Killi-Data Wassup n°6

Overview of Killifish research output

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DOUBLE EDITORIAL : Wildekamp and K-D livebearers extension

With Killi-Data Wassup n°6, this editorial is exceptionally double because 2 unavoidable but independent news are dealt with.

First, Dutch Ruud Wildekamp passed away on August 18 (born 1945), aged 74. Along a long life focused on cyprinodontiformes fishes he has described exactly 40 killifish names, including not less than 32 within genus *Nothobranchius* as an example of his special interest for that genus. Few people know that his naturalist interest stems from his father and that his professional career truly is in the army (not only an «alimentary job») because he is deeply invested in army planes and museum and he has published over many years several books including a very last one, published just after his death {curiously 2 other killifish specialists are from the army too, the late Colonel Joergen J. Scheel and the still active and enthusiastic Heinz-Otto Berkenkamp in Germany). Apart from many scientific papers he is known as a talented drawer for having initiated idealized sketches of all known species, both oviparous and viviparous, and for having authored a series of 4 books on oviparous killifish between 1993 and 2004 (edited by Brian Watters and published by AKA), widely distributed among specialists, each dealing with valid species for alphabetically listed genera. Due to severe heart problems (and a triple by-pass surgery), back during this first decade, his activity is much reduced and the fifth and last book in the series has been delayed and ultimately could not be published, all the more that very many new species have been described since 1993, with many generic systematic changes, notably by Wilson Costa, in the mean time, so that, time passing, it has become more and more out of scope to cover the remaining and the modified names in a single volume and not too far from book 4. Many hobbyists are anxious that their series is not finalized (recurrent questions to Killi-Data are evidences of that need) but according to Tonnie Woeltjes (pers. comm., September 2019), a team of Dutch specialists has decided to tackle the challenge to finish up the series in coming years (still published by AKA) so that his memory is fully acknowledged.

Second, the project Killi-Data celebrates its twenty-fifth anniversary in 2019, since the first book is published in 1994 (with 2 editions, one in January, the other in November), then in 1996, 2000 and 2007 (and from 2001 moved into a database online, today a huge inter-operative relational knowledge-base) ; along this anniversary, the Killi-Data project and the database are strongly expanded in order to include livebearing Cyprinodontiformes (i.e., 585 taxa) to reach 2177 taxa in total, today. This extension is phylogenetic since Parenti's published thesis (1981) but the scientific correspondence of the common name killi (plural killies) is strongly varying along time, before and after that work : in the past, killifish is artificially equal to some North American species, including for example oviparous *Fundulus* sp. and the dwarf livebearer *Heterandria formosa* or 'least Killifish', then it is extended to all oviparous Cyprinodontiformes, excluding livebearers (e.g. by aquarists, sometimes adding ricefishes today in Atheriniformes), or, like today, and herein, to all Cyprinodontiformes whatever is their mode of breeding (e.g., in major American database for systematics of upper levels, Integrated Taxonomic Information System, or I.T.I.S., cyprinodonts, cyprinodontiforms,

cyprinodontes, or killifishes bear the same meaning). This major extension starts about 2 and a half years ago with the enthusiastic cooperation and endurance of a bunch of students in biology that is materialized by a long publication by Huber (herein analyzed) in September 2019 in parallel to the enlargement of Killi-Data knowledge base which is to include in addition more than 200 items for each taxon, valid or synonymous or unavailable, plus live color photos and maps of distribution by groups of related valid species.

VIEW FROM THE CHAIR

Killi-Data Wassup n°6 contains several features that push to some comments raised from some of the selected publications in view of the translation of their results into Killi-Data, and not as opinions or judgments on the quality of those research papers.

First, the publication by Huber of a full revision of taxonomy of livebearing Cyprinodontiformes ; this is a milestone in the knowledge of livebearer killifish since all taxa are nomenclaturally and systematically reviewed, whenever generic and specific taxa, valid, synonymous or unavailable, within more than 150 pages ; it is impossible, even with a full summary, to list all findings and it is surprising that no researcher for Poeciliidae has tackled the issue since the major review by Rosen & Bailey, back in 1963, except a few focused genera by Rauchenberger or Lucinda {the 2 other groups, small in number of species, Anablepsinae and Goodeinae, are better served, the first owing to Ghedotti, the second owing to a cooperative group named GWG combining experts aquarists and professional ichthyologists with a fully detailed website at http://www.goodeidworkinggroup.com/home but with only about 40 species ; note : the list of family-group names is consequently extended and updated online to encompass all Cyprinodontiformes, at http://www.killi-data.org/list-names-familygroup.php .

Second, Garcia, Rios, Gutierrez, Serra & Loureiro disclose for the first time in oviparous killifish, and notably among Rivulidae, a case of molecular introgression in a hybrid swarm, largely distributed, between *Austrolebias charrua* and *reicherti*, in Uruguay coastal plain ; this is a major finding, even if it is a common case among viviparous killifish (not only Poeciliidae) with natural recent or old hybridization {and if recent it has induced un-necessary descriptions such as *Xiphophorus kosszanderi* and *Xiphophorus roseni*, both today considered as simple synonyms, respectively of *variatus* and *couchianus*, or better labeled as ICZN-wise unavailable names {and those results should be a warning for research on other oviparous groups of killifish in complicated areas with extreme variations, such as lampeyes of coastal Gabon and Congo in genus *Plataplochilus* (and more northerly *Procatopus*), not long ago considered as close cousins of Poeciliidae}.

Third, Teimori and Motamedi disclose first full mitochondrial genome of an *Aphanius* sp. (standard Iranian sp., *farsicus*) and that is another contribution to still emerging data on full molecular genomes of killifish (about a dozen sp. in total at this time) ; however, most important are the reservations by the authors regarding the recent split of the family Cyprinodontidae and separation of Aphaniidae as valid family for members of genus *Aphanius* (the Western Palaearctic killifishes), while family Cyprinodontidae is restricted to New World genera such as *Cyprinodon*, *Floridichthys* and *Jordanella* ; based on phylogenetic relationships achieved in their present study, the authors recommend that validation of family Aphaniidae still needs more phylogenetic supports, and this can be investigated by adding more sequences of the *Aphanius* species ; those results show with high bootstrap values in all median branches, a rare case for molecular data, that *Jordanella*, *Cyprinodon* and *Aphanius* form a single strongly supported clade, with *Jordanella* as primitive and the 2 other genera as derived, and this is a warning to fish international databases (in this case, including Killi-Data, even with some reluctance for that not urgent move) which (sign of times for being always at front edge of novelties, following FaceBook or Twitter social networks???) have immediately changed the family-group names pyramid from 7 to 14 families based on recent multigene trees, not full mitogenome trees… will there be in the future international cooperation for agreeing on at least systematics at the family level, or not, will this be still the utmost firepower which gets priority, or not? {besides, philosophically speaking, it should be remembered too

that back during the mid 1990ies some people keep claiming firmly that the then molecular output is the end of the game… but molecular trees of that time, i.e., based on 1 or 2 sequences, are today clearly outdated (even by strong errors) compared to today multigene trees, not to speak of what will be future mito, then nuclear-full genome trees (and unknown future genetic trees)… and we are left today with very old and probably largely erroneous trees in large genera like *Rivulus* or *Simpsonichthys* (in their large senses) without new modern research on them}.

SELECTION OF PUBLICATIONS

- Meng, F., J. Chen, Z. Miao, K. Zhu, Y. Huang, Q. Wang, B. Liu & Y. Liu. [Meng et al. show full mitogenome of *Orestias ascotanensis*, 16 617 bp, surprisingly nearer to *Poeciliopsis monacha* than to *Xiphophorus* (both Poeciliinae) in limited molecular tree with 100 bootstrap values for each branch. 2019. MtDNA, https://www.tandfonline.com/doi/full/10.1080/23802359.2019.1687033] {Jean Huber, 18-November-2019} <°))))>< <°))))>< <°))))><
- Barbosa, C., D.K. Garcez, M.V. Volcan & L.J. Robe. [Barbosa et al. find a drift (165 KYA) on 4 of 8 pops of *Austrolebias nigrofasciatus* based on 3 sequences and nearly 100 spms per set ; samples of *Austrolebias nigrofasciatus* (n = 103), endemic to a quite small area of laguna Patos-Mirim encompassing São Gonçalo Channel lowlands, come from 8 isolated temporary ponds, 4 located at known distribution range and 4 others located along rio Piratini lowlands, where morphologically different individuals are found ; based on multigene sequencing the authors separate the 4 new populations with a high number of exclusive haplotypes from Piratini since 165 000 years during a population expansion {a time associated with a glacial event for exclusion, preceded by an interglacial period for expansion} but molecular separation does not warrant full speciation {more generally molecular differentiation, possible speciation and putative cryptic new species naming should be an important field of discussion in killifish systematics, bearing in mind 5 recent new species from also a very limited area in non annual subgenus *Chromaphyosemion*} ; besides the authors rightly stress conservation issues (and possible actions). 2019. JFB, https://onlinelibrary.wiley.com/doi/10.1111/jfb.14201] {Jean Huber, 16-November-2019} <°))))>< <°))))>< <°))))><
- Motamedi, M, Teimori, A, Iranmanesh, A. [Motamedi et al. evaluate sexual and side dimorphism in growth-dependent otolith structure in scaleless *Aphanius furcatus* from Iran [this is a follow-up of similar study on *vladykovi*, earlier this year [ref.: Sanjarani, N.V., Esmaeili, H.R., Masoudi, M. & B. Reichenbacher 2019. Ontogenetic Otolith Development in an Endemic Tooth-Carp, *Aphanius vladykovi* (Teleostei: Aphaniidae). Journal of Ichthyology, 59 (3): 336–343.]. 2019. A.Z., https://onlinelibrary.wiley.com/doi/abs/10.1111/azo.12313] {Jean Huber, 14-November-2019} <°))))>< <°))))>< <°))))><
- Ruiz, G.C., Arista, V.B.P. & A.S. Andreu. [Ruiz et al. detail LHT of *Fundulus lima* from oases of Baja California Sur with 3 age classes based on annual growth rings in scales. 2019. RBT, https://revistas.ucr.ac.cr/index.php/rbt/article/view/36920/40152] {Jean Huber, 13-November-2019} <°))))>< <°))))>< <°))))><
- Teimori, A. & Motamedi, M. [Teimori and Motamedi disclose full mitochondrial genome of *Aphanius farsicus* with some doubts on distinct validity of family Aphaniidae, as a pioneering work in the genus, consisting of 16 485 base pairs {note : for comparison, a few 'cousin' sp. are studied and full mitochondrial genome of *Orestias ascotanensis* from Chilean Andes is with 16 617 bp, of *Cyprinodon nevadensis pectoralis* is with 16 499 bp and of *Cyprinodon variegatus* is with 16 498 bp}. 2019. JoI, https://link.springer.com/article/10.1134/S0032945219050151] {Jean Huber, 2-November-2019} <°))))>< <°))))>< <°))))><

- Iida, A., H.N. Arai, Y. Someya, M. Inokuchi, T.A. Onuma, H. Yokoi, T. Suzuki, E. Hondo & K. Sano. [Iida et al. show matrotrophy in *Xenotoca eiseni* {K-D placed in *Xenoophorus*} is thru vitellogenin transport from mother to embryo ; this anatomical study by a Japanese team provides data for the first time to explain how nutrients are transmitted from mother to embryo during gestation of Goodeinae (true viviparous sp.) and the explanation is vitellogenin, a well known yolk nutrient protein, that is synthesized in liver of female animals, and subsequently carried into ovary {or better said, vitellogenin is one of the matrotrophic factors since there might be others, still to be discovered}. 2019. PNAS, https://www.pnas.org/content/116/44/22359] {Jean Huber, 31-October-2019} <°))))>< <°))))>< <°))))><
- Mar, V.S., L.M.S. Mar, Y.D. Herrerias, M.N. Medina & O.D. Dominguez. [Mar et al. report first transplant of *Chapalichthys encaustus* (already native to Mexico) in Teuchitlan River, Jalisco (but no clue to explain or justify the event). 2019. Hidr., https://hidrobiologica.izt.uam.mx/index.php/revHidro/article/view/1281] {Jean Huber, 31-October-2019} <°))))>< <°))))>< <°))))><
- Valdesalici, S. & J.R.G. Gil. [Valdesalici and Gil describe *Anablepsoides bibosi* {K-D maintained in *Rivulus*} from Bolivia, vicariant from *chapare*, but with higher LL ; according to the authors, *bibosi* is morphologically separated from *chapare* by basic morphological characters {the single known 2 type localities are only separated by about 25 kms and the 2 color patterns are similar, the detailed color pattern of *chapare* being itself quite close to *christinae*, and it seems not realistic to increase descriptions output of congeneric species from Bolivia without, before, an in-depth field survey, a detailed variability comparison and comparative molecular data, notably because no biogeographical barrier seems available to argument on differentiation, even if both *chapare* and *bibosi* are collected at foothills of Andean plateau and might have benefited for speciation of palaeo-micro-refugia} ; according to the authors the 2 species are part of a *limoncochae* species group with a huge distribution from Bolivia to coastal lower Amazon basin {however that species group might be paraphyletic and it is not yet supported except by similar morphology and a common color pattern with reduced posterior lines on male sides, and, notably preliminary, limited -and old- molecular evidence only supports 2 subgroups in named *micropus* (or *urophthalmus*) group including but not only that pattern differentiation, one western with lower Amazon and Guiana shield species, the other from mid-Amazon and upstream, from Venezuela to Bolivia}. 2019. Aqua, https://aqua-aquapress.com/product/aqua-254_anablepsoides-*bibosi*/] {Jean Huber, 30-October-2019} <°))))>< <°))))>< <°))))><
- Conway, K.W., M. Mateos & R.C. Vrijenhoek. [The Vrijenhoek team describes *Poeciliopsis jackschultzi* sympatric with *occidentalis* and hybrigenic clones, restricted in Sonora ; the new species is known since long (discovered by co-describer Robert C. Vrijenhoek, back in 1981) but only detailed sequencing herein allows to separate the new species because, in that region of Mexico and neighboring USA, *Poeciliopsis* populations are frequently made of clones and hybrids of with other congeners (e.g. the well studied case of *lucida*) ; besides , *jackschultzi* is in type area sympatric with *occidentalis*, a hybridogenetic all-female biotype *monacha-occidentalis*, and hybrids between *monacha-occidentalis* females and *jackschultzi* males {a fascinating biological complexity and a major challenge for systematists!} ; note : distribution of *jackschultzi* is highly restricted, and main habitat, as spring-fed marshy streams and pools, is susceptible to loss and degradation in a desert environment with increasing human water demand, making the species as highly endangered (as pure strain). 2019. Zookeys, https://zookeys.pensoft.net/article/37586/] {Jean Huber, 28-October-2019} <°))))>< <°))))>< <°))))><
- Garcia, G., N. Rios, V. Gutierrez, S. Serra & M. Loureiro. [Garcia et al. disclose molecular introgression in a hybrid swarm, largely distributed, between *Austrolebias charrua* and *reicherti* ; a previously hypothesized bimodal hybrid zone between those 2 taxa, from laguna Dos Patos Merin system, is confirmed by RNA-seq-based sequencing of transcriptomes from pools of individuals of *charrua*, *reicherti* and their putative natural hybrids and by a set of 111 725 SNP (single nucleotide polymorphism) markers, representing

presumably fixed allelic differences among the 2 species. 2019. Genes, https://www.mdpi.com/2073-4425/10/10/789/htm] {Jean Huber, 16-October-2019} <°))))>< <°))))>< <°))))><

- Rodriguez, S.M., G. Hidalgo, L. Brito, M. Arrebola, L. Morales, D. Hernandez, D. Sanchez, J.G. Rodriguez, C. Castellini & J.L. Ponce. [Rodriguez et al. show limited overlap and no sex variation in food study of *Gambusia punctata* and *puncticulata* when sympatric in Cuba. 2019. RIM, https://www.oceandocs.org/bitstream/handle/1834/15570/RIM%2039%281%29%20art%208.pdf?sequence=1&isAllowed=y] {Jean Huber, 16-October-2019} <°))))>< <°))))>< <°))))><
- Zee, J.R. Van Der, K. Bernotas, P.H.N. Bragança & M.L.J. Stiassny. [Zee et al. describe *Poropanchax pepo* with rounded Dorsal and and Anal fins, in lower Congo, most southern congener, 700 km away from Gabon known location (*stigmatopygus*, previously as *scheeli*, according to Wildekamp & Malumbres, 2004) ; the new species lacks nearly all previously known characteristics of genus *Poropanchax* (such as cephalic pores, extended unpaired fins in male and above all a fragmented horizontal metallic blue pattern on male sides (in 2 or 3 bands), except *scheeli* ; but it shares, with rediagnosed components, an osteological character ; besides *pepo* shows a higher D/A ratio and a high % of predorsal length vs. S.L. which is not shown in previous understanding of *Poropanchax* ; according to the authors, *Poropanchax* now includes *luxophthalmus*, *pepo*, *rancureli*, *stigmatopygus* but the authors do not discuss validity of *hannerzi*, a subspecies of *luxophthalmus*, add *scheeli* to the group and delete *normani* from it, following preliminary molecular data {the *normani* move is not applied in Killi-Data pending a major revision of all lampeyes with new diagnoses by Bragança, one of the describers, expected in 2020 or 2021, simply because it is not possible in a data base to label a genus name with kommas or alike as "*Poropanchax*", like in the case of *normani*}. 2019. AMN, https://bioone.org/journals/American-Museum-Novitates/volume-2019/issue-3941/3941.1/An-Unexpected-New-*Poropanchax*-Cyprinodontiformes-Procatopodidae-from-the-Kongo-Central/10.1206/3941.1.short] {Jean Huber, 11-October-2019} <°))))>< <°))))>< <°))))><
- Domínguez, O.C. & Uribe, M.C. [Dominguez and Uribe disclose spermatozoa continuously from 3rd week post-hatching until pool desiccation in male *Millerichthys robustus* {a study that should be replicated for various annual components of South America and Africa, even if it can be hypothesized as a generalized situation, since male respond to the cycle of female, and more, in *Nothobranchius furzeri*, for example, this condition must still be earlier and more pronounced, Omar Dominguez-Castaneda, pers. comm. to Huber, October 2019}. 2019. E.B.F., https://link.springer.com/article/10.1007/s10641-019-00912-4] {Jean Huber, 21-September-2019} <°))))>< <°))))>< <°))))><
- Frota, A., C.S. Pavanelli & W.J. Graça. [Frota et al. analyze distributions of (sub)genera *Anableps*, *Jenynsia*, *Plesiojenynsia* along hydrological evolution of Neotropicals ; existence of areas of endemism for the family Anablepsidae {or Anablepidae} reveals an intimate association with historical events that occur along palaeo-history in geological evolution of South America, which can be associated with main diversification patterns and historical hypotheses for Neotropical freshwater fishes biogeography {and which is today fully supported by multigene molecular data for those not too old, notably less old than 45 MYA, until results based on full genome molecular data are published in the coming decade... but which is not fully supported by cladistic morpho-osteological data}. 2019. Zootaxa, https://biotaxa.org/Zootaxa/article/view/zootaxa.4671.4.4] {Jean Huber, 21-September-2019} <°))))>< <°))))>< <°))))><
- Wildekamp, R.H. [Wildekamp synonymizes Costa-newly-described *Nothobranchius kwalensis* (color variation) and *prognathus* (type locality preoccupied) into *melanospilus* ; the author shows clearly that type locality of *prognathus* is identical to that of *melanospilus* {if one excepts synonymizations due to misunderstandings or lack of communication between authors resulting in 2 descriptions of the same species separated by a few weeks, this is the quickest modern synonymization within killifish and it is surprising to read that Costa overlooks Wildekamp's previous works unless Costa publishes an answer

with new argumentation} ; the other synonymization, suggested by the author is for *kwalensis* as a simple color variation {and in that case, it is not followed by Killi-Data because it is an opinion, it is not argumented on facts and observations -scientifically evidenced-, even if it seems highly probable} ; the fact is that among *Nothobranchius* experts, such descriptions of congeners based on micro-osteological characters are not well accepted because among annuals osteological variations are large between populations, or within them, or along age, or along years of collections {time will tell who is right and who is wrong and if more generally Costa's numerous descriptions of cryptic species based on micro-characters will stand in the long term or not, precisely on each case... nobody knows today and Killi-Data will not take an option and will only follow latest published evidence... as a warning, readers should remember that Lucinda has described in a single paper 21 species of viviparous genus *Phalloceros*, only separated by details of gonopodium and that very recently most of those species are confirmed as valid based on first molecular results}. 2019. JAKA, http://www.killi-data.org/registration.php] {Jean Huber, 4-September-2019} <°))))>< <°))))>< <°))))><

- Huber, J.H. [Huber fully reviews taxonomy of livebearing Cyprinodontiformes (Anablepsinae, Goodeinae, Poeciliidae, minus oviparous *Tomeurus gracilis*) with new genus *Hiatirhaphis* ; each taxon is analyzed from its description until latest published evidence in order to assess its status and evaluate its validity ; detailed results include (1) very numerous proposed changes following argumentations in accordance with the edition of ICZN Code applicable at the concerned date, (2) lectotypes that are designated to clarify some ambiguity in type series or other reasons, (3) etymology of each taxon that is suggested based on Latin and Greek roots or historical evidence, mostly for the first time, (4) systematics of genera and subgenera that are aligned to latest molecular evidence (Reznick et al., 2017) and shown in 3 tables according to the 3 (sub)families with addition of a new distinguishing meristic character (D/A ratio), unused for livebearing Cyprinodontiformes, but so important in oviparous groups, enabling to move a species flock (*eiseni* et al.) of Goodeinae to another genus (*Xenoophorus*) and a species flock of Poeciliidae to a new genus *Hiatirhaphis* nov. gen. 2019. K-D-S, http://www.killi-data.org/series-kd-2019-Huber.php] {Jean Huber, 2-September-2019} <°))))>< <°))))>< <°))))><
- Valdesalici, S. & G. Amato. [Valdesalici and Amato describe *Nothobranchius derhami* from western Kenya with beauty male, dedicated to ecologist Patrick de Rham ; the species is well known by aquarists and since long (previously referred as sp. Nyando River), at least from the collections (1985) by renown Swiss ecologist Patrick de Rham (already honored with *Rivulus derhami*) ; in his paper, the collector (Rham, 1991b) is pioneering in comparing the behavior, the ecology of the new species (then, as undetermined sp.) and sympatric *robustus* [ref.: Rham, P. de. 1991a,b. Safaris Poissons au Kenya. I et II. Aquarama, 120: 31-44; 121: 21-30.] {e.g., *derhami* lives in classic habitats of *Nothobranchius*, as temporary pools or marshes in particular totally isolated where it is the only species of fish, whereas *robustus* lives in pockets of water of small streams which during high waters connect to Lake Victoria basin or swamps surrounding it ; because of its habitat in rivulets *robustus* is sometimes perceived as a semi-annual sp. but this an error because I have been also able to get *robustus* fry by collecting dry sediments in places where a good population is fixed with probable eggs in it, pers. comm. to Huber, October 2019} ; here, the describers assign *derhami*, from Lake Victoria basin, western Kenya, to *ugandensis* superspecies {part of *Zononothobranchius* subgenus} and hypothesize that because of its very restricted distribution, *derhami* may be considered as vulnerable in terms of endangerness. 2019. Aqua, https://aqua-aquapress.com/product/aqua-253_nothobranchius-*derhami*/] {Jean Huber, 16-August-2019} <°))))>< <°))))>< <°))))><
- Valdesalici, S. [Valdesalici describes very large lineated *Moema funkneri* predator from East Bolivia in homage to Scottish collector Jurij Phunkner (also known spelt as George Funkner) ; this is a species with a barred pattern made of oblique rows of red brown dots in male, like *heterostigma* and *quiii* ; according to the author, the new species is diagnosed by details in live pattern and a relatively higher number of scales

in series (LL, TRAV, CIR). 2019. Aqua, https://aqua-aquapress.com/product/aqua-253_moema-*funkneri*/] {Jean Huber, 16-August-2019} <°))))>< <°))))>< <°))))><

- Garcia, D., C. Smith, E. Machin, M. Loureiro, M. Reichard. [Garcia et al. show 2nd cohort fish with earlier maturity in *Austrolebias bellottii* and *nigripinnis*, if unnatural mid-winter desiccation ; this is another example of the flexibility to environmental conditions and phenotypic plasticity for annual killifish ; during Austral winter of 2015, the Rio Negro region in western Uruguay, where the 2 *Austrolebias* sp. are often sympatric, has faced an unprecedented mid-winter desiccation of pools that usually contain water from Autumn to late Spring (typically only desiccating in Summer), and that year many desiccated pools have been re-inundated from later rains, generating a second cohort of killifish in some pools (not less than 53%) in response to atypical conditions ; the authors show that 2nd cohort of fish develops more rapidly than first in terms of at least body size. 2019. F.B., https://onlinelibrary.wiley.com/doi/abs/10.1111/fwb.13376] {Jean Huber, 7-August-2019} <°))))>< <°))))>< <°))))><
- Watters, B.R., Nagy, B., Van der Merwe, P.D.W., Cotterill, F.P.D. & Bellstedt, D.U. [Watters et al. review *Nothobranchius taeniopygus* group with 5 new sp., *angelae*, *ottoschmidti*, *rungwaensis*, *skeltoni*, *sonjae* (Tanzania) ; the *taeniopygus* superspecies is split again with not less than 5 new cryptic species with morphological, molecular and ecological data ; in a restricted sense the superspecies encompasses *taeniopygus*, *ivanovae* and the 5 new species, according to the authors, but in a larger sense (including *ugandensis* and related sp.), i.e. identical to *Zononothobranchius* subgenus, the superspecies has 23 valid components, i.e., *angelae*, *bellemansi*, *derhami* (described just after), *ivanovae*, *kardashevi*, *neumanni*, *nubaensis*, *ottoschmidti*, *robustus*, *rubroreticulatus*, *rungwaensis*, *sagittae*, *seegersi*, *serengetiensis*, *skeltoni*, *sonjae*, *steinforti*, *streltsovi*, *taeniopygus*, *taiti*, *torgashevi*, *ugandensis*, *usanguensis* ; among the 5 new species (all separated by a combination of characters, the banded pattern of Anal fin in male being insufficient per se), the most distinctive is *skeltoni*, dedicated to Paul Skelton, emeritus professor and managing director of South African Institute of Aquatic Biodiversity. 2019. IEF, https://pfeil-verlag.de/publikationen/review-of-the-nothobranchius-*taeniopygus*-species-group-from-central-and-western-tanzania/] {Jean Huber, 6-August-2019} <°))))>< <°))))>< <°))))><
- Yogurtçuoglu, B. [Yogurtçuoglu shows 2 sympatric *Aphanius* sp. in highly alkaline lake Salda, Turkey, *fontinalis* and *saldae*, reproduce simultaneously. 2019. MFR, http://www.publish.csiro.au/mf/MF18485] {Jean Huber, 4-August-2019} <°))))>< <°))))>< <°))))><
- Costa, W.J.E.M. [Costa describes *Leptopanchax sanguineus*, possibly extinct and previously misidentified as *splendens* from same type area in Rio de Janeiro state ; in an earlier paper, 6 months before [ref.: Costa, W.J.E.M., J.L.O. Mattos & P.F. Amorim. 2019. Rediscovery of *Leptopanchax splendens* (Cyprinodontiformes: Aplocheilidae): a seasonal killifish from the Atlantic Forest of south-eastern Brazil that was recently considered extinct. Journal of Fish Biology, 94 (2): 345-347], Costa with other authors already points out the misidentification and regards the close-by population as un-named new sp., distinct from *splendens* and the present description fills the hole {it is not understood why, even if it is not important, both manuscripts are not fused into one, in renown Journal of Fish Biology} ; the new sp. (and single population) has not been collected since the late 1980ies but with recent experience (and for example the rediscovery of *splendens*) impossible is a forbidden word with annual killifish! (*Mucurilebias leitaoi* and *Prorivulus auriferus* are still missing after their first and single collection, long ago) ; if rediscovered it will be a real need to study molecularly both *splendens* and *sanguineus* because they are very close in collections and male color patterns ; note : there are today 6 species in genus *Leptopanchax* (described by Costa in 2016), if *citrinipinnis* is confirmed as valid by independent authors as Costa always claims (*aureoguttatus*, *citrinipinnis*, *itanhaensis*, *opalescens*, *sanguineus*, *splendens*). 2019. ZK, https://zookeys.pensoft.net/article/34034/] {Jean Huber, 30-July-2019} <°))))>< <°))))>< <°))))><

- Zak, J., M. Vrtilek & M. Reichard. [The Reichard team reports on field diel activity of 3 sympatric Notho. sp., with gut fullness and diet richness peaked in morning ; for this rare, though empirical and probably preliminary field study, results show that male is more active than female (notably with sexual active pursuit of female), swimming activity peaks at mid-day, gut fullness and diet richness increases before spawning activity and peaks in the morning, diet is dominated by chironomid larvae during daytime and by notonectid bugs at night for all 3 species and that for *furzeri* alone, the only species occurring at all sites, oocytes are ovulated in early morning, most spawning events have occurred by the early afternoon and no loyalty to any particular pool section can be detected {note : this a follow-up study on same 3 sympatric sp., *furzeri*, *pienaari*, *orthonotus*, of following recent bibliographic reference, and others, less recent by same team : Vrtilek, M., J. Zak, M. Polacik, R. Blazek & M. Reichard. 2018. Longitudinal demographic Study of wild Populations of African annual killifish. Nature Scientific Reports, 8: 4774 [https://www.nature.com/articles/s41598-018-22878-6]}. 2019. BJLS, https://academic.oup.com/biolinnean/advance-article-abstract/doi/10.1093/biolinnean/blz108/5537092] {Jean Huber, 27-July-2019} <°))))>< <°))))>< <°))))><
- Godoy, R.S., Lanés, L.E.K., Weber, V., Stenert C., Noblega H.G., Oliveira G.T., Maltchik L. [Godoy et al. show that 70% spms of annual *Austrolebias minuano* have liver alterations of different severities throughout life cycle (age-associated alterations in annual fish, like in aging model, *Nothobranchius furzeri*). 2019. BG, https://link.springer.com/article/10.1007/s10522-019-09822-5] {Jean Huber, 18-July-2019} <°))))>< <°))))>< <°))))><
- Sanjarani, N.V., Esmaeili, H.R., Masoudi, M. & B. Reichenbacher [The Reichenbacher team report on early otolith development in *Aphanius vladykovi* (birth to 120 days), compared to *farsicus*. The authors show for the first time (at least in Cyprinodontiformes) that otolith morphology is an important source of taxonomic information, not only for fully adult specimens but also along development of fish during the early life stages (15 larvae and early juveniles of *vladykovi* representing 9 different developmental stages , i.e. from birth to 120 days post hatching) ; results are similar to *farsicus*, overall, along development phase, exemplifying their close phylogenetic relationship, but with some differences. 2019. J.Ichthyol, https://link.springer.com/article/10.1134/S0032945219030172] {Jean Huber, 10-July-2019} <°))))>< <°))))>< <°))))><

Yin-Liao, I., P.A. Wright & F. Laberge. [Yin-Liao et al. experiment on *Kryptolebias marmoratus* aestivating activity, as unable to explore objects in terrestrial environment ; using a novel object test, the authors show that tested fish explore objects in the aquatic environment, but not in the terrestrial environment ; the authors also explore variables between aquatic refuges, like shallow water depth (simulating desiccation risk) and the presence of a conspecific potential competitor, both of them increasing emersion outside of refuges, and high water salinity, this time with no effect on emersion. 2019. JFB, https://onlinelibrary.wiley.com/doi/abs/10.1111/jfb.14085] {Jean Huber, 10-July-2019} <°))))>< <°))))>< <°))))><

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