margin on lower last fin), it has been collected only a few dozens of km from *rubrocaudatus* region; the male differs from other congeners by an elliptical caudal fin with brown oblique stripes and a broad yellow stripe on the lower portion, which lacks a black marginal stripe. More information is available at Wild Peru (Brian Perkins), <http://wildperu.blogspot.fr/>; and a nice collecting report (by Sumer Tiwari) is located at <http://www.reef2rainforest.com/2014/04/16/collection-trip-to-peru-part-1/>. Tyrone Genade

These and other taxonomic issues are discussed at <http://www.killi-data.org/faq.php>, Q46. Jean Huber

***Laimosemion leticia* (Teleostei: Cyprinodontiformes: Rivulidae), a new species from the upper Rio Amazonas, Southern Colombia.** Valdesalici S. *Zootaxa*, 4085:279–284, 2016. URL <http://dx.doi.org/10.11646/zootaxa.4085.2.8>



*Laimosemion leticia*. Photo by Stefano Valdesalici

This is a miniature species, not exceeding 26 mm. This species comes from the Rio Tacana drainage, upper Rio Amazonas basin, Southern Colombia. It is reported to inhabit shallow, muddy water from a swampy area just north of Leticia, the capital of the department of Amazonas and south-

ernmost municipality of Colombia. Tyrone Genade

## Killifish Biology: Ecology & Physiology

**The African Turquoise Killifish Genome Provides Insights into Evolution and Genetic Architecture of Lifespan.** Valenzano DR; Benayoun BA; Singh PP; Zhang E; Etter PD; Hu CK; Clement-Ziza M; Willemsen D; Cui R; Harel I; Machado BE; Yee MC; Sharp SC; Bustamante CD; Beyer A; Johnson EA; & Brunet A. *Cell*, 163:1539–1554, 2015. URL <http://dx.doi.org/10.1016/j.cell.2015.11.008>

**Insights into Sex Chromosome Evolution and Aging from the Genome of a Short-Lived Fish.** Reichwald K; Petzold A; Koch P; Downie BR; Hartmann N; Pietsch S; Baumgart M; Chalopin D; Felder M; Bens M; Sahm A; Szafranski K; Taudien S; Groth M; Arisi I; Weise A; Bhatt SS; Sharma V; Kraus JM; Schmid F; Priebe S; Liehr T; Gorlach M; Than ME; Hiller M; Kestler HA; Volff JN; Schartl M; Cellerino A; Englert C; & Platzer M. *Cell*, 163:1527–1538, 2015. URL <http://dx.doi.org/10.1016/j.cell.2015.10.071>

Two papers published on December 4th, 2015, on the scientific journal *Cell* (Valenzano et al.; Reichwald et al.), reported the sequencing of the *Nothobranchius furzeri*'s genome by two independent teams: one from Stanford University and the Max Planck Institute for Biology of Ageing in Cologne (Germany), and the other from the Leibniz Institute on Aging in Jena (Germany). The complete sequence of the genome of this species have enabled these two teams to shed light on the genetic basis of the extremely short lifespan of this species (Valenzano et al.), and on the other hand on the genetic bases of sex determination in this teleost. A complete genome sequence is a fundamental resource that would enable a rapidly growing scientific community to adopt this species as a novel model organism to study the biological ba-



sis of several evolutionarily and ecologically relevant traits, such as embryonic diapause, sexual coloration and dimorphism; as well as a number of medical-relevant traits, such as rapid aging onset, cancer and neurodegeneration. Following a broad hobbyist community that has spearheaded the exploration of the species diversity and trait unicity of killifish, an expanding scientific community has finally acknowledged the relevance of this group of teleosts, and future research will help reveal the biological basis of the adaptations that set apart these unique fish from all other teleosts. *Dario Valenzano*

**Longitudinal RNA-Seq Analysis of Vertebrate Aging Identifies Mitochondrial Complex I as a Small-Molecule-Sensitive Modifier of Lifespan.** Baumgart M, Priebe S, Groth M, Hartman N, Menzel U, Pandolfini L, Koch P, Felder M, Ristow M, Englert C, Guthke R, Platzer M, & Cellerino A. *Cell Systems*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1016/j.cels.2016.01.014>

Researcher took samples from young fish and sequenced and quantified the RNA transcripts and then tracked the individual fish and measured their RNA levels at different ages. It was found that certain RNA levels in youth predicted lifespan. The genes most implicated involved mitochondrial metabolism. Fish were then treated with rotenone—a potent inhibitor of mitochondrial metabolism—to stress the fish and trigger a hormetic response to correct for the deficiencies in mitochondrial metabolism. This resulted in a 15% increase median lifespan of the *N. furzeri* used in the experiments. This paper has huge implications as a proof of concept: deleterious gene expression profiles can be identified in youth and corrective action can be taken to extend lifespan. *Tyrone Genade*

**Circadian activity rhythms during the last days of *Nothobranchius rachovii*'s life: A descriptive model of circa-**

**dian system breakdown.** Lucas-Sánchez A, Martínez-Nicolás A, Madrid JA, Almáida-Pagánd PF, Mendiola P, de Costa J. *Chronobiology International*, 32:395–404, 2015. URL [www.tandfonline.com/doi/pdf/10.3109/07420528.2014.984040](http://www.tandfonline.com/doi/pdf/10.3109/07420528.2014.984040)

Previous research by Lucas-Sánchez employed *N. korthausae* (*Experimental Gerontology*. 2013, 48:507–16) to show that as *Nothobranchius* age their circadian rhythms degenerate. In this new paper he uses *N. rachovii* to develop a new method to track age-related circadian rhythm breakdown in the final days of life of the fish. This research is very interesting in that it shows that in the final 22 days of life there is a rapid breakdown of the circadian rhythms. In the *N. korthausae* experiments it was discovered that melatonin supplementation corrected the circadian rhythm degeneration. In this new paper they propose that the system they have developed to track changes in circadian rhythm can be used to ascertain the health of the individual and take actions (such as melatonin supplementation) to correct the breakdown and possibly extend lifespan. The research has broad applicability to humans who also suffer from a circadian breakdown in later life as well as during the course of neurodegenerative disease. It is possible that interventions to correct for physiological problems in maintaining metabolism and immune function (that depend on normal circadian function) can be correct before there is serious damage to the organism, and in so doing delay death and debilitation. *Tyrone Genade*

**The short-lived African turquoise killifish: an emerging experimental model for ageing.** Kim Y, Nam HG, and Valenzano DR. *Disease Model Mechanism*, 9:115–129, 2016. URL <http://dmm.biologists.org/content/9/2/115>

A review of the different model organisms used in aging research and what *N. furzeri* is useful for aging research. The potential uses of *N. furzeri* are discussed. *Tyrone Genade*

**Conservation of Hox gene clusters in the self-fertilizing**

**fish *Kryptolebias marmoratus* (Cyprinodontiformes; Rivulidae).** Kim BM, Lee BY, Lee JH, Rhee JS, and Lee JS. *Journal of Fish Biology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1111/jfb.12898>

Hox genes regulate embryonic development in vertebrates and invertebrates. The structure of the *Kryptolebias marmoratus* Hox genes is published and discussed with respect to the evolution of the Hox genes. *Tyrone Genade*

**The relationship between handling time and cortisol release rates changes as a function of brain parasite densities in California killifish *Fundulus parvipinnis*.** Weinersmith KL, Hanninen AF, Sih A, McElreath R and Earley RL. *Journal of Fish Biology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1111/jfb.12894>

A non-invasive method for measuring hormone levels is introduced. The hormone levels are also correlated with parasite load. Fish with a high parasite load are reported to be more sensitive to stress, and produce higher levels of cortisol. *Tyrone Genade*

**A Simultaneous Genetic Screen for Zygotic and Sterile Mutants in a Hermaphroditic Vertebrate (*Kryptolebias marmoratus*).** Sucar S, Moore GL, Ard ME, and Ring BC. *G3 (Bethesda)*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1534/g3.115.022475>

The paper describes a means of using *Kryptolebias marmoratus* to screen for genes affecting fertility. *Tyrone Genade*

**Investigating the mechanisms of Ni uptake and sub-lethal toxicity in the Atlantic killifish *Fundulus heteroclitus* in relation to salinity.** Blewett TA, Ransberry VE, McClelland GB, and Wood CM. *Environmental Pollution*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1016/j.envpol.2016.01.002>

The sensitivity of *Fundulus heteroclitus* to nickel toxicity, and how this is mitigated by water magnesium and calcium concentrations, is determined and its use as a biomonitor is

discussed. *Tyrone Genade*

**The potential role of polyamines in gill epithelial remodeling during extreme hypoosmotic challenges in the Gulf killifish, *Fundulus grandis*.** Guan Y, Zhang GX, Zhang S, Domangue B, and Galvez F. *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*, 194–195:39–50, 2016. URL <http://dx.doi.org/10.1016/j.cbpb.2016.01.003>

*Fundulus grandis*'s ability to cope with changes in salinity is studied with respect to changes in the polyamines in the gills of the fish. *Tyrone Genade*

**Multipurpose effectiveness of *Couroupita guianensis*-synthesized gold nanoparticles: high antiplasmodial potential, field efficacy against malaria vectors and synergy with *Aplocheilus lineatus* predators.** Subramaniam J, Murgan K, Panneerselvam C, Kovendan K, Madhiyazhagan P, Dinesh D, Kumar PM, Chandramohan B, Suresh U, Rajaganesh R, Alsalhi MS, Devanesan S, Nicoletti M, Canale A, and Benelli G. *Environmental Science and Pollution Research*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1007/s11356-015-6007-0>

An interesting paper that shows that sublethal application of a plant extract or gold nanoparticles was able to increase the effectiveness of killifish predation on mosquito larvae from 56% to 84–98%. While obviously gold nanoparticles are not a cost effective way forward, the simple use of the plant extract to boost the effectiveness of killifish for mosquito control could have wide-ranging application for the control of mosquito-borne diseases. *Tyrone Genade*

**A fish back from the dead.** Pennisi, E. *Science*, 351:433, 2016. URL <http://dx.doi.org/10.1126/science.351.6272.433>

The ability of *Austrofundulus limnaeus* eggs to survive without oxygen is reviewed and the results of changes in DNA expression are discussed with respect to what they can teach us about dealing with human injury due to lack of oxy-

gen. *Tyrone Genade*

**Place versus response learning in fish: a comparison between species.** McAroe CL, Craig CM and Holland RA. *Animal Cognition*, 19:153–161, 2016. URL <http://dx.doi.org/10.1007/s10071-015-0922-9>

An interesting paper that used *Nothobranchius guentheri* in experiments to explore how place learning (how to navigate to the same spot regardless of the starting point) occurs. The study also used goldfish, zebrafish and *Betta splendens*. The researchers report that “The findings that three of the four species showed a preference for the adoption of a place strategy suggest that fish, like mammals and birds, are capable of complex spatial memory and that the lack of a hippocampal structure is not necessarily detrimental to the navigational abilities of fish.” Only the zebrafish did not adopt place-strategy to find their way back to the learned location. *Tyrone Genade*

**Effects of a pesticide and a parasite on neurological, endocrine, and behavioral responses of an estuarine fish.** Renicka VC, Weinersmith K, Vidal-Dorsch DE, and , Anderson TW. *Aquatic Toxicology*, 170:335–343, 2016. URL <http://dx.doi.org/10.1016/j.aquatox.2015.09.010>

This paper reports the effects of pesticides and parasites on *Fundulus parvipinnis*. It measured neurotransmitter activity, cortisol levels and behavior. Cortisol levels were measured directly from the water. They found that low, sub-lethal levels of chlorpyrifos (2–3 µg/L) had a significant effect on the fish, reducing brain and muscles levels of acetylcholinesterase (the neurotransmitter-metabolizing enzyme critical to proper neurotransmitter function) by 60–74.6%, swimming speed; and a reduction of cortisol production in response to stress. Lethal levels range from 9 µg/L (rainbow trout) to 0.8 mg/L for goldfish. Chlorpyrifos is a widely used pesticide sold all around the world traded under the

names Brodan, Detmol UA, Dowco 179, Dursban, Empire, Eradex, Lorsban, Paqeant, Piridane, Scout, and Stipend (ref: <http://extoxnet.orst.edu/pips/chlorpyr.htm>). *Tyrone Genade*

**The influence of habitat structure on energy allocation tactics in an estuarine batch spawner.** Brigolin D, Cavarro F, Zanatta R, Pastres S, and Malavasi S. *Estuarine, Coastal and Shelf Science*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1016/j.ecss.2016.01.038>

Experiments employing *Aphanius fasciatus* (from a two lagoons near Venice) to examine the trade-off between fecundity and survival are reported. Fish from low predation environments spawned more frequently and invested less energy in each spawn compared to fish from high predation environments. The fish would seem to adapt their spawning strategy to the environment they live in. *Tyrone Genade*

**Acclimation and acute temperature effects on population differences in oxidative phosphorylation.** Baris TZ, Crawford DL, and Olleksiak MF. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 310:R185–R196, 2016. URL <http://dx.doi.org/10.1152/ajpregu.00421.2015>

*Fundulus heteroclitus* (Maine and Georgia populations) and *grandis* were used to determine how the fish respond at a molecular-physiological level to changes in temperature. The efficiency of oxidative phosphorylation (that supplies the cells with ATP for cellular work) of each species was examined when subjected to acute temperature changes. Each fish showed differences with respect to ADP and substrate-dependent mitochondrial respiration (how the cell responds to ADP concentrations) and the LEAK ratio (how much of the energy is used to generate heat vs form ATP). These fish show biochemical adaptations to the temperature ranges of their respective environments. *Tyrone Genade*

**Ecological influences on the local movement dynamics of**

**the blackspotted topminnow, *Fundulus olivaceus*.** Clark SR & Schaefer JF. *Behavioral Ecology and Sociobiology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1016/j.cbpa.2016.02.006>

This interesting paper reports how the environmental factors (seasons, predators etc..) effect the behavior of *F. olivaceus*. Tyrone Genade

**Local adaptation to osmotic environment in killifish, *Fundulus heteroclitus*, is supported by divergence in swimming performance but not by differences in excess post-exercise oxygen consumption or aerobic scope.** Brennan RS, Hwang R, Tse M, Fanguie N, & Whitehead A. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1007/s00265-016-2073-7>

This paper explores the physiological adaptation made between fresh and seawater populations of *Fundulus heteroclitus*. While the fish seem to have adapted their swimming to their native environment but not their metabolisms.

Tyrone Genade

**Mitochondrial physiology and reactive oxygen species production are altered by hypoxia acclimation in killifish (*Fundulus heteroclitus*).** Du SNN, and Mahalingam S, Borowiec BG, & Scott GR. *Journal of Experimental Biology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1242/jeb.132860>

*Fundulus heteroclitus* were exposed to hypoxic conditions and found to alter their mitochondrial metabolism as well as increase expression of enzymes responsible for clearing reactive oxygen species (free radicals). This did not prevent the faster accumulation of free radical damage to cellular components. Tyrone Genade

**Warm acclimation improves hypoxia tolerance in *Fundulus heteroclitus*.** McBryan TL, Healy TM, Haakons KL, & Schulte PM. *Journal of Experimental Biology*, 219:474–484,

2016. URL <http://dx.doi.org/10.1242/jeb.133413>

McBryan et al tested whether the adaptation to one environmental stress, heat, resulted in benefits against other environmental stress (hypoxia). They found that fish that adapted to higher temperatures also displayed better adaptation towards hypoxia. The implications of this paper are discussed at <http://jeb.biologists.org/content/219/4/467>. To the hobbyist keeping cool-water killifish this exposes the link between temperature and oxygen content in the water. It might be that cool-water fish are unable to cope with temperature because they can't then cope with oxygen deprivation. Tyrone Genade

**Correlation between microbiota and growth in Mangrove Killifish (*Kryptolebias marmoratus*) and Atlantic cod (*Gadus morhua*).** Torunn F, Sjulstad EB, Bakke I, Olsen Y, Hagiwara A, Sakakura Y, & Vadstein O. *Scientific Reports*, 6:21192, 2016. URL <http://dx.doi.org/10.1038/srep21192>

This paper reports on the consequences of the bacterial colonies in the intestines of the fish on growth. A strong correlation was found between the make-up of the bacterial colonies and growth of each species. Tyrone Genade

**A Genetics Map for the Only Self-Fertilizing Vertebrate.** Kanamori A, Sugita Y, Yuasa Y, Suzuki T, Kawamura K, Uno Y, Kamimura K, Matsuda Y, Wilson CA, Amores A, Postlethwait JH, Suga K, & Sakakura Y. *G3: Genes| Genomes| Genetics*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1534/g3.115.022699>

This paper reports a linkage map of the chromosomes of *Kryptolebias*. The data shows strong conservation of the organization of the genes in *Kryptolebias* compared to platyfish and Medaka. The paper provides a framework for later sequencing of the *Kryptolebias* genome. Tyrone Genade

**Statistical power to detect change in a mangrove shoreline fish community adjacent to a nuclear power plant.**



Dolan TE, Lynch PD, Karazsia JL, & Serafy JE.". *Environmental Monitoring and Assessment*, 188:1–16, 2016. URL <http://dx.doi.org/10.1007/s10661-016-5177-7>

The paper reports on the use of *Floridichthys carpio* to track fish population density near the Turkey Point Nuclear Generating Station. The methods developed will be used to track changes in biodiversity around the nuclear power plant and other locations. These results come at a convenient time since news of the Turkey Point reactor is leaking radioactive waste into the adjacent water: <http://fusion.net/story/278064/turkey-point-leaking-radiation-into-biscayne-bay/>. Tyrone Genade

**Morphological-based variation of the fish populations using Groupwise Registration; applied to microscopic images of fish otolith using *Aphanius dispar* as a model.** Teimori A & Eslami A. *Iranian Journal of Science and Technology (Sciences)*, Epub ahead of print, 2016. URL [http://ijsts.shirazu.ac.ir/article\\_3618\\_0.html](http://ijsts.shirazu.ac.ir/article_3618_0.html)

This paper reports on a new method for automatic morphological analysis of samples. For proof of principle the authors analyzed otoliths of *Aphanius dispar* and showed morphological differentiation among *A. dispar* populations Tyrone Genade.

**Neurotrophin-4 in the brain of adult *Nothobranchius furzeri*.** D'Angelo L; Avallone L; Cellerino A; de Girolamo P; Paolucci M; Varricchio E; & Lucini C. *Annals of Anatomy-Anatomischer Anzeiger*, Epub ahead of print, 2016. URL [http://nsuworks.nova.edu/occ\\_stueta/396/](http://nsuworks.nova.edu/occ_stueta/396/)

In this paper the authors define the expression of the neurotrophin-4 in the brain of *N. furzeri* using messenger RNA probes. They show that this neurotrophin, important for regulating development of neuronal networks, is expressed by neurons and glial cells of the forebrain and hind-

brain, with little expression in the midbrain; as well as that this expression is preserved into adulthood. Tyrone Genade

**Hepatic Responses of Juvenile *Fundulus heteroclitus* from Pollution-adapted and Nonadapted Populations Exposed to Elizabeth River Sediment Extract.** Riley AK; Chernick M; Brown DR; Hinton DE; & Di Giulio RT. *Toxicologic Pathology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1177/0192623316636717>

In this paper the author report that *Fundulus heteroclitus* has adapted genetically to pollutants (in this case cancer-causing polycyclic aromatic hydrocarbons) in the Elizabeth River. Fry were more resistant to the pollutants compared to fry from a population that inhabits unpolluted water. Interestingly, fry of the Elizabeth River population that were unexposed to pollutants showed more liver abnormalities than unexposed fry from an unpolluted population suggesting a physiological cost for the increased resistance to pollutants. Tyrone Genade

**Salinity Preference in the Estuarine Teleost Fish *Mummichog (Fundulus heteroclitus)*: Halocline Behavior.** Marshall WS; Tait JC; & Mercer EW. *Physiological and Biochemical Zoology*, Epub ahead of print. DOI 10.1086/686037, URL <http://dx.doi.org/10.1086/686037>

This paper reports experiments on salinity and temperature preference of *Fundulus heteroclitus* and how this relates to the migration of the fish into warm freshwater for spawning. Tyrone Genade

## Theses & Dissertations

**Skin permeability of the amphibious mangrove rivulus *Kryptolebias marmoratus* in response to emersion.** Heffell Q. Masters Thesis, *University of Guelph*, 2016. URL <http://hdl.handle.net/10214/9491>

The thesis reports experiments testing how the skin of *Kryptolebias marmoratus* responds to changes in salinity. The authors reports the use of a novel dye-dilution technique to measure water flux through the skin of the fish. Exposure of the fish to more saline environments, or forced emersion, correlated with decreased skin permeability to water. After seven days the fish had adapted to the salinity and water permeability increased. The fish have evolved mechanisms to minimize water loss. *Tyrone Genade*

**Feeding Ecology of the Invasive Lionfish (*Pterois* spp.) and Comparison with Two Native Species: Schoolmaster *Lutjanus apodus* (Walbaum, 1792) and Graysby *Cephalopholis cruentata* (Lacepède, 1802).** Secord JJ. Master's Thesis, *Nova Southeastern University*, 2015, URL [http://nsuworks.nova.edu/occ\\_stuetd/396/](http://nsuworks.nova.edu/occ_stuetd/396/)

This thesis investigates predation by lionfish, Schoolmaster and Graysby on *Floridichthys carpio*. Per gram of prey per gram of predator, lionfish consumed the most prey. Lionfish preferred the small prey size, as did Schoolmaster, but out-competed it for prey by being able to consume more. *Tyrone Genade*

**Founding fish: gene duplication contributes to immunological diversity in bottlenecked populations of introduced rainwater killifish.** Desmet DN. Master's Thesis, *San Francisco State University*, 2015. URL <http://sfsu-dspace.calstate.edu/handle/10211.3/163010>

Gene variants of the Major Histocompatibility Complex Class IIB are compared among several introduced popula-

tions of *Lucania parva* in California and New Mexico are compared. Two of only four variants were found in the majority of fish from all locations. Allele diversity was low in general. The low diversity suggests a strong bottleneck and/or common ancestry between all populations sampled.

## Interesting research on other fish

**Variation in cold tolerance in escaped and farmed non-native green swordtails (*Xiphophorus helleri*) revealed by laboratory trials and field introductions.** Tuckett QM, Ritch JL, Lawson KM, Lawson LL, Hill JE. *Biological Invasions*, 18:45–56, 2016. URL <http://dx.doi.org/10.1007/s10530-015-0988-y>

This paper reports that *X. helleri* has adapted to low temperature environments after escape from the aquarium trade. Farm raised fish from tropical areas could tolerate temperatures down to 11.3–5.5 °C while feral populations could tolerate 8–6.1 °C. Feral fish have adapted to the local climate. Killifish that escape into local water systems could also adapt and establish feral populations. Little data is available as to how adaptable killifish species are to cold. *Tyrone Genade*

**First record of the genus *Jenynsia* from marine water on the coast of Punta del Este, Maldonado, Uruguay (Cyprinodontiformes: Anablepidae).** Calviño P, & Alonso F. *Journal of Fish Biology*, Epub ahead of print, 2016. URL <http://dx.doi.org/10.1111/jfb.12895>

This paper reports the first location where *Jenynsia multi-dentata* was captured in sea water—off the coast of Punta del Este port, Maldonado, Uruguay. This species is known to inhabit estuarine habitats but had not yet been encountered in a fully marine habitat. *Tyrone Genade*

**Dose-dependent fluoxetine effects on boldness in male Siamese fighting fish.** Dzieweczynski TL; Campbell BA; &

Kane JL. *Journal of Experimental Biology*, 219:797–804, 2016. ISSN 0022-0949, DOI 10.1242/jeb.132761, URL <http://jeb.biologists.org/content/219/6/797>

Fluoxetine, known as Prozac by the general public, is a selective serotonin re-uptake inhibitors used to treat depression. In these experiments the authors exposed *Betta splendens* to increasing doses of fluoxetine (0.5 to 5  $\mu\text{g/L}$ ) and observed their behavior. Male fish exposed to fluoxetine were less bold and more unpredictable than unexposed males. Changes in behavior were dose-dependent suggesting that the outcomes of treatment depend on

the dose and careful monitoring. The decline in boldness could have fitness consequences where Prozac is a water pollutant. It has been blamed for the decline in UK starlings (<https://www.york.ac.uk/research/themes/prozac-and-starlings/>) where Prozac can reach 0.096  $\mu\text{g/L}$  in rivers receiving effluent from towns (<http://www.ncbi.nlm.nih.gov/pubmed/24411166>); and upto 0.099  $\mu\text{g/L}$  in Canadian sewage effluent (<http://www.ncbi.nlm.nih.gov/pubmed/14713027>). It is already known to effect the reproductive behavior of aquatic species (<http://www.ncbi.nlm.nih.gov/pubmed/24411166>). Tyrone Genade

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## How to join Killi-Data International

Killi-Data presents top quality information on Killies or oviparous Cyprinodontiformes fishes, in a Data Base, with full ichthyological, ecological and historical coverage of each taxon with all details of systematics, morphology, genetics, patterns of each species and, with nearly 3000 color photos and maps for over 1100 valid species (male and female); as well as with all aquarium information for maintenance and breeding of each species.

Killi-Data is now nested in non-profit association "K-D-I" for services to their members (access to Data Base, Killiflash and PDFs of K-D-S journal) for a modest fee (a once-off €10 Euro registration fee, + €6 per year) with all revenues redistributed in grants (for researchers and collecting aquarists).

Email [editor@killi-data.org](mailto:editor@killi-data.org) for help.