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 Epilatys 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 Epilatys 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 Epilatys 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.

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/?fref=bn, 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, Ignatio 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/gpuiffelipe/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 Salvador, 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


Breeding report: *Simpsonichthys mediopapillatus* Pindai

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


This new molecular study involving 29 named or unnamed species is a major breakthrough in the systematics of *Simpsonichthys, Xenurolebias, Ophthalmolesbias, Spectrolebias* and *Hypsolebias*, since the splitting by Costa in 2010 of *Simpsonichthys s.s.* and leveling of *Xenurolebias, Ophthalmolesbias, 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 monophylyism of the genera *Simpsonichthys*, *Spectrolebias*, *Hypsolebias* and also of the *H. flammaeus* 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 heloplitesto-group (which they name *antenori*-group) are related (within the *antenori*-heloplitesto 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 unnamed), 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


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

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 there evolution there of. 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 independently. *Tyrone Genade*


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*, 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, schlesi (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


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 southernmost 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; Pietzsch 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; Priebes S; Liehr T; Gorlach M; Than ME; Hiller M; Kestler HA; Volff JN; Scharlt 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


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


Previous research by Lucas-Sánchez employed N. koorthausae (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. koorthausae 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


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


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*


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*


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


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-born diseases. *Tyrone Genade*


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-

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.


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, sublethal 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, Paquent, Piridane, Scout, and Stipend (ref: http://extoxnet.orst.edu/pips/chlorpyr.htm).


Experiments employing Aphanius fasciatus (from 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.


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.

Ecological influences on the local movement dynamics of

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


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*


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*


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*


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.

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

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 Tyron 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_stuetd/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 hindbrain, 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


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

The thesis reports experiments testing how the skin of *Kryptolebias marmoratus* responds to changes in salinity. The authors report 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


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


Gene variants of the Major Histocompatibility Complex Class IIDB are compared among several introduced populations 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


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


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. Dzeweczynski TL; Campbell BA; &
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 µg/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 µg/L in rivers receiving effluent from towns (http://www.ncbi.nlm.nih.gov/pubmed/24411166); and up to 0.099 µg/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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