Killi-Data Wassup n°9

Overview of Killifish research output

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EDITORIAL : the human concept to be revisited in taxonomy?

With Killi-Data Wassup n°9, this editorial tackles the human dimension vs. the 2 major and very old taxonomic issues, i.e. the genus-subgenus and the species-subspecies concepts discussed in the 2 preceding K-D-W (other levels, such as family-group names, would use the same argumentation with little added value and they are much less universally used), and, likewise, the human dimension materializes differently along time.

Of course, nobody would quarrel that the human dimension in taxonomy (= nomenclature+systematics) is the oldest issue ever since taxonomy itself is an artificial production by human beings themselves (taxonomists), precisely by Linnaeus !

And no doubt either that Linnaeus himself and his then colleagues would be terrified to death by taxonomy as pictured today! No matter, even taxonomists today do not know at all where they are aiming because present picture of taxonomy, already quite complicated, is not going to get more clarified (or even more stable) because the more we learn the more the picture becomes complex (of course -and fortunately- fish are not aware of published activities by taxonomists and it is not known if they would change their ways of speciation or diversification, passive and active, i.e., hazard and necessity, in order that taxonomists have an easier duty). Truth is that fish are incredibly complex beings, but human beings (and their thinking) are not simple either!

Let's try then to make it understandable, even if not simple.

Like already discussed many times there are 2 extremes of thinking, the "splitter" way (more analytical, focused on separating-dividing, using many names) and the "lumper" way (more focusing on grouping, on similarities, using few names), with obviously a continuity of variation between those 2 extremes (and the ICZN Code has of course no preference for any!).

On top of the (1) "splitter" or (2) "lumper" continuous variation in humans, there is another specificity in taxonomy that practically concerns Cyprinodontiformes (and a few other fish groups) : it is the multiplicity of author's origins, I.e. (3) "professionals" (with an education degree in ichthyology such as a Ph.D. when young adults), possibly paid as wages for their works but constrained by career objectives (today it is very rarely the case due to budget discrepancies and professionals are paid for outside duties, such as teaching or for conservation objectives or in fisheries) and (4) "amateurs" (usually aquarists with no ichthyology education when young) and not paid as wages in fish research (with no constraints but strong personal financial investments, notably in collecting trips) ; obviously both types are respectable (and welcome cheerfully if they are knowledgeable, responsible and serious) and, like for the "splitter" or "lumper" variation, there is again a continuity between those 2 extremes in taxonomy. For examples, a "professional" with highest standards of records in killifish research publication may publish very few or no names (e.g., David Reznick) or on the contrary publish very many new names (e.g., Wilson Costa, Carl Leavitt Hubbs) and an "amateur" may bring

few new names and add major results in fish knowledge and get an honorary Ph.D. in the old age for that (e.g., Joergen Scheel) or on the contrary publish many new names after personal collections (e.g. Lothar Seegers, Manfred Meyer, or Alfred Radda, the first having finalized a Ph.D. in ichthyology late, in his 50ies, and many others specialized likewise), whenever “splitter” or “lumper”.

All authors who create new names will find themselves as belonging to somewhere between those 4 extremes. And that positioning is not changed along modern times, between say the 1960ies and today, and even more in recent years “aquarists” have grown to professional standards in their specialization and have been easily offered to co-author publications with “professionals” (along the trendy way of team working).

If an author complies with the ICZN Code from 2000 onwards for a new name, today, then he is free to do what he wants (even financially because there is no cost for the process including for Zoobank registration, just rules to abide, notably today the triptych minimum as types deposition, diagnosis, Zoobank number) whenever (s)he is “splitter” or “lumper”. This means that any author can create new names with limited constraints even if the process is more formal than in the early modern times (say in the 1960ies to 1980ies), either alone or in teams (it does not require to fulfil difficult techniques that may be seen as barriers to entry such as for molecular studies).

Yes, with all 4 types of profiles, “you” can produce new findings, create new names, build incremental research… fine.

Besides, the ”human” concept in (killifish) taxonomy has evolved along time, notably when comparing today and early modern times (1960ies-1980ies) with improvements (less opinion-based sterile discussions, more evidence, less isolated subjective works, more referenced team works) but setbacks (more pseudo-neutral and-or ignoring attitudes, more hidden biases).

In early modern times (1960ies-1980ies), scientific improvements are often accompanied by opinion-based sterile discussions (even quarrels), today seen as bringing little added value and today shown as useless because, for example, molecular data have brought evidence that early modern knowledge has been mostly erroneous in terms of phylogenies (and when correct, it is more a question of luck because that correct result is based on incorrect argumentation). As a result and anecdotally, *Aphyosemion* “schertzi” (a nick name derived from German, meaning joke, created in 1985, of course a nomen nudum), is emblematic of the issues of the end of early modern times because some “humans” thought that so many new species in previous years were already too much… while today they would be scared to death with molecular species-genera and over-split names!

Truly, there is a major quantitative change along time for the “human” concept in taxonomy : this is the huge difference between the total number of species and generic names created say before 1988 (ca. 230 years, 87%) and after (up to today, 30 years, 13%, more than 7 times less long) during a total period of 262 years, respectively 1502 (68%) and 701 (32%)! Intuitively, the first period should be linked in theory with discoveries and explorations, then with relatively more names and the second period, much shorter, should be linked with deepening of knowledge, then with relatively fewer names… if things were to be “equal”… but it is by far the reverse (and the reason obviously is cryptic and molecular naming and also a me-too effect (with no hashtag) for latest generation researchers, first “professionals”, then “amateurs” who do want to create names themselves too !)… unavoidable.

Is this better or worse ? Neither, probably just different !

Yes the present period is not better, not worse, just different and with new major pitfalls : (1) the hurdle for a Ph.D. student or even a post-doc to access to a professional career (not necessarily in the first steps in the killifish arena as his-her dream) and that is a real shame to see them, desperate, not to be able to live their life as they wish to… they need to be over patient, over tenacious in order to satisfy, maybe once in the long run, but not for sure, their needs ; (2) the hurdle for a young scientifically focused aquarist to emerge with the

amateur scientist status even without a formal Ph.D. while the ranks of aquarists have been considerably reduced in quantity during the last 20 years (youngsters are more interested in video games and social networks to spend their spare times) and that is a real shame because fewer collecting trips by young aquarists are set and collecting reports are becoming exceptions rather than routines (sometimes collecting reports are missing because of a lack of legal permits) and this negatively impacts incremental knowledge in killifish.

Three further emblematic present (real, but rare) extreme examples as “non-objective human situations” (with no imposed or permanent solutions) in our present world of extreme (but very short lived) flow of communications : (1) when an author in an aquarist magazine publishes a systematic account-review on a genus or a species or a species-group and presents as a compromise (which he-she believes “good”, aiming at consensus) a balanced picture of various publications and opinions, comparing (with pros and cons) present-recent ones and very old ones (then outdated), (2) when an author in a scientific journal creates new names or formally proposes to up(down)grade older names (in a usually splitting way) impacting validity of names without new diagnoses, while his-her new “evidence” is limited or unstable or using non systematic criteria, (3) when an author in an aquarist or a scientific magazine publishes analyses with truncated references inducing a biased presentation of current systematics (etc.).

Now, YOU reader, as whatever type of taxonomist, as simple aquarist interested in biology or writer in aquarists magazines interested in taxonomy… you are human too! Then where do you think you position yourself between those 4 extremes (outside local tags such as your country, your culture, your network, etc.) and those 3+ today emblematic situations ? Please think of it, it will help YOU a lot to understand and respect “colleagues” (and biological complexity vs. “simple” binominal taxonomy).

Let’s live together in fine mutual respect of diversity, tolerate unavoidable heterogeneities in taxonomy at a certain point (even maybe for very long periods), take a bit more time and distance, and humbly understand our limits (and differences).

Let’s favor latest published evidence as such, even if it looks “less” correct than previous stuff based on opinion-only by so-called experts or on local flag-oriented preferences (the invented-here syndrome).

Hoping that results of the latest published evidence translate into reasonable, acceptable and more stable (but still temporary) sets of names!

Wishful thinking ?… No, just food for thoughts !

VIEW FROM THE CHAIR

Killi-Data Wassup n°9 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 new attempt by Furness et al. [Furness, A.I., J.C. Avise, B.J.A. Pollux, Y. Reynoso & D.N. Reznick. 2021. The Evolution of the Placenta in poeciliid fishes. Current Biology , doi.org/10.1016/j.cub.2021.02.008] to understand the very difficult issue of diversity of placenta origin with matrotrophy-lecithotrophy and superfetation options (and a continuum) by livebearers {as difficult as the annualism origin and its variation in oviparous killifish and again a continuum} ; as already known (mainly by the same team of authors), placental evolution includes maternal provisioning strategies that range from fully provisioning eggs {with nutrients}

before fertilization (lecithotrophy) to extensive matrotrophy, or the post-fertilization maternal provisioning of embryos during gestation, via a follicular placenta (placenta has evolved at least 9 times in Poeciliidae resulting in a matrotrophy index (M.I.) as an artificial criterion and today but there is no consistent family-wide associations between placentation and habitat and there are species with placentation and species without, even within a genus) ; the objective of the present study is to compare present species characteristics for placenta (M.I.) with external morphological or habitat characters ; the authors test 3 adaptive hypotheses for the repeated evolution of placenta in Poeciliidae (resource-availability, locomotor-performance, life-history facilitation), but none supports all the predictions of any one hypothesis ; unexpectedly a single isolated criterion provides with some differentiation, i.e. body morph (either deep or slender) ; hence, there may be 2 phenotypic adaptive peaks, corresponding to 2 selective optima, associated with placentation: one represented by shorter-bodied species that have fast LHT (life history traits), and the second by deeper-bodied species with slow LHT ; in total, placental species tend to have superfetation and reduced reproductive allotment, placental species tend to have either few large offspring or many small offspring (tend! So would note a character playing biological complexity).

Second, the innovative approach by Calixto et al. [Calixto, M.R., A.N. Lira, M.G. Rubio, G.P.P. Leon & C.D.P. Pinacho. 2021. Phylogenetic Relationships and ecological Niche Conservatism in killifish (Profundulidae) in Mesoamerica. J. Fish Biol., doi.org/10.1111/jfb.14727] to tackle taxonomy along combination of molecular data and types of ecological niches (less morphology or osteology) in *Profundulus* and *Tlaloc*, 2 very related genera, with rather but not completely superimposed mosaic distribution areas, from northerly rio Papagayo in Guerrero state, Mexico, to southerly rio Lempa in Honduras ; first the authors work with 271 records (mainly from checked GPS-GBIF data) including 8 valid species {but according to other authors, it may be up to 12}, and records per species are counted from 9 only for *Profundulus kreiseri*, to 73 for *Profundulus punctatus* (*Tlaloc portillorum* is excluded because of the low number, 5, and poor geo-references of available records) ; the authors typify 19 bioclimatic variables (including altitude and slope with several subdivisions) on the one hand and use GenBank available data on the other hand for all species (valid, doubtful or hypothetically un-named or synonymous) ; at least in one case, sister species diverge in their ecological niches in a notable way (*Profundulus oaxacae-Profundulus punctatus*) ; from an ecological perspective, the influence of several bioclimatic variables for these fish is evidenced ; however, similarity of ecological niches between species of both genera are not related to phylogenetic structure of each group ; in other words, although ecological similarities can be found, these do not necessarily occur between sister species ; in conclusion, the authors support the hypothesis that there is no niche conservatism in species of Profundulidae and propose that {past} ecological divergence appears a relevant process for the current diversification of this family of 2 genera.

SELECTION OF PUBLICATIONS (last in, first out)

- Okyere, I., J.A. Obeng, S. Ayitey, J.R. van der Zee, H. Meeus. [Okyere et al. compare brackish (preferred) vs. freshwater and mop color (black) in lab prolificity of *Aplocheilichthys spilauchen* ; a team of European aquarists and African ecologists explore preference in lampeye mangrove Killifish according to freshwater (0.04 ‰) and brackish water (5.01 ‰) to ascertain the captive breeding prospects for mosquito control in areas where they occur ; results show significantly higher number of eggs in brackish water than

freshwater and that black-colored mop {a color artificial substrate for spawning, made of threads of nylon attached to a cork} is the most preferred spawning substrate, followed by green, blue and white colored mops ; with microscopic monitoring of embryos, cleavage occurs within first 30 min after fertilization, organogenesis begins in averagely on 25th hour, and hatching time in approximately 230 h {9.6 days} ; other differences such as relatively bigger eggs and certain embryonic developmental faster stages in freshwater than brackish water are just non-significant trends {in the wild and over a huge range, *Aplocheilichthys spilauchen* occurs both in mangroves with salt water contents and in freshwaters more inland, up to several dozens kms from sea coast}. 2021. J.F.B., https://onlinelibrary.wiley.com/doi/abs/10.1111/jfb.14729] {Jean Huber, 23-March-2021} <°))))>< <°))))>< <°))))><

- Styga, J.M. & D.P. Welsh. [Styga and Welsh show, in *Fundulus* et al. , that preferred spawning habitat, and not max. T.L., significantly influences anal sheath size ; basic sexual morphometrics-characters can be extremely variable and evolve quickly with external constraints ; in female of Fundulidae family, anal sheath, a character thought to facilitate release and proper placement of eggs on spawning substrate (labelled '0' if anal sheath is shorter than 1/10th the size of first Anal fin ray and '1' if longer), is studied in relation to spawning habitat (labelled '0' if spawning typically occurs on branching or fibrous aquatic substrates and '1' if typically on loose media, such as sand, soil or rocks) and to maximum body size (T.L.) (from 60 mm to 200 mm) ; results for 26 *Fundulus* congeners plus 2 related *Lucania* sp. (excluding *Fundulus xenicus* because it is documented as spawning on both aquatic vegetation and loose substrate) indicate that preferred spawning habitat, and not maximum body length, significantly influences anal sheath size (length). 2021. B.J.L.S., https://academic.oup.com/biolinnean/advance-article-abstract/doi/10.1093/biolinnean/blab017/6179101] {Jean Huber, 23-March-2021} <°))))>< <°))))>< <°))))><
- Calixto, M.R., A.N. Lira, M.G. Rubio, G.P.P. Leon & C.D.P. Pinacho. [Calixto et al., within *Profundulus* molecular study, show incongruence between niche and speciation and confirm validity of *oaxacae* ; the family Profundulidae, encompassing today 2 very closely related valid genera, *Profundulus* and *Tlaloc* {in the recent past, *Tlaloc* is considered as a junior synonym} is a group of small-sized fish species distributed between southern Mexico and Honduras, where they are frequently the only fish representatives at higher altitudes in upstream basins where they occur {small and relict, in Central America, on both Atlantic and (dominantly) Pacific slopes of Mexico, Belize, Guatemala, El Salvador, Honduras (mostly, between 900 m and 2300 m altitude, rarely near coast)} ; the authors typify 19 bioclimatic variables (including altitude and slope) and compare them with available taxonomy (including variable number of valid names and yet un-named species) and molecular evidence and they also discuss known distribution for each (with biological explanations, or not, for areas where killifish are missing ; the authors examine whether niche classification may be informative to draw groups geographically and ecologically consistent with any of the different hypotheses of valid species, and the result is that there is no determinant ; from the new molecular tree obtained by GenBank samples, it appears that *Profundulus oaxacae* forms a geographically and ecologically distinct group from *punctatus* and should be considered as a valid species ; reversely, the status of recently described *Profundulus parentiae*, based on molecular markers {then a molecular species} plus a single osteological character, and part of *balsanus* group, is in need of further evidence. 2021. J.F.B., https://onlinelibrary.wiley.com/doi/10.1111/jfb.14727] {Jean Huber, 21-March-2021} <°))))>< <°))))>< <°))))><
- Passos, C., F. Reyes, C. Jalabert, L. Quintana, B. Tassino & A. Silva. [Passos et al. show *Austrolebias reicherti* male increases cortisol levels along drying pools (lab cortisol pushing courtship and bold color) ; this a lab experiment {paper not obtained} ; fish, like all vertebrates {including humans} normally respond to environmental challenges by increasing glucocorticoids (GC) levels, which mediate a reallocation of resources from delayable activities such as reproduction in order to help immediate survival necessities ;

oppositely, on the other hand, along less breeding opportunities, stress is shown to adaptively promote reproduction rather than suppress it, even at expense of well-being ; due to their unique life cycle and particular desiccating habitat, annual killifishes such as *Austrolebias* sp. are ideal models to test the prediction that GCs promote reproduction ; measurements of GCs show that male *Austrolebias reicherti* increase their cortisol levels as the breeding season progresses and environmental conditions deteriorate, following the second option ; besides, increased GCs in male is accompanied by increases in female gonadosomatic and hepatosomatic indexes and a decrease in male hepatosomatic index ; cortisol levels and reproductive effort increase, contrary to expectations to well being state and survival constraints (first option) ; and finally artificial GCs addition as treatment promotes courtship and bold coloration in male {which may be an option for aquarists failing to obtain quantitative eggs at end of life span}. 2021. A.B., https://www.sciencedirect.com/science/article/abs/pii/S0003347221000427] {Jean Huber, 9-March-2021} <°))))>< <°))))>< <°))))><

- Furness, A.I., J.C. Avise, B.J.A. Pollux, Y. Reynoso & D.N. Reznick. [Furness et al. suggest, in Poecillidae, 2 phenotypic adaptive peaks with placentation, fast-life small-bodied species or the reverse ; species in all live-bearing Poeciliidae family have independently evolved placentas numerous times while retaining closely related non-placental sister species, and this complex pattern represent a major challenge for the understanding of past mechanisms even with molecular data ; the authors aggregate a comparative dataset on reproductive mode, life histories and habitat selection for an extensive species sample ; results show no consistent family-wide associations between placentation and habitat, but placental species exhibit significantly reduced reproductive allotment and have a higher likelihood of exhibiting superfetation (the ability to gestate multiple broods at different developmental stages, often as much as 5 broods) ; besides, there is significant interactions between body size and placentation for offspring size and fecundity and, compared to non-placental species, placental species show higher fecundity and smaller offspring size in small-bodied species and lower fecundity and larger offspring size in large-bodied species. 2021. C.B., https://www.sciencedirect.com/science/article/pii/S0960982221002153] {Jean Huber, 6-March-2021} <°))))>< <°))))>< <°))))><
- Golden, K.B., M.C. Belk & J.B. Johnson. [Golden et al. discard, in 20 different populations of *Alfaro cultratus* either with predators or not, any correlation with LHT data ; the authors test the idea of predation linked to significant effect on life history diversification in Costa Rican livebearing fish *Alfaro cultratus* ; specimens in this species (and related congener *huberi*) have a narrow transverse body and keeled ventral surface, and female does not develop a distended abdomen when pregnant like other livebearing fishes (notably in genera *Poecilia* and *Gambusia*) ; in 20 different populations with both high-predation and low-predation environments, significantly lower reproductive allotment in female from high-predation environments than in female from low-predation environments are obviously confirmed, but no significant difference in female or male size at maturity, number of offspring produced by female, or size of offspring ; besides, female shows isometric patterns of allocation for clutch dry mass in both high-predation and low-predation environments ; then body shape constraints in *Alfaro* is thought to limit the life history divergence typically seen between populations from high-predation and low-predation environments in other livebearing species {note : results of this new study are antagonist to previous papers in *Brachyrhaphis*, a related genus, also in tribe Hetrandriini, that find a rationale between LHT data divergence and presence vs. absence of predators, e.g. since Johnson [Johnson, J.B. 2001. Adaptive Life-History Evolution in the livebearing fish *Brachyrhaphis rhabdophora*: genetic Basis for parallel Divergence in Age and Size at Maturity and a Test of Predator-induced Plasticity. Evolution, 55 (7): 1486-1491, and, Johnson, J.B. & M.C. Belk. 2001. Predation Environment predicts divergent Life-History Phenotypes among Populations of the livebearing fish *Brachyrhaphis rhabdophora*. Oecologia (Berlin), 126 (1): 142-149], not to speak of controversial studies on "tit-for-tat" concept behavior of guppies (*Poecilia reticulata*) in front

of predators}. 2021. F.E.E., https://www.frontiersin.org/articles/10.3389/fevo.2021.607802/full] {Jean Huber, 6-March-2021} <°))))>< <°))))>< <°))))><

- Domínguez, O.C., T.M.C. Muñoz, S. Valdesalici, S.C. Valdez & C. Passos. [Dominguez et al. detail live pattern of *Millerichthys robustus* in distant localitiess, 5 phenotypes in male and 1-15 ocelli in female ; owing to researches by the present team, knowledge of unique annual and relict southeastern Mexican oviparous killifish, *Millerichthys robustus*, has dramatically increased in recent years {from an atypical *Rivulus* morpho-species known only from preserved specimens of type locality, with its molecular phylogenetic position still missing} ; the authors present new phenotypic color variations along its now wider but still limited known range ; 5 usually co-occurring color phenotypes in male are continuously distributed in various perceptual units between 2 extreme colors (yellow or red) within 4 collecting localities : yellow, moderate orange, dark orange, strong orange and red (only orange phenotypes are present in all 4 localities studied) ; frequency of those phenotypes on a geographical scale, in 4 localities that represent opposite points of total distribution in the Mexican ; besides, female color variation is observed in the number of ocelli (from 1 to 15) at base of caudal peduncle and dorsal region ; such ocelli have been linked in fish {including, but not proven, in speciose Killifish genus *Rivulus*}, with anti-predator functions because they resemble the eyes of vertebrates, thus shifting the target of predator attacks to less vital body parts ; female with 3 ocelli is the most frequent phenotype, and female with 13–15 ocelli occurs only in northern populations ; the authors believe that those variations are not randomly distributed along distribution, which suggest then that color phenotypes may react differently to biotic and abiotic factors. 2021. E.B.F., https://link.springer.com/article/10.1007/s10641-021-01076-w] {Jean Huber, 2-March-2021} <°))))>< <°))))>< <°))))><
- Domínguez, O.C., T.M.C. Muñoz, S. Valdesalici, S.C. Valdez & C. Passos. [Dominguez et al. show *Millerichthys robustus* male prefers larger body size female with high number of ocelli (5-7) on peduncle ; a typical lab behavioral experiment with unexpected results ; usually (in classic theory of sexual roles, female is more careful in her choice of a mate because the reproductive investment is relatively higher {at least in oviparous sp. like for *Millerichthys* uniquely annual species in Mexico) ; the authors herein study the possible mate choice and if based on physical characteristics, such as body size and color ornaments, notably according to variations in ocelli number {small dark grey blotches} transversally at base of Caudal fin, or according to body size, in classical dual decision experiments ; results favor a strong preference of male for female with greater numbers of ocelli on the base of the caudal fin (females with 5-7 versus 1-2 ocelli) and with larger body size ; besides, large female with more ocelli produces more and larger eggs than large female with fewer ocelli, and than small female regardless of number of ocelli ; this preferred attraction is probably linked to better outcomes for species survival, as an immediate hypothesis, but the authors go further by hypothesizing that large body size and high number of ocelli in female has evolved through male mate choice. 2021. E.E.E., https://www.tandfonline.com/doi/abs/10.1080/03949370.2021.1883121] {Jean Huber, 27-February-2021} <°))))>< <°))))>< <°))))><
- Bragança, P.H.N. & F.P. Ottoni. [Bragança and Ottoni confirm ICZN unavailability of *Poecilia kempkesi* named by Poeser (2013), based on articles 13 (diagnosis) and 16…The poeciliid species, *Poecilia kempkesi* Poeser, 2013, is the 4th species of the subgenus *Acanthophacelus* Eigenmann, 1907 to be described, based on individuals from a single urban anthropized locality close to Paramaribo, Suriname (Poeser, 2013). The description itself lacked any section clearly distinguishing the new species from the remaining species of *Poecilia* Bloch & Schneider 1801, and in particular from the species of the subgenus *Acanthophacelus*, type species *Poecilia reticulata* Peters, 1859. According to Article 13 of the International Code of Zoological Nomenclature (ICZN, 1999) the criteria of availability for that species-group name are not met. Besides Article 16.4 of the ICZN is not clearly fulfilled concerning types designation. Hence the name is proposed to be considered as ICZN-wise not-available {note : results are identical to recent previous reference, Huber,

J.H. 2019. A nomenclatural and systematic Analysis of livebearing Cyprinodontiformes (Acanthopterygii: Anablepsinae, Goodeinae, Poeciliidae). Killi-Data Series 2019 , 4-155, 3 tabs., 8 figs., hence if distinct, the species should be renamed properly as new while fulfilling at least minimal ICZN requirements}. 2021. Zootaxa, https://www.biotaxa.org/Zootaxa/article/view/zootaxa.4927.2.10] {Jean Huber, 15-February-2021} <°))))>< <°))))>< <°))))><

- Guedes G.H.S., Salgado F.L.K., Uehara W., Pavia D.L.F. de, Araujo F.G. [Guedes et al. collect *Leptopanchax opalescens* (last collection, in 2012) with LHT data (rare, less than 1 fish per square m, 3 females to 1 male) ; the new collection occurs in temporary open vegetation pools (22°42.35'S, 43°41.59'W) in the hydrographic basin of the Guandu River, state of Rio de Janeiro, Brazil, after 8 years without records {but not far from other historical records} ; size, sex ratio and length-weight relationship (LWR) are given ; specimens were collected during rainy season (January-April 2020) in shallow pools (mean depth = 21 cm), with relatively acidic pH (5.2) and low concentrations of dissolved oxygen (3.5 mg/l) ; fish density is low at 0.89 specimen per square meter ; total length (TL) of male ranges from 21.1 to 28.8 mm {not as cm in abstract}, and female somewhat smaller with a dis-equilibrated sex-ratio (2.83 Female: 1Male) ; *Leptopanchax opalescens* is a critically endangered species {in a strongly human-developed region}. 2021. Zool., https://zoologia.pensoft.net/article/54982/download/pdf/482787] {Jean Huber, 21-January-2021} <°))))>< <°))))>< <°))))><
- Nagy, B. [Nagy describes *Nothobranchius elucens* in subgenus *Zononothobranchius* from Nile basin, related to *taiti*, both from northern Uganda ; the new species, from a seasonal habitat in the Aringa system belongs to *rubroreticulatus* species group and is separated by male coloration of Anal and Caudal fins with electric blue subdistal band (hence the name) and slender dark distal band ; the species is already known as sp. 'Madi Opei' in aquarium circles ; it is distinct by molecular data and is known from a single locality (with attached risks, until further collections, hopefully) ; *taiti* and eluscens type localities are separated by ca. 208 km. 2021. Zootaxa, https://www.mapress.com/j/zt/article/view/zootaxa.4915.1.10] {Jean Huber, 20-January-2021} <°))))>< <°))))>< <°))))><
- Pezold, F., Ford, K. & Schmidt, R.C. [Petzold et al. describe orange body red-spotted *Epiplatys*, as *cashneri*, 2009 collected by Oleg Mediannikov, from southern Liberia ; this is a surprising addition to the already speciose fauna of genus *Epiplatys* in that region (including neighboring Côte d'Ivoire {Ivory Coast} ; the species is easily separated by an orange body background with red spots and reddish orange median fins with dark red spots and dark red submargins in male ; there are no longitudinal dark bands or broad dark crossbars on sides like most species in *fasciolatus-olbrechtsi* group where it belongs (molecularly) ; it is already known in aquarium exchanges as *Epiplatys* sp. 'Orange Liberia, based on a strain developed by Christian Cauvet ; ecological details are provided and surprisingly *Epiplatys olbrechtsi olbrechtsi* is often sympatric (also *Scriptaphyosemion schmitti*) {nomenclatural note: ICZN-wise the description is dated 2021, not 2020, like published}. 2021. Aqua, https://aqua-aquapress.com/epiplatys-*cashneri*-a-new-species-of-killifish-cyprinodontiformes-nothobranchiidae-from-liberia-west-africa/] {Jean Huber, 19-January-2021} <°))))>< <°))))>< <°))))><
- Teimori, A. & M. Motamedi. [Teimori and Motamedi present *Aphanius farsicus* full Mt-genome, Aphaniidae unstable vs. 7 families, paraphyletic vs. Cyprinodontidae ; recent molecular studies have shown that family Cyprinodontidae is polyphyletic in terms of the phylogeny {by the same team of authors} ; to molecularly evaluate the phylogenetic validity of the new family Aphaniidae {recently upgraded from Cyprinodontidae}, data (complete mitochondrial genome genes) of 5 other families of Cyprinodontiformes (*Kryptolebias marmoratus*, *hermaphroditus*, *Aplocheilus panchax*, *Poecilia sphenops*, *Fundulus sciadicus*, *Xenotoca eiseni* {as *Xenoophorus* in Killi-Data}) and 2 species of Beloniformes related family as outgroup, are excerpted from GenBank and added to complete mitochondrial genome of *Aphanius farsicus*, as single representative of family Aphaniidae ; results indicate a close relationship between the genera *Aphanius* (Aphaniidae) and *Cyprinodon* (Cyprinodontidae) so that the group

containing those 2 families appears as paraphyletic ; therefore, according to the authors, by considering the phylogenetic position of genus *Aphanius* in present tree, the validation {= upgrading} of family Aphaniidae seems unstable and premature, would require further studies and still needs more phylogenetic supports {possibly by adding nuclear sequences and more species-groups in the sampled tree}. 2021. JAPB, https://japb.guilan.ac.ir/article_4521.html] {Jean Huber, 16-January-2021} <°))))>< <°))))>< <°))))><

- Bragança, P.H.N., J.R. van der Zee, A. Chakona, R.C. Schmidt & M.L.J. Stiassny. [Bragança et al. molecularly show major heterogeneity along huge distribution of monotypic *Aplocheilichthys spilauchen* with 6-7 ESU {Evolutionary Systematic Units = OTU, Operational Taxonomic Units, as by the present authors} ; *Aplocheilichthys spilauchen*, a present monotypic species, is one of the few brackish water lampeye species and is a dominant species in mangrove habitats {including nearby freshwaters} along tropical and subtropical zones of Atlantic coast over a huge range in Western Africa ; it is known by many populations from Sénégal to Angola ; the authors molecularly study (with several mitochondrial sequences) ca. 10 populations from the whole range and unexpectedly disclose most of them are molecularly distinctive and since absolute pairwise genetic distances are ranging between 8 and 22% {broad differences} they propose possibly cryptic species, some to be described {there are already 3 names, currently considered as junior synonyms, that might be revalidated, *typus* from Guinée, *bensonii* from Liberia, *tschiloangensis* from Angola, while *spilauchen* is from northern Gabon ; if molecular branches are coupled with known historical distribution of coastal mangroves and historical sea currents and events (e.g., major climate shifts and sea-level fluctuations, onset of the modern Congo River outlet, increased volcanism in Cameroun Volcanic Line) in Western Africa since mid-Miocene {to explain dispersion}, then the authors disclose at least 6-7 ESU, or molecular species, that are to be separated by diagnoses {in a subsequent work}. 2021. Hyd, https://link.springer.com/content/pdf/10.1007/s10750-020-04497-3.pdf] {Jean Huber, 6-January-2021} <°))))>< <°))))>< <°))))><
- Mustikasari, D., S. Suryaningsih & A. Nuryanto. [Mustikasari et al. compare morphology of *Aplocheilus panchax* at ex-tin mining pits vs. standard river, in small Bangka island, Indonesia ; the Blue *panchax* {as a single sp. named *panchax* or as a series of distinct molecular sp., according to authors} lives in broad ranges of habitat from open waters to closed waters, including atypical locations, as ex-tin mining pits, in Bangka Island, Indonesia ; tin pits are clustered into 6 different ages from 11 localities, i.e., Station A and Station B (< 5 years old), Station C and Station D (5-15 years), Station E and Station F (15 - 25 years), Station G (25 - 50 years), Station H (50 - 100 years) Station I and Station J (> 100 years), and Limbung River Stream of Bangka Regency as Station K (standard river habitat, no tin pit) ; surprisingly the authors evidence that very close but distinctive (e.g. tin human polluted) habitats might cause morphological variations over a limited course of time and this means that speciation rate or at least morphological variation can be achieved in a short time with killifish due to different ecological factors : results show that almost all of body parts found in ex-tin mining pits and rivers are significantly different (p-value < 0.05), except some truss characters of caudal peduncle. 2020. JBBE, https://journal.unnes.ac.id/nju/index.php/biosaintifika/article/view/26593] {Jean Huber, 31-December-2020} <°))))>< <°))))>< <°))))><
- Piller, K.R., D.D. Bloom, J. Lyons & N.S. Mercado. [Piller et al. molecularly evidence only 2 species in viviparous *Chapalichthys*, *encaustus* and *pardalis* (*peraticus*, synonym of latter) ; genus *Chapalichthys* consists of 3 allopatrically distributed species occurring on Mesa Central, Mexico ; the objectives of this study are two-fold: (1) to assess the phylogenetic relationships among multiple populations and all 3 species of *Chapalichthys* using 1,047 bp of mtDNA (ND2) sequence data, (2) in light of the phylogenetic results, to re-examine the taxonomic status of *peraticus* using meristic and pigmentation characters ; molecular phylogeny indicates 2 clades, each consisting of a valid species, one with multiple populations of *encaustus*, the other with multiple individuals of *pardalis* and *peraticus* (both with nearly identical

mitochondrial sequences for ND2) ; morphologically, meristic counts of all characters examined show overlap for all 3 species and provide no species-specific diagnostic information ; *encaustus* is easily separated from both *pardalis* and *peraticus* by vertical bars along sides (vs. a spotted pattern) ; however, *pardalis* and *peraticus* cannot be differentiated from one another based on pigmentation or meristics ; then herein, only 2 valid species of *Chapalichthys*, *encaustus* and *pardalis*, are recognized {notes : the type locality of *peraticus*, near Cotija, is only about 15 km northwest Tocumbo, of type locality of *pardalis* ; the systematic status of *pardalis* is seen unstable until the present work and variable according to authors, the 3 options for the 3 named congeners, i.e. 1, 2 or 3 distinct species, being discussed, today taxonomy is clear ; *pardalis* and *peraticus* are descriptions by same author in same article, only separated by a few pages}. 2020. Copeia, https://bioone.org/journals/copeia/volume-108/issue-4/CI2020044/Systematics-and-Taxonomy-of-*Chapalichthys*-Cyprinodontiformes--Goodeidae-a-Small/10.1643/CI2020044.short] {Jean Huber, 30-December-2020} <°))))>< <°))))>< <°))))><

- Teimori, A. & H.R. Esmaeili. [Teimori and Esmaeili benchmark epural plate of 18 sp. in *Aphanius+Aphaniops+Paraphanius*, with new diagnostic character for *Aphaniops* ; axial skeleton morphology of 18 species in Aphaniidae is disclosed by X-ray radiography ; number of total vertebrae in genus *Aphanius* varies from 26 to 29, in genus *Aphaniops*, from 24 to 28, and in genus *Paraphanius* (*mento*), from 26 to 27 ; vertebral column in *Aphanius* is often slightly curved, from almost straight (most common) to slightly or strongly curved and straight in 2 other species ; caudal skeleton of Aphaniidae is characterized by a single and completely fused hypural plate, and a total number of 9-12 branched segmented soft rays, a single and elongate epural bone ; the authors propose a new diagnostic character between *Aphanius* plus *Paraphanius mento* (a straight epural bone in caudal skeleton) and *Aphaniops* (often sinuous-like and thick) ; family Aphaniidae is closer to Cyprinodontidae (*Cualac tessellatus*), Valenciidae (*Valencia letourneuxi*) and Fundulidae (*Fundulus sciadicus*) than other Cyprinodontiformes in caudal skeleton (in agreement with multigene phylogeny of the order). 2020. A.Z., https://onlinelibrary.wiley.com/doi/abs/10.1111/azo.12370] {Jean Huber, 29-December-2020} <°))))>< <°))))>< <°))))><
- Bragança, P.H.N., E.C. Guimarães, P.S. Brito & F.P. Ottoni. [The Ottoni team evidences *Poecilia reticulata* natural distribution limited to west of Guiana (absent in Brasil, Guyane, Suriname) ; the invasive occurrence of the guppy, one of the most widely introduced freshwater fish species due to aquaria release and mosquito control, is well documented ; the authors study its natural distribution range based on extensive field surveys carried out in the Brazilian Amazon in the past 10 years, information present in literature, online databases and museum records and as a result it is considered to be naturally absent from the Amapa and Para territories in northern Brazil, and from Guyane and Suriname {however, the molecular species, *kempkesi*, from Suriname, is not studied, either valid or as a junior synonym, planted or not}. 2020. Cybium, http://sfi-cybium.fr/fr/natural-occurrence-poecilia-*reticulata*-peters-1859-cyprinodontiformes-poeciliidae] {Jean Huber, 16-December-2020} <°))))>< <°))))>< <°))))><
- Shumka S., Kalogianni E., Sanda R., Vukic J., Shumka L., Zimmerman B. [Shumka et al. disclose a new spring-fed stream population of *Valencia letourneuxi*, highly endangered in Albania, due to alien species ; threats on killifish are native fish, but also a planted species {not a planted viviparous killifish as usual}; the new collection, a spring-fed stream, is very close well known Albanian population, in Lake Butrinti {just in front of Corfu island, with in-between a small sea channel {it is a very low population density with only 11 individuals collected and it is not known if it is native there or moved from main Butrinti population}. 2020. KMAE, https://www.kmae-journal.org/articles/kmae/pdf/2020/01/kmae200099.pdf] {Jean Huber, 1-December-2020} <°))))>< <°))))>< <°))))><
- Byrne, M.S., P.M. Bianco, L.B. Campos, N.A. Ossana, L. Ferrari L. & J.I. Tunez. [Byrne et al show lack of genetic structure between sub-basins of Buenos Aires region in *Cnesterodon decemmaculatus* (bioindicator); analysis of a 700-bp fragment of mitochondrial DNA control region shows moderate to

high levels of genetic diversity and lack of genetic structure between northeastern basins of that ecoregion of Argentina, validating a possible future bioindicator project. 2020. MFR, https://www.publish.csiro.au/mf/MF20157] {Jean Huber, 1-December-2020} <°))))>< <°))))>< <°))))><

- Fernandes, M.O., Barbosa, C., Garcez, D.K., Junior, A.S.V., Volcan, M.V. & Robe, L.J. [The Robe team molecularly discloses 4 clusters in *Austrolebias charrua* sp. group (incl. *minuano*, *pongondo*), with putative synonymy {or future further splitting} ; the authors disclose with combined nuclear and mitochondrial markers 4 lineages, 1 isolated with *pongondo*, 2 independent with 1 lumping specimens of *charrua* (a population previously assigned to *minuano*) and type locality *minuano*, 1 separate with *charrua* (with several populations more southerly) ; the authors suggest there maybe doubts about distinction *minuano* from senior *charrua*, pending further studies with more sequences ; those divergences seem to have arisen before the Pleistocene Lagoon-Barrier Depositional System. 2020. E.B.F., https://link.springer.com/article/10.1007/s10641-020-01045-9] {Jean Huber, 26-November-2020} <°))))>< <°))))>< <°))))><
- Vermeulen, F.B.M. [Vermeulen describes a new species, *Rivulus mejiai*, first congener in Colombia of *hartii* group, in Eastern Cordillera Andes foothills ; the new species is only known from 2 nearby localities, in a small mountain creek ; type locality is a steep, cascading stream with crystal-clear water and strewn with boulders ; the author refers the species to the *hartii* species group, known as subgenus *Oditichthys* (*amphoreus*, *cajariensis*, *fransvermeuleni*, *hartii*, *holmiae*, *igneus*, *immaculatus* and *waimacui*) and most species have a large size between 60 and 150 mm (T.L.), a high number of scales in lateral series (39-47), a high number of Dorsal rays (8.5-10.1), Anal rays (15-20), and Ventral rays (7) and are excellent swimmers ; it is diagnosed from congeners by a series of interrupted horizontal red lines on its purple-blue sides (7 or 8 of these are visible just posterior to the operculum but they gradually merge into only 3 pronounced lines on the caudal peduncle), like many species in {probably artificial} *limoncochae* group {for which molecular data are eagerly awaited, like for the new species in order if, whatever its geographical position at foothills of Andes, it is genetically closer to *hartii* or to *limoncochae* species group}. 2020. K-D S, http://www.killi-data.org/series-kd-2020-Vermeulen.php] {Jean Huber, 15-November-2020} <°))))>< <°))))>< <°))))><
- Vermeulen, F.B.M. & D.A.V. Mejia. [Vermeulen and Mejia describe 2 new sympatric species, *Rivulus carolinae* with unique fin and *Rivulus flammaecauda*, striped and flamed ; the 2 new species are known from a single locality in a stream near village La Guadalupe, itself less than 2 km away from type locality and single locality of new *foliiscola* ; *carolinae* is diagnosed from all congeners by combining a relatively small size, unique male color pattern and a characteristic Caudal fin shape, and with a unique color pattern in female and *flammaecauda* is diagnosed by its robust size, by a unique lineated and reticulated pigmentation pattern on sides and a flamed pattern on Caudal fin in male {the twin new species are more traditional in their discovery, since pairs of species are routinely found in that huge ecoregion including upper and mid Amazon, rio Negro and north in rio Orinoco, one related to *rectocaudatus*, the other to *romeri* group}. 2020. K-D S, http://www.killi-data.org/series-kd-2020-Vermeulen_Mejia2.php] {Jean Huber, 15-November-2020} <°))))>< <°))))>< <°))))><
- Vermeulen, F.B.M. & D.A.V. Mejia. [Vermeulen and Mejia describe a Colombian new species, *Rivulus foliiscola*, with unique pattern, morph and snake-like behavior ; this is a unique species, tentatively placed in *Owiyeye* group, notably the medium-large species, such as *rectocaudatus* {the fact that another new species, *flammaecauda*, closely related to *rectocaudatus*, is reported about 2 km away from its type locality, pushes to caution} ; uniqueness is based on morphology (notably Caudal fin shape), pattern, behavior (non annual, snake-like) and ecology (bottom dweller) {a probably future star among aquarists, if not too difficult to breed}. 2020. K-D S, http://www.killi-data.org/series-kd-2020-Vermeulen_Mejia1.php] {Jean Huber, 15-November-2020} <°))))>< <°))))>< <°))))><

- Huber, J.H. [Huber describes a since long known lampeye species from Angola, *Lacustricola bragancai*, based on misidentification (unknown live) ; the new species is described following a misidentification by famous Belgian ichthyologist Max Poll (1908 - 1991), identified as *myaposae* while that species is originally described from coastal fringes of East Africa ; it is diagnosed on preserved specimens from putatively related components of the same species-group, by absence of a mid-longitudinal dark band on sides of female and by a slightly lower D/A deviation {) ; note : the systematic positioning as a '*Lacustricola*' sp. follows Bragança et al. (2020) with a future assignment to a new genus or subgenus being expected soon along a comprehensive molecular revision of African lampeyes}. 2020. K-D S, http://www.killi-data.org/series-kd-2020-Huber] {Jean Huber, 15-November-2020} <°))))>< <°))))>< <°))))><
- Furness, A.I., A. Hagmayer & B.J.A. Pollux. [Furness et al. show correlation between male morph, coloration and gonopodium size with type of sexual behavior in *Poecilia gillii* ; mature males of commonly named shortfin molly {*Mollienesia* subgenus} display extensive variation in size and morphology {like subcongeners *mexicana* and *sphenops*, etc.} without discrete size classes structuring (instead in a size and morphological continuum) ; large male has darker and more orange-colored Dorsal and Caudal fins, plus proportionately deeper bodies, larger Dorsal and Caudal fins and shorter gonopodium than smaller male, whereas small male has lighter and more inconspicuous fin coloration ; study shows similar levels of mating attempts (gonopodial thrusts) whatever male size, but small males are significantly more likely to chase females than large males (while large males exhibit higher rates of gonopodial nibbling as a probable way for male to test if female is carrying fertilizable ova and, not surprisingly, a higher probability of chasing other males away. 2020. B.J.L.S., https://academic.oup.com/biolinnean/advance-article/doi/10.1093/biolinnean/blaa151/5958110] {Jean Huber, 13-November-2020} <°))))>< <°))))>< <°))))><

Bragança, P.H.N., J.R. van der Zee, R. Sonnenberg & E.J.W.M.N. Vreven. [Bragança et al. describe 2 new cryptic sp. from northeastern Gabon, *Hylopanchax multisquamatus* and *thysi*, with redefinition of genus ; both species are from Ivindo River basin, but one species is not newly known (*multisquamatus*) since it has been since long misidentified as *silvestris* (after Lambert & Géry, 1968) or *stictopleuron* ; both new species, allopatric in same drainage and closely related, are diagnosed from congeners by pattern on papilla and sides (reticulate) and from one another by morphometrics ; osteological data of genus *Hylopanchax* are presented for the first time and an updated diagnosis is provided based on external morphology, coloration pattern, and osteology (a truncate and slightly downwards directed anterior process of angulo-articular and a guitar-shaped lachrymal with both its anterior and posterior margins sharply curved) {note : 2 other species, *zebra* and *catenatus*, are temporarily moved from *Hypsopanchax* to '*Hypsopanchax*' un-named and related genus up until expected global review of lampeyes by Bragança}. 2020. JFB, https://onlinelibrary.wiley.com/doi/10.1111/jfb.14606] {Jean Huber, 31-October-2020} <°))))>< <°))))>< <°))))><

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Killi-Data Wassup is a service of information to members that does not aim to be comprehensive of whole Killifish research output (it presents only a subjective selection of articles, primarily those being coherent with Killi-Data focus on names, systematics and nomenclature), that is not regular, that separates clearly, the “selection of publications” (listed as last-in first-out) with (1) a full neutral synthesis for each major publication, (2) a quick snapshot of contents for other publications, (3) the results of new collecting trips (if

any reported to editor), AND, within a paragraph titled “View from the chair”, personal, but impartial and balanced comments raised from some of those 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.

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