Data Collection on Intergeneric Hybrids and Basic Types: „PISCES“

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https://www.wort-und-wissen.org/artikel/data-collection-basic-types/

„PISCES“

3 classes, 88 orders, 554 families, 32000 species

Systematics according to en.wikipedia 2025 and FishBase: Froese R & Pauly D (Editors) FishBase. World Wide Web electronic publication. www.fishbase.org

Class Chondrichthyes 13 orders, 49 families, 1100 species.
Class Cyclostomata (Agnatha) 1 order Petromyzontiformes, 3 families, 110 species.
Class Osteichthyes
subclass Sarcopterygii 3 orders, 4 families, 8 species. [Coelacanthiformes, 1 family; Ceratodontiformes 1 family; Lepidosireniformes 2 families]
subclass Actinopterygii, 71 orders, 498 families, 28.000 species.

Abbreviations:
° = taxa actually not accepted in the rank of a genus (synonym), e.g. *Platessa*° = *Pleuronectes*
10: 50 etc. The numbers behind the names of families etc. refer to extant genera and species
IS = interspecific hybrid. **IG** = intergeneric hybrid. **IST** = intersubtribal hybrid.
IT = intertribal hybrid. **ISF** = intersubfamilial hybrid. **IF** = interfamilial hybrid.
ISO = intersubordinal hybrid.
AS = asymmetric hybrids, they do not equally express maternal and paternal features
HY = assumed intergeneric hybridogeneous origin of a taxon
nat. hyb. = natural hybrid **art. hyb.** = artificial hybrid

Colors within the crosses:
Red letters: intergeneric hybrids (incl. former IG).
Gray letters: hybridity unconfirmed or erroneous.
Green letters: notes on tribes, subfamilies etc. involved in the hybridization.

Yellow shaded: Notes concerning basic types.

Preface: how reliable are the cited hybrids?

In this paper some 500 intergeneric hybrids are listed. It is not possible to give a correct evaluation for all these crosses. Therefore, they all must be treated with caution. This is especially true for the old data given by Schwartz 1972 and 1981, who thoroughly listed the literature of all hybrids known to him at that time, but did not give an evaluation!

In fishes, there exist some specific problems in the interpretation of hybrid reports: 1. The presumed hybrid could be in reality of gynogenetic origin, i.e. the chromosomes are only maternal though the hybridization was successful. 2. The “hybrid” could be partial, i.e. only a

very small part of the genetic material of the male parent has been transferred (= asymmetric hybrid). 3. The embryogenesis could have started but did not pass beyond the maternal stage.

Obviously questionable and unconfirmed hybrid combinations are written in gray letters, but certainly some more are unconfirmed. Erroneous reports are also written in gray letters and in addition crossed out.

Summary:

Intergeneric hybrids (nothogenera) **in total 472** (including **17 IT + 31 ISF + 79 IF + 11 ISO**). 270 intergeneric hybrids alone within Cypriniformes.
For interordinal „hybrids" (**IO**), which normally do not develop beyond the maternal stage of embryogenesis see the appendix at the end of this file.

14 preliminary basic types:
9 families, 5 >1 family.
Species pro basic type ranging from 7 to 3900; average (8803: 14) = 629 species.

Acestrorhamphidae (Characiformes) 54: 685. **1 IG + 2 ISF**

Acipenseriformes families Acipenseridae + Polyodontidae 6: 29. **1 IG + 1 IF**

Carangiformes families Pleuronectidae + Paralichthyidae 25: 166. **9 IG + 2 ISF + 1 IF**

Centrarchidae (Centrarchiformes) 7: 34. **6 IG + 8 ISF**

Cichlidae (Cichliformes) 200: 1500. **20 IG + 2 ISF**

Cypriniformes suborders Cyprinoidei + Cobitoidei (all 21 families) 925: 3900. **202 IG + 62 IF + 6 ISO**

Cyprinodontiformes (all 14 families) 150: 1500. **28 IG + 16 IT + 10 IF + 5 ISO**

Epinephelidae (Perciformes) 9: 169. **3 IG**

Ictaluridae (Siluriformes) 7: 50. (possibly part of a larger basic type). **3 IG**

Lepisosteidae (Lepisosteiformes) 2: 7. **1 IG**

Percidae (Perciformes) 10: 200. **3 IG + 5 ISF**

Salmonidae (Salmoniformes) 10: 190. **7 IG + 4 ISF**

Sparidae (Acanthuriformes) 38: 155. **5 IG**

Siluriformes families Clariidae, Claroteidae, Heteropneustidae, Pangasiidae 32: 218 (probably part of a larger basic type). **1 IG + 3 IF**

General references:

Ackermann K (1898) Thierbastarde. Zusammenstellung der bisherigen Beobachtungen über Bastardierung im Thierreiche nebst Litteraturnachweisen. Die Wirbelthiere. Fische. Abhandl. u. Ber. Ver. Naturk. Kassel 43, 4–11. = ref. 2 of Schwartz 1972.

Bartley DM, Rana K & Immink AJ (1997) The use of inter-species hybrids in aquaculture and their reporting to FAO. http://www.fao.org/DOCREP/005/W7611E/W7611e7.htm

Chen J et al. (2018) A comparative study of distant hybridization in plants and animals. Sci. China Life Sci. 61, 285–309. doi: 10.1007/s11427-017-9094-2. Epub 2017 Aug 28. https://www.ncbi.nlm.nih.gov/pubmed/28861869 still to be analyzed

Donaldson EM (1977) Bibliography of fish reproduction 1963–1974. Part 1. - General, non-teleostean species and Teleostei, *Abramis* to *Clinostomus*. Part 2 - Teleostei, *Clupea* to *Ompok*. Part 3 - Teleostei, *Oncorhynchus* to *Zygonectes* and Addendum. Fisheries & Marine Service Technical Report (Canada) No. 732. http://www.dfo-mpo.gc.ca/Library/18310.pdf (= part 1)

FAO (1971) Seminar/Study Tour in the U.S.S.R. on Genetic Selection and Hybridization of Cultivated Fishes. 19 April – 29 May 1968. Lectures. Rep. FAO/UNDP(TA), (2926): 360 p. Rome: Food and Agriculture Organization of the United Nations. http://www.fao.org/docrep/005/B3310E/B3310E00.htm#TOC

FishBase: Froese R & Pauly D (Editors) FishBase. World Wide Web electronic publication. www.fishbase.org

Eschmeyer: Eschmeyer's Catalog of Fishes (ECoF). https://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

Hubbs C (1971a) Teleost hybridization studies. Proceedings California Academy of Science 38, 289–297 (1970). http://ia902609.us.archive.org/29/items/proceedingsofcal0438cali/proceedingsofcal0438cali.pdf

Hubbs CL (1955) Hybridization between fish species in nature. Syst. Zool. 4, 1–20. http://sysbio.oxfordjournals.org/content/4/1/1.extract = ref. 696 of Schwartz 1972, ref. 765 of Schwartz 1981

Schwartz FJ (1972) World literature to fish hybrids with an analysis by family, species, and hybrids. Gulf Coast Research Laboratory. 328 p. https://books.google.de/books/about/World_literature_to_fish_hybrids.html?id=Av46AQAAIAAJ&redir_esc=y 1945 references! But please note that Schwartz only cites publications and does not evaluate them!

Schwartz FJ (1981) World literature to fish hybrids with an analysis by family, species, and hybrids: Supplement 1. Seattle, Wash.: U. S. Department of Commerce: NOAA. National Marine Fisheries Service NOAA Tech. Rep. NMFS SSRF-750. 507 p. http://archive.org/stream/noaatechnical19811982unit/noaatechnical19811982unit_d

jvu.txt 1814 references! But please note that Schwartz cites publications and does not evaluate them!
Scribner KT, Page KS & Bartron ML (2001) Hybridization in freshwater fishes: a review of case studies and cytonuclear methods of biological inference. Rev. Fish Biology and Fisheries 10, 293–323. http://www.springerlink.com/content/ju8743n375875p03/ mainly interspecific
Slastenenko P (1957) A list of natural fish hybrids of the world. Publ. Hydrobiol. Res. Inst. Univ. Istanbul 4 (2–3), 76–97. 212 hybrids
Yakovlev VN, Slyn'ko YV, Grechanov IG & Krysanov EY (2000) Distant hybridization in fish. J. Ichthyol. 40, 298–311.

Acanthuriformes 30 families

formerly part of order Perciformes
30 families:
Lutjanidae, Moronidae, Pomacanthidae, Sparidae, …

Acanthuriformes: Lutjanidae 18: 110. 1 IG

snappers = Schnapper
4 subfamilies
Lutjaninae 6: 76 *Lutjanus 73, Ocyurus 1* (since 2019 often included in *Lutjanus*), …

Lutjanus × *Ocyurus chrysurus* Lutjaninae Domeier 1992 (art. hyb.), Loftus 1992 (nat. hyb., *L. ambiguus* is of hybridogeneous origin *Lutjanus synagris* × *O. chrysurus* **HY**) (*Ocyurus chrysurus* is nested within species of the polyphyletic *Lutjanus* according to Frédérich & Santini 2017, 22. https://doi.org/10.26496/bjz.2017.2)

Acanthuriformes: Moronidae 2: 6 + extinct genera. 1 IG

temperate basses = Wolfsbarsche, Streifenbarsche
Dicentrarchus 2, Morone 4.
Morone 3 IS.
Morone saxatilis × *Roccus*° (= *Morone*) *americanus, chrysops* **IS** Schwartz 1972 (ref. 197, 338a, 785a, 1443), Schwartz 1981 (ref. 323, 1537)

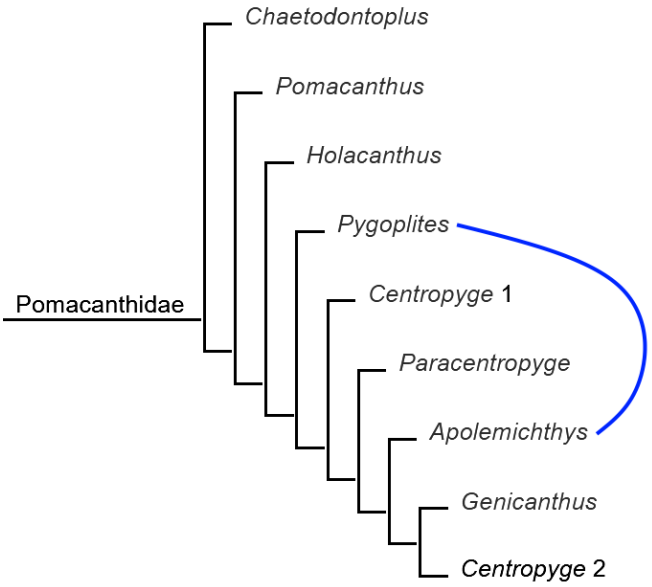
Acanthuriformes: Pomacanthidae 8: 88. 1 IG

marine angelfishes = Kaiserfische

IS: see https://www.forbes.com/sites/grrlscientist/2020/08/22/angels-in-disguise-angelfishes-hybridize-more-than-any-other-coral-reef-fishes/ e.g. many hybrids within *Centropyge.*

Apolemichthys kingi × *Pygoplites diacanthus* (art. hyb., accidental cross)

https://reefbuilders.com/2024/03/08/regal-x-tiger-angelfish-could-be-the-first-cross-genera-hybrid/ with photo of regal × tiger angelfish



Pomacanthidae: hybrid in the phylogeny of Baraf et al. (2025. doi: 10.1093/sysbio/syaf016de.eriki, from de.wikipedia, CC BY 4.0). *Centropyge* is polyphyletic.

References:

Baraf LM et al. (2025) Phylogenomics of marine angelfishes: diagnosing sources of systematic discordance for an iconic reef fish family (F: Pomacanthidae). Systematic Biology. doi: 10.1093/sysbio/syaf016de.eriki

Acanthuriformes: Sciaenidae 70: 275 + extinct genera. **3 IG**

drums or croakers = Umberfische, Trommler

Larimichthys (Pseudosciaena°) crocea × *Miichthys ("Sciaena") miiuy* Yaolan 2008

Pogonias cromis × *Sciaenops ocellatus* Henderson-Arzapalo & Colura 1984, Bartley et al. 1997

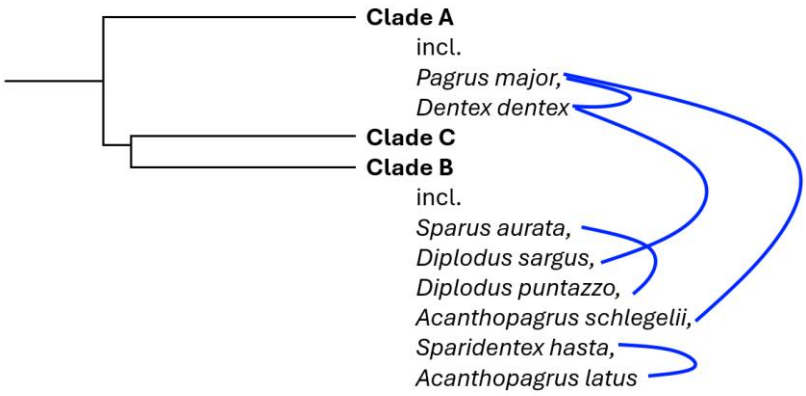
Sciaena umbra × *Umbrina ("Sciaena") cirrosa* (art. hyb., viable) Barbaro & Francesco unpubl., cited in Colombo et al. 1998

Acanthuriformes: Sparidae 38: 155 + extinct genera. **5 IG**

seabreams and porgies = Meerbrassen

Probably **basic type family Sparidae** (38: 155): The hybrids listed below help to establish all Sparidae as a basic type, according to the mt-DNA-based phylogeny of Chiba et al. (2009, fig. 2. doi: 10.1266/ggs.84.153; in fig. 3: 4 basal genera are not included: *Calamus* 13, *Stenotomus* 2, *Archosargus* 3 and *Lagodon* 1). The divergence time of this family is ca. 110 mya (without these 4 basal genera ca. 90 mya) (Chiba et al. 2009, fig. 4).

Acanthopagrus schlegelii × *Pagrus major* Schwartz 1972 (ref. 616)
Acanthopagrus latus × *Sparidentex hasta* Bartley et al. 1997 (= Al-Abdul-Elah)
Dentex dentex × *Diplodus sargus* Jug Dujakovic & Glamuzina 1993
Dentex dentex × *Pagrus major* Kraljevic & Dulcic 1999
Diplodus puntazzo × *Sparus aurata* Jug Dujakovic & Glamuzina 1990
Pagrus major × *Sparus aurata* Schwartz 1972 (ref. 616), Bartley et al. 1997, Gorshkov et al. 1998, 2002 (gynogenetic?)



Sparidae: hybrids in the (simplified) phylogeny after Chiba et al. (2009, Fig. 2. doi: 10.1266/ggs.84.153). Some genera are polyphyletic.

References on Acanthuriformes:

Bartley DM, Rana K & Immink AJ (1997) The use of inter-species hybrids in aquaculture and their reporting to FAO. http://www.fao.org/DOCREP/005/W7611E/W7611e7.htm

Colombo L et al. (1998) Towards an integration between chromosome set manipulation, intergeneric hybridization and gene transfer in marine fish culture. p. 77–122 in: Bartley DM & Basurco B (eds.). Genetics and breeding of Mediterranean aquaculture species. Zaragoza: CIHEAM.

Domeier ML (1992) A laboratory produced hybrid between *Lutjanus ambiguus* and *Ocyurus chrysurus* and a probable hybrid between *L. griseus* and *O. chrysurus* (Perciformes: Lutjanidae). Bull. Marine Science 50 (3), 501–507.

Gorshkov S et al. (1998) Chromosome set manipulations and hybridization experiments in gilthead seabream (*Sparus aurata*). I. Induced gynogenesis and intergeneric hybridization using males of the red seabream (*Pagrus major*). Israeli J. Aquaculture Bamidgeh 50, 99–110.

Gorshkov S et al. (2002) Chromosome set manipulations and hybridization experiments in gilthead seabream (*Sparus aurata*). II. Assessment of diploid and triploid hybrids between gilthead seabream and red seabream (*Pagrus major*). J. Applied Ichthyology 18 (2), 106–112.

Henderson-Arzapalo A & Colura RL (1984) Black drum × red drum hybridization and growth. J. World Mariculture Society 15, 412–420.
Hertwig G & Hertwig P (1914) Kreuzungsversuche an Knochenfischen. Archiv für Mikroskopische Anatomie 84, Abt. 2, 49–88. + Tafel V. interfamilial hybrids only a few days old and without normal embryos
Jug Dujakovic J & Glamuzina B (1990) Intergeneric hybridization in Sparidae. 1. *Sparus aurata* × *Diplodus puntazzo* ♂ and *Sparus aurata* × *Diplodus vulgaris* ♂. Aquaculture 86, 369–378.
Jug Dujakovic J & Glamuzina B (1993) Intergeneric hybridization in Sparidae. 2. *Diplodus sargus* × *Dentex dentex* ♂. J. Appl. Aquaculture 2 (1), 105–114.
Kraljevic M & Dulcic J (1999) Intergeneric hybridization in Sparidae (Pisces: Teleostei): *Dentex dentex* female × *Pagrus major* male and *P. major* female × *D. dentex* male. J. Appl. Ichthyol. 15, 171–175.
Loftus WF (1992) *Lutjanus ambiguus* (Poey), a natural intergeneric hybrid of *Ocyurus chrysurus* (Bloch) and *Lutjanus synagris* (Linnaeus). Bull. Marine Science 50 (3), 489–500.
Skakelja N et al. (2000) Implications for possible use of four genera of Sparidae family, *Dentex, Diplodus, Pagellus* and *Sparus* in breeding and hybridization – A comparative karyological approach. Periodicum Biologorum 102, Suppl. 1, 85–90.
Yaolan Z (2008) Primary study on the distant hybridization of *Pseudosciaena crocea* and *Miichthys miiuy*. http://en.cnki.com.cn/Article_en/CJFDTOTAL-JOKE200809026.htm

Acipenseriformes 2 families 6: 29 + several extinct taxa.

1 IG + 1 IF

Acipenseridae (sturgeon) 4: 27 *Acipenser 19* (polyphyletic), *Huso 2, Scaphirhynchus 3* (nested within *Acipenser* s. l.), *Pseudoscaphirhynchus 3* + fossil genera.
Polyodontidae (paddlefish) 2: 2 *Polyodon* 1, *Psephurus* extinct 1.

Basic type Acipenseriformes families Acipenseridae + Polyodontidae (6: 29): Scholl 2024. **1 IG + 1 IF.**

IS: see Shivaramu (2019), Tranah et al. (2004).

Acipenser gueldenstaedtii, nudiventris, ruthenus × *Huso huso* Acipenserinae (nat. hyb., art. hyb., fertile) Nikoljukin 1971, Schwartz 1972 (ref. 175, 656, 1248, 1688 etc.), Schwartz 1981, Bartley et al. 1997, Lozovskaya & Lozovskii 2002, Skirin & Svirsky 2008, Shivaramu 2019
Acipenser gueldenstaedtii × *Polyodon spathulata* (art. hyb., accidentally) interfamilial **IF** Acipenseridae × Polyodontidae Káldy et al. 2020

References:

Bartley DM, Rana K & Immink AJ (1997) The use of inter-species hybrids in aquaculture and their reporting to FAO. http://www.fao.org/DOCREP/005/W7611E/W7611e7.htm
Káldy J et al. (2020) Hybridization of Russian Sturgeon (*Acipenser gueldenstaedtii*, Brandt and Ratzeberg, 1833) and American Paddlefish (*Polyodon spathula*, Walbaum 1792) and Evaluation of Their Progeny. Genes 11 (7) https://doi.org/10.3390/genes11070753
Lozovskaya MV & Lozovskii AR (2002) Free-radical lipid oxidation in intergeneric and interspecific sturgeon hybrids at early stages of ontogeny. Bull. Exp. Biol. Med. 134, 333–334.
Nikoljukin NI (1971) Acipenseridae. FAO 1971 Seminar/Study Tour in the U.S.S.R. on Genetic Selection and Hybridization of Cultivated Fishes. 19 April – 29 May 1968. http://www.fao.org/docrep/005/B3310E/B3310E25.htm
Scholl B (2024) Die Störartigen. Ein Missgeschick enthüllte einen „uralten" Grundtyp. Studium Integrale J. 31, 124–127. https://www.si-journal.de/index2.php?artikel=jg31/heft2/sij312.html
Shivaramu S (2019) Hybridization of sturgeons. Ph.D. thesis. University of South Bohemia in České Budějovice. Faculty of Fisheries and Protection of Waters. ISBN 978-80-7514-095-1. https://theses.cz/id/rkrkhj/Shivaramu_Ph.D._thesis.pdf
Skirin VI & Svirsky VG (2008) Morphologica L. Characteristics of hybrids from bigeneric crossing of *Huso* and *Acipenser*. Vladimir Ya. Levanidov's Biennial Memorial Meetings. [Russian with English summary] http://www.biosoil.ru/levanidov/articles/a0441.pdf
Tranah G, Campton DE & May B (2004) Genetic evidence for hybridization of pallid and shovelnose sturgeon. Journal of Heredity 95, 474–480. interspecific *Scaphirhynchus albus* × *S. platyrhynchus*

Anabantiformes 3 suborders, 8 families

formerly part of order Perciformes

Anabantiformes: Osphronemidae 15: 135 + 1 extinct genus. **2 IG + 3 ISF** (suborder Anabantoidei)

gouramis, gouramies = Labyrinthfische p. p.

5 subfamilies:

Belontinae 1: 2.

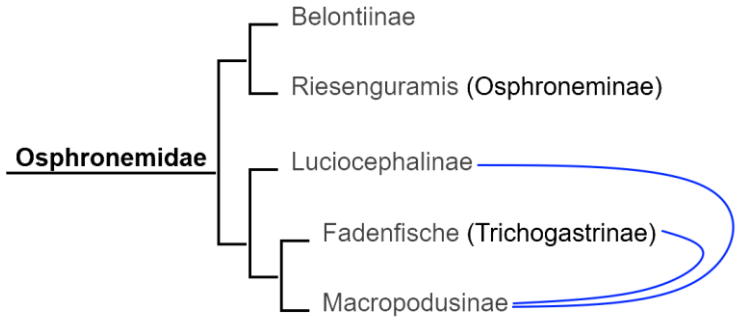
Luciocephalinae 4 *Ctenops*, …

Macropodusinae 6 *Betta 70*, *Macropodus*, …

Osphroneminae 1: 4.

Trichogastrinae 2 *Trichogaster*, *Trichopodus trichopterus.*

Possibly **basic type family Osphronemidae** (15: 135). But the presumed intergeneric cases of hybridization are only based on one publication, the PhD thesis of Schmidt 1930. If these are correct, 3 out of the 5 subfamilies are connected by hybridization (13: 129), see the figure below. – No new reports on intergeneric hybrids exist. So, it is necessary to find out which results Schmidt (1930) has found.



Osphronemidae: Hybrids in the phylogeny of Rüber L, Britz R & Zardoya R (2006) doi:10.1080/10635150500541664, from de.wikipedia 2025, CC BY 4.0

Betta splendens × *Ctenops vittatus* **ISF** Macropodusinae × Luciocephalinae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Betta splendens × *Macropodus* div. spec. Macropodusinae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Ctenops vittatus × *Macropodus* div. spec **ISF** Luciocephalinae × Macropodusinae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Macropodus div. spec. × *Trichogaster* div. spec. **ISF** Macropodusinae × Trichogastrinae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Trichogaster labiosus, lalius × *Trichopodus trichopterus* Trichogastrinae Schwartz 1972 (ref. 1473 = Schmidt 1930)

References on Anabantiformes:
Schmidt H (1930) Beiträge zur Kenntnis der tropischen Süßwasser-Teleostier. 107 p. Dissertation. Berlin. 107 p. PhD thesis

Atheriniformes 2 suborders, 8 families

2 suborders:
Atherinopsoidei 2 families: Atherinopsidae, Notochiridae
Atherinoidei 6 families: Atherinidae 25: 165, Melatonaeidae, ...

Atheriniformes: Atherinidae 25: 165 (suborder Atherinoidei)

silversides = Ährenfische

4 subfamilies:
Atherininae 5, Atherinomorinae 6, Bleheratherininae 1, Craterocephalinae 2.

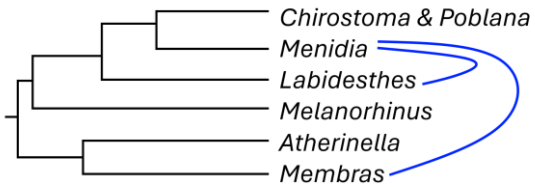
Atheriniformes: Atherinopsidae 13: 110. **3 IG** (suborder Atherinopsioidei)

Neotropical silversides

2 subfamilies:
Atherinopsinae 6: 30 *Atherinops, Leuresthes, ...*
Menidiinae 7: 80 *Labidesthes, Membras, Menidia, …*
Schwartz 1981: *Menidia ca. 6 IS*

In the family **Atherinopsidae** at least subfamily Menidiinae (7: 80) is connected by hybridization in the phylogeny of Bloom et al. (2011, fig. 2. doi:10.1016/j.ympev.2011.12.006) (cf. en.wikipedia 2025). Subfamily Atherinopsinae (6: 30) in the phylogeny of Dyer (1997, fig. 2+42+45. https://www.researchgate.net/publication/30857160) is not robust (it changes according to method/criteria).

Atherinops affinis × *Leuresthes tenuis* Atherinopsinae Schwartz 1972 (ref. 739 = Hubbs 1967; 991 = Leonhardt 1903)
Labidesthes sicculus × *Menidia audens* Menidiinae Schwartz 1972 (ref. 740a = Hubbs 1970)
Membras martinica × *Menidia beryllina, menidia* Menidiinae (art. hyb.) Schwartz 1972 (ref. 742 = Hubbs & Drewry 1959; ref. 1434 = Rubinoff 1961 (only 1 individual lived longer than 14 days), Schwartz 1981 (ref. 1332)



Atherinopsidae subfamily Menidiinae: hybrids in the (simplified) phylogeny of Bloom et al. (2011, fig. 2. doi:10.1016/j.ympev.2011.12.006)

Atheriniformes: Melanotaeniidae 7: 75. **1 IG** (suborder Atherinoidei)

rainbow fish = Regenbogenfische

In the family **Melanotaeniidae**: The "northern" clade is connected with >30 species, according to the phylogeny of Unmack et al. (2013, fig. 2. http://dx.doi.org/10.1016/j.ympev.2012.12.019).

Chilatherina campsi × *Melanotaenia affinis* Melanotaeniinae Allen & Cross 1982, Tappin 2008

References on Atheriniformes:

Allen GR & Cross NJ (1982) Rainbowfishes of Australia and Papua New Guinea. New Jersey: T. F. H. Publications.

Hubbs C & Drewry GE (1959a) Artificial production of an intergeneric atherinid fish hybrid. Copeia 1959, 80–81. = ref. 742 of Schwartz 1972

Hubbs C (1967) Analysis of phylogenetic relationships using hybridization techniques. In: Symposium on newer trends in taxonomy. Bull. Natl. Inst. Sci. India 34, 48–59. = ref. 739 of Schwartz 1972, not found

Hubbs C (1970) Teleost hybridization studies. Proc. Calif. Acad. Sci 38 (15), 289–298. = ref. 740a of Schwartz 1972

Kobayasi H (1951) A chromosome study in inter-family hybrids between the funa and the loach. The Nucleus 8 (1), 1–6. = ref. 891 of Schwartz 1972

Kobayasi H (1965) A chromosome study of fund-loach hybrids. On the chromosome hybrids of Russian carp and loach. Dogatsu (Zool. Mag.) 74, 261–267. = ref. 873 of Schwartz 1981.

Leonhardt E (1903) Die Bastarde der deutschen karpfenähnlichen Fische. Fischerei Zeitung 6 (46), 721–725, 741–743, 760–761, 775–776, 793–794, 803–804. = ref. 990/991 of Schwartz 1972, available as reprint 2010 Kessinger Publishing, ISBN-13: 9781162508528

Rubinoff I (1961) Artificial hybridization of some atherinid fishes. Copeia 1961 (2), 242–244. http://www.jstor.org/pss/1440019 = ref. 1434 of Schwartz 1972.

Tappin R (2008) Rainbowfish. Hybridisation. http://rainbowfish.angfaqld.org.au/Hybrid.htm For most part interspecific hybrids of *Melanotaenia*.

Batrachoidiformes only 1 family

Batrachioididae 23: 80.
4 subfamilies

Blenniiformes 3 suborders, 13 families

formerly part of Perciformes

Blenniiformes: Pomacentridae 31: 385. **1 IG**

clown fishes = Riffbarsche
4 subfamilies

Amphiprion sebale × *Premnas* Pomacentrinae Allen et al. 2008, Mebs 2009, Dhaneesh et al. 2011, http://www.orafarm.com/blog/2011/06/17/mystery-clownfish/ 2011

References:
Allen GR, Drew J & Kaufman L (2008) *Amphiprion barberi*, a new species of anemonefish (Pomacentridae) from Fiji, Tonga and Samoa. Aqua Int. J. Ichthyol. 14, 105–114.
Dhaneesh KV et al. (2011) Influence of brooder diet and seasonal temperature on reproductive efficiency of clownfish *Amphiprion sebale* in captivity. Recent Research in Science and Technology 3 (2), 95–99.
Mebs D (2009) Chemical biology of the mutualistic relationships of sea anemones with fish and crustaceans. Toxicon 54, 1071–1074.

Carangiformes 6 suborders, 31 families + extinct taxa

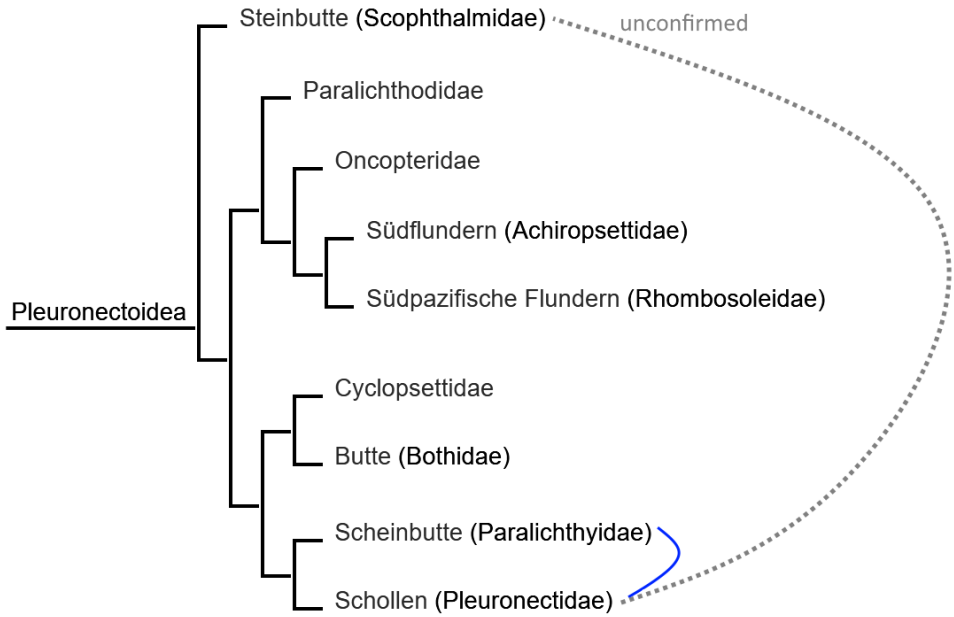
Incl. the former Pleuronectiformes
suborder Pleuronectoidei 3 superfamilies, 17 families:
superfamily Citharoidea 1 family Citharidae 4: 7
superfamily Soleoidea 5 families Samaridae 4: 29, …
superfamily Pleuronectoidea 9 families (70: 389) Achiropsettidae 4: 4, Bothidae 20: 162, Cyclopsettidae 4: 45, Oncopteridae 1: 1, Paralichthodidae 1: 1, Paralichthyidae 10: 65, Pleuronectidae 26: 101, Rhombosoleidae 9: 19, Scophthalmidae 4: 10

Carangiformes: Pleuronectidae 25: 101 + extinct taxa. **9 IG + 2 ISF + 1 IF** (suborder Pleuronectoidei, superfamily Pleuronectoidea)

right eye flounders = Schollen, Rechtsaugenflundern
4 subfamilies:
Atheresthinae 1: 2, Hippoglossinae 7: 9, Microstominae 2: 9, Pleuronectinae (incl. Pleuronichthyinae) 14: 36.

https://en.wikipedia.org/wiki/Flatfish#Hybrids: Hybrids are well known in flatfishes. Pleuronectidae is the marine fish family with the largest number of reported hybrids. Two of the most famous intergeneric hybrids are *Platichthys flesus* × *Pleuronectes platessa* and *Platichthys stellatus* × *Parophrys vetulus.*

Probably **basic type family Pleuronectidae + its sister clade family Paralichthyidae** (25: 166). Several hybrids connect 3 of the 4 subfamilies of Pleuronectidae and 1 hybrid connects the 2 families. – Old reports of an interfamilial hybrid with Scophthalmidae (*Scophthalmus* × *Pleuronectes)* cited by Schwartz 1971, are unconfirmed.



Superfamily **Pleuronectoidea:** Hybridization within the phylogeny according to de.wikipedia (2025, CC BY 4.0; cf. Atta et al. (2021). doi: 10.1016/j.ympev.2021.107315).

Glyptocephalus cynoglossus × *Pleuronectes platessa* **ISF** Microstominae × Pleuronectinae (nat. hyb.) Schwartz 1972 (ref. 709, 1265, 1548, 1549)

Hippoglossoides platessoides × *Pleuronectes (Platessa°) platessa* Pleuronectinae Schwartz 1972 (ref. 74), Schwartz 1981 (ref. 1193)

Hippoglossus hippoglossus × *Pleuronectes platessa* **ISF** Hippoglossinae × Pleuronectinae Schwartz 1981 (ref. 1298)

Isopsetta isolepis × *Parophrys vetulus* Pleuronectinae (nat. hyb.) Hubbs & Kuronuma 1942, Hubbs 1955, Garrett 2005

Isopsetta isolepis × *Platichthys stellatus* Pleuronectinae Schwartz 1972 (ref. 1494)

Platichthys (Kareius°) bicoloratus × *Platichthys stellatus* **IS** Pleuronectinae (nat. hyb.) Schwartz 1972 (ref. 709, 908, 1284, 1458, 1737, 1768)

Lepidopsetta bilineata × *Platichthys stellatus* Pleuronectinae Schwartz 1972 (ref. 82 etc.)

Limanda limanda × *Platichthys flesus* Pleuronectinae Schwartz 1972 (ref. 709, nat. hyb., 1265, *1284, 1548, 1549),* Riley & Thacker 1969 (art. hyb.), Schwartz 1972 (ref. 1394, 1549)

Limanda limanda × *Pleuronectes platessa* Pleuronectinae (nat. hyb.) Schwartz 1972 (ref. 709, 1265, 1548, 1549)

Limanda ferruginea × *Pseudopleuronectes platessa* Pleuronectinae (nat. hyb.) Schwartz 1972 (ref. 709, 1209, 1265, 1548, 1549)

Paralichthys olivaceus × *Verasper variegates* **IF** Paralichthyidae × Pleuronectidae Hippoglossinae Kim et al. 1996, Li et al. 2006

Parophrys × *Platichthys* Pleuronectinae (nat. hyb., fertile) Aron 1957, Schwartz 1972 (ref. 83, 1284, 1394, 1490, 1549 etc.), Schwartz 1981 (ref. 710), Garrett et al. 2007 (→ *Isopsetta ischyra* hybridogeneous origin **HY**)

Platichthys flesus × *Pleuronectes platessa* Pleuronectinae Ubisch 1952, Riley & Thacker

1969 (nat. hyb.), Schwartz 1972 (ref. 709, 1284, 1702, 1703 etc.), Schwartz 1981 (ref. 1298, 1514 etc.)

~~*Pleuronectes microcephalus, platessa ("Platessa vulgaris") × Scophthalmus (= Rhombus°) maximus*~~ ~~**IF**~~ Pleuronectidae Pleuronectinae × Scophthalmidae (nat. hyb.) Schwartz 1972 (ref. 356, 392 = Krause 1881, 472, 709, 932, 933, 1548, 1549, 1611). Krause 1881 only describes a presumed hybrid and possible parents are only assumptions.

Carangiformes: Scophthalmidae 4: 10. 1 IG (suborder Pleuronectoidei, superfamily Pleuronectoidea)

turbots = Steinbutte

Lepidorhombus 2 boscii, whiffiagonis, Phrynorhombus (= *Rhombus*°) *1 norvegicus, Scophthalmus* (incl. *Rhombus*°) *4 aquosus, rhombus* (= *Pleuronectes*° *laevis, Pleuronectes*° *rhombus, Rhombus*° *laevis*), *maeoticus, maximus* (= *Psetta*°, *Rhombus*° *maximus* etc.), *Zeugopterus 3 norvegicus, punctatus, regius* (= *Phrynorhombus unimaculatus*).

There are old reports of an interfamilial hybrid *Scophthalmus* × *Pleuronectes* cited by Schwartz 1971, but this cross is unconfirmed.

Zeugopterus regius ("Phrynorhombus unimaculatus") × *Zeugopterus* (*Rhombus*°) *punctatus*
IS Schwartz 1972 (ref. 634)

Pleuronectes × *Scophthalmus:* see above

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https://books.google.de/books?id=424XAAAAYAAJ&pg=PA119&redir_esc=y#v=onepage&q&f=false *Pleuronectes platessa* × *Scophthalmus maximus*

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Purdom CE & Lincoln RF (1973) Gynogenesis in hybrids within the Pleuronectidae. (abstract). p. 30 in: Int. symposium on the early life history of fish. FAO Fish Circ. 317. = ref. 1298.

Riley JD & Thacker GT (1969) New intergeneric cross within the Pleuronectidae, Dab × Flounder. Nature 221 (5179), 484–486. = ref. 1331 of Schwartz 1981. *Limanda limanda* × *Platichthys flesus*

Ubisch L von (1952) Untersuchungen über Pleuronectiden. III. Weitere Untersuchungen über die Ursachen der Farbanomalien bei *Pleuronectes platessa* und der Bastarde *Pleuronectes platessa* × *Pleuronectes flesus* ♂. Roux Arch. Entwicklungsmechanik Org. 145, 528–548.

Centrarchiformes 4 suborders, 22 families

Often considered as part of Perciformes.

Centrarchiformes: Centrarchidae 7: 34 + extinct taxa 6 IG + 8 ISF (suborder Centrarchoidei)

sunfishes = Sonnenbarsche

2 subfamilies (North America):

Centrarchinae 6 *Acantharchus, Ambloplites, Archoplites, Centrarchus, Enneacanthus, Pomoxis.*

Lepominae 2 *Lepomis* (incl. *Allotis*°, *Apomotis*°, *Chaenobryttus*°, *Eupomotis*°, *Helioperca*°, *Xenotis*°), *Micropterus.*

Basic type family Centrarchidae: Nearly all genera and both subfamilies are connected by hybridization, including the most distant genera.

IS: Schwartz 1981: *Lepomis ca. 20 IS, Micropterus ca 6 IS.*

Acantharchus × *Micropterus* **ISF** Centrarchinae × Lepominae Bolnick & Near 2005

Ambloplites × *Archoplites* (art. hyb.) Bolnick & Miller 2006 (only up to the blastula stage)

Ambloplites rupestris × *Lepomis (Chaenobryttus*°*) gulosus* **ISF** Centrarchinae × Lepominae (art. hyb.) Schwartz 1972 (ref. 1701 = Tyus 1969)

Ambloplites × *Enneacanthus* (art. hyb.) Tyus 1973, Schwartz 1981 (ref. 388), Bolnick & Near 2005

Ambloplites × *Lepomis* **ISF** Centrarchinae × Lepominae (art. hyb.) Schwartz 1972 (ref. 645, 1701), Tyus 1973, Schwartz 1981, Bolnick & Near 2005

Ambloplites × *Micropterus* **ISF** Lepominae × Centrarchinae (art. hyb.) Schwartz 1972 (ref. 645, 1701), Tyus 1973, Schwartz 1981, Bolnick & Near 2005

Ambloplites rupestris × *Pomoxis nigromaculatus* Centrarchinae Tyus (art. hyb.), Schwartz 1972 (ref. 1701), Tyus 1973, Schwartz 1981, Bolnick & Near 2005

Centrarchus macropterus × *Lepomis macrochirus* **ISF** Centrarchinae × Lepominae Hester 1970, Schwartz 1972 (ref. 645), Bolnick & Near 2005

Centrarchus macropterus × *Pomoxis annularis* (nat. hyb.) Burr 1974, Bolnick 2009

Chaenobryttus° (*Lepomis*) *gulosus* × *Lepomis* **IS** (art. hyb.) Hubbs 1955, Birdsong & Yerger 1967 (nat. hyb.), West 1970, Schwartz 1972 (ref. 1701, 1548, 1549), Schwartz 1981

Chaenobryttus° (*Lepomis*) *gulosus* × *Micropterus* West 1970 (art. hyb.), Childers 1971, Schwartz 1972 (ref. 645 etc.), Schwartz 1981 (ref. 1711, 1712)

Chaenobryttus° (*Lepomis*) × *Pomoxis* **ISF** Lepominae × Centrarchinae Schwartz 1981 (ref. 1083, 1084)

Enneacanthus × *Lepomis* **ISF** Centrarchinae × Lepominae Hester 1970, Schwartz 1972 (ref. 645 = Hester 1970), Bolnick & Near 2005

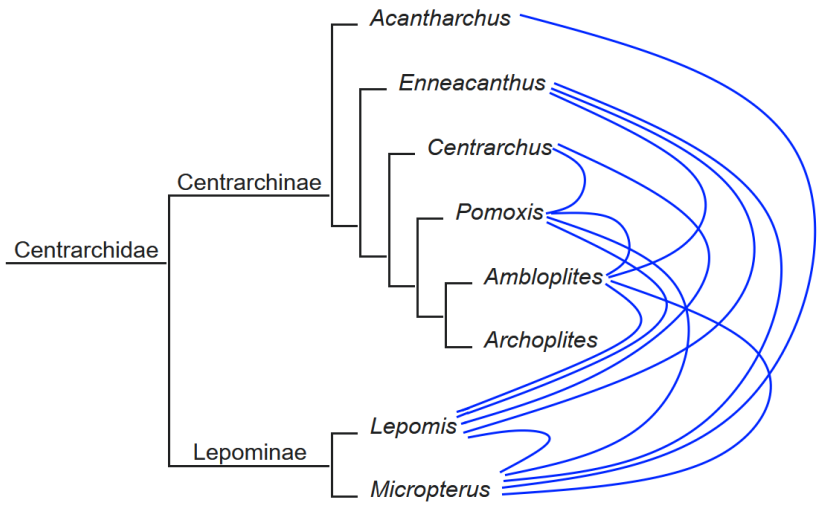
Enneacanthus × *Micropterus* **ISF** Centrarchinae × Lepominae Bolnick & Near 2005

Lepomis (*Eupomotis*°) *gibbosus* × *Lepomis* (*Helioperca*°) *macrochryps* **IS** Lepominae Schwartz 1981 (ref. 1193)

Lepomis cyanellus × *Micropterus salmoides* Lepominae Childers 1971 (art. hyb.), Schwartz 1972 (ref. 645, 1412, 1712, 1770 etc.), Whitt et al. 1973, Schwartz 1981, Bolnick & Near 2005

Lepomis × *Pomoxis* **ISF** Lepominae × Centrarchinae Hester 1970, Childers 1971, Schwartz 1972 (ref. 1768, 1770), Schwartz 1981, Bolnick & Near 2005

Micropterus × *Pomoxis* **ISF** Lepominae × Centrarchinae Merriner 1971, Schwartz 1972 (ref. 645, 1101, 1701), Bolnick & Near 2005



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Whitt GS, Childers WF & Cho PL (1973) Allelic expression at enzyme loci in an intertribal hybrid sunfish. J. Hered. 55–61.

Characiformes 2 suborders, 28 families, 290 genera, 2300 species + fossil taxa

characins and allies = Salmler-Verwandte

Originally all species were grouped within a sole family Characidae s. l. The taxonomy has significantly changed in the last years and many species have been shifted to other genera.
2 suborders:
Characoidei **characids = Echte Salmler** 26 families, 270 genera, 2300 species.
Citharinoidei 2 families, 20 genera, 25 species.

Characiformes: Acestrorhamphidae 54: 685. **1 IG + 2 ISF** (suborder Characoidei)

American tetras = Amerikanische Tetras

15 subfamilies, e.g.
Acestrorhamphinae 5 *Astyanax 137*, *Ctenobrycon 7*, *Psalidodon* (formerly synonymous with *Astyanax) 46* …
Hyphessobryconinae 5 *Hyphessobrycon* 150, …
Megalamphodinae 6 *Megalamphodus*, …
Pristellinae 3 *Gymnocorymbus 4*, *Hemigrammus* 55, Pristella 3.
Stichonodontinae 5 *Moenkhausia 84*, …
Thayeriinae 9 *Bario* 10 (many species formerly placed in *Moenkhausia*), …

According to the hybrid *Gymnocorymbus ternetzi* × *Hemigrammus caudovittatus* (= *Hyphessobrycon/Psalidodon anisitsi)* in combination with the phylogeny of Melo et al. (2024, fig. 6. https://doi.org/10.1093/zoolinnean/zlae101) and Oliveira (2025, fig. 8. https://doi.org/10.3390/taxonomy5020033) all Acestrorhamphidae with 15 subfamilies

and 685 species form a basic type, except for 3 small basic subfamilies (Oxybryconinae, Trochilocharacinae & Stygichthyinae: 6: 28).

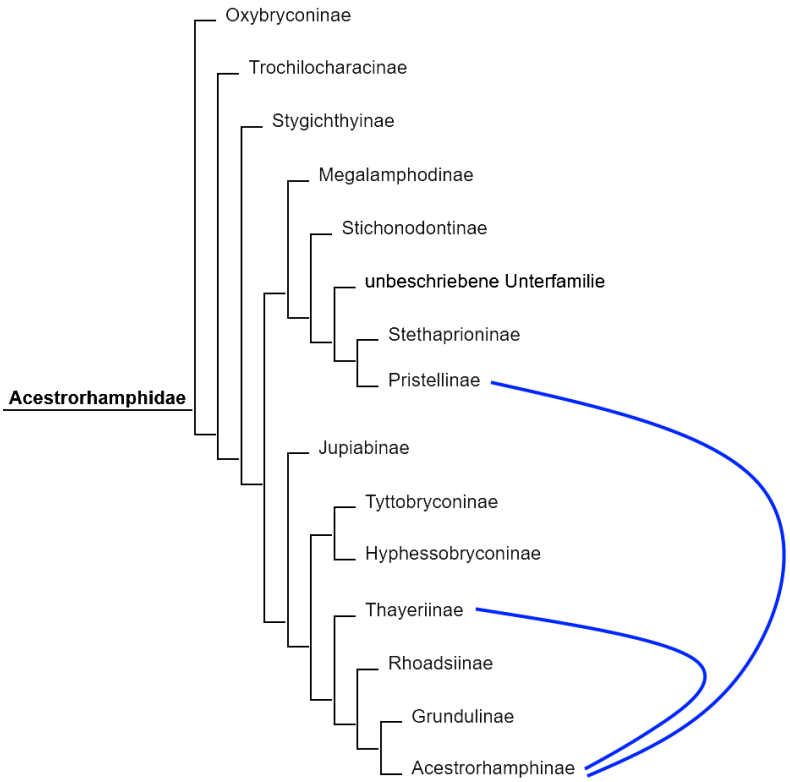
Astyanax (Anoptichthys°) jordani × *Astyanax* **IS** Acestrorhamphinae (viable, fertile)
Pfeiffer 1967, Wilkens 1971, Schwartz 1972 (ref. 456, 851a, etc.), Schwartz 1981

Astyanax (Anoptichthys°) jordani × *Ctenobrycon spilurus* Acestrorhamphinae (art. hyb.)
Schwartz 1972 (ref. 829 = Kauffeld 1954)

Astyanax (Anoptichthys°) jordani × *Bario ("Moenkhausia") oligolepis* **ISF** Acestrorhamphinae × Thayeriinae Schwartz 1972 (ref. 829 = Kauffeld 1954)

Gymnocorymbus ternetzi × *Psalidodon anitsitsi ("Hemigrammus caudovittatus")* **ISF** Pristellinae × Acestrorhamphinae David & Pandian 2006

Megalamphodus eques ("Hemigrammus serpae") × *Megalamphodus ("Macropodus") sweglesi* **IS** Megalamphodinae Schwartz 1981 (ref. 118, unconfirmed data of an annual show 1979)



Acestrorhamphidae: hybrids in the phylogeny of Melo BF et al. (2024. doi: 10.1093/zoolinnean/zlae101) from de.wikipedia (2026, CC BY 4.0).

Characiformes: Citharinidae 3: 9. 1 IG (suborder Citharinoidei)

lutefishes = Geradsalmler

Citharinus 6, Citharidium 1, Citharinops 1.

Citharidium ansorgii × *Citharinops ("Citharinus") distichodoides* (nat. hyb.) Schwartz 1972 (ref. 333 = Daget 1963)

Characiformes: Serrasalmidae 17: 107. **1 IG + 1 ISF** (suborder Characoidei)

serrasalmids, Sägesalmler

Formerly part of Characidae.

3 subfamilies:

Collossomatinae (lowland pacus) 3: 9 *Colossoma 1, Mylossoma 5, Piaractus 3.*

Myleinae (upland pacus) 9: 41.

Serrasalminae (piranhas) 5: 57 *Metynnis 14, …*

Possibly **Serrasalmidae** (17: 107) forms a basic type. There is an old report of a hybrid *Metynnis altidorsalis* × *Mylossoma duriventre* which would connect all 3 subfamilies: Colossomatinae × Serrasalminae directly, including Myleinae as sister taxon of Serrasalminae, see the phylogeny of Kohlmann et al. (2021, fig. 2+3+4. doi: 10.1093/sysbio/syaa065). But this hybrid needs confirmation!

Colossoma macropomum × *Piaractus brachypomus, mesopotamicus* Colossomatinae
Bartley et al. 1997, Martin et al. 2002, Ciasullo 2004

Metynnis altidorsalis (*„schreitmuelleri"*) × *Mylossoma duriventre* (*„argenteum"*) **ISF**
Serrasalminae × Colossomatinae Schwartz 1972 (ref. 91 = Azuma 1969).

References on Characiformes:

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Cichliformes 3 families 205: 1500

Formerly part of Perciformes.
3 families:
Cichlidae 200: 1500, Pholidychthyidae 1: 2, Polycentridae 4: 5

Cichliformes: Cichlidae 200: 1500. 20 IG + 2 ISF

cichlids = Buntbarsche

The subdivision of the family is matter of discussion.
4 subfamilies:
Cichlinae 7 tribes.
Etroplinae 1 tribe, 3 genera.
Pseudocrenilabrinae 10 tribes.
Ptychochrominae 1 tribe, 5 genera.

Alone some 500–700 species in lake Malawi.
Interesting link: „How to breed hybrid cichlids": http://www.wikihow.com/Breed-Hybrid-Cichlids

Probably **basic type family Cichlidae** (200: 1700) as suggested by Fehrer 1997, Scherer 1998, Junker 2019. At least the two big subfamilies Cichlinae (all American species, 60: 600) and Pseudocrenilabrinae (all Middle Eastern and African species, except for those of Madagascar; >1.100 species) are connected via hybridization; their divergence time from the two small basal subfamilies (Southasia+Madagascar) is ca. 100 mya (cf. Azuma Y et al. 2008, Fig. 2. http://www.biomedcentral.com/1471-2148/8/215; Irisarri I et al. 2018, Fig. 2. doi: 10.1038/s41467-018-05479-9).

IS: Schwartz 1981: *Pseudotropheus 3 IS, Tilapia ca. 15 IS.*

Aequidens rivulatus × *Hemichromis fasciatus* **ISF** Cichlinae × Pseudocrenilabrinae
Schwartz 1981 (ref. 966)

Amphilophus × *Cichlasoma* Cichlinae http://totalfish.weebly.com/flowerhorns.html
Amphilophus × *Herichthys* Cichlinae https://en.wikipedia.org/wiki/Cichlid 2026 (with photo) („red Texas cichlid")
Archocentrus (= *Herotilapia*°) *multispinosa* × *Cichlasoma* Cichlinae Schwartz 1981 (ref. 1591)
Astatotilapia calliptera × *Metriaclima*° (= *Maylandia*) *estherae* Pseudocrenilabrinae Stelkens et al. 2009
Astatotilapia calliptera × *Protomelas taeniolatus* Pseudocrenilabrinae Stelkens et al. 2009
Astatotilapia. calliptera × *Pundamilia nyererei* Pseudocrenilabrinae Stelkens et al. 2009
Aulonocara × *Pseudotropheus* Pseudocrenilabrinae http://therealowner.com/pets/beautiful-aquarium-world/
Aulonocara × *Trematocranus* Pseudocrenilabrinae http://therealowner.com/pets/beautiful-aquarium-world/
Cichlasoma nigrofasciatum × *Geophagus brasiliensis* Cichlinae Schwartz 1981 (ref. 221, 966, 1591)
Cichlasoma nigrofasciatum × *Herichthys cyanoguttatus* Cichlinae Schwartz 1972 (ref. 1416)
Cichlasoma trimaculatum × *Heros managuense* Cichlinae You-Ling et al. 2009
Cichlasoma octofasciatum × *Pelamotochromis kribensis* **ISF** Cichlinae × Pseudocrenilabrinae Schwartz 1972 (ref. 1175)
Cynotilapia afra × *Pseudotropheus zebra* Pseudocrenilabrinae Stauffer et al. 1996
Gymnogeophagus (= *Geophagus*°) *gymnogenes* × *Heros facetus* Cichlinae Schwartz 1972 (ref. 1501, 1502 = Schütz 1912)
Labeotropheus × *Pseudotropheus* Pseudocrenilabrinae (nat. hyb.) Schwartz 1981 (ref. 869a), McElroy & Kornfield 1993
Mbipia × *Pundamilia* Pseudocrenilabrinae Keller et al. 2013 (expected hybridization, **HY**)
Neochromis omnicaeruleus × *Pundamilia pundamilia* Pseudocrenilabrinae Stelkens et al. 2009
Oreochromis × *Sarotherodon* Pseudocrenilabrinae Schwartz 1972 (ref. sub *Tilapia* s. l.: 409, 655, 656, 1028, 1318, 1789, 1798), Baroiller et al. 2000, Togueni et al. 2009, Bezault et al. 2012
Oreochromis div. spec. × *"Tilapia zilii" (Coptodon)* Pseudocrenilabrinae Schwartz 1972 (ref. 1318, 1319, 1692), Rana et al. 1996
Haplochromis (Paralabidochromis°*) chilotes, rockkribensis* × *Pundamilia nyererei, pundamilia* Pseudocrenilabrinae Stelkens et al. 2009
Sarotherodon galilaeus × *"Tilapia zilii" (Coptodon)* Pseudocrenilabrinae Schwartz 1972 (ref. 1317, 1318), Rana et al. 1996

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Bezault E et al. (2012) Analysis of the meiotic segregation in intergeneric hybrids of Tilapias. Int. J. Evol. Biol. 2012, 1–10. http://www.hindawi.com/journals/ijeb/2012/817562/ *Oreochromis niloticus* × *Sarotherodon melanotheron*

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Junker R (2019) Mit oder ohne Streifen – Evolution oder präexistente Vielfalt? Studium Integrale J. 26, 56–57. https://www.si-journal.de/index2.php?artikel=jg26/heft1/sij261-s.html

Keller I et al. (2013) Population genomic signatures of divergent adaptation, gene flow and hybrid speciation in the rapid radiation of Lake Victoria cichlid fishes. Mol. Ecol. 22 (11), Special Issue SI, 2848–2863.

McElroy DM & Kornfield I (1993) Novel jaw morphology in hybrids between *Pseudotropheus zebra* and *Labeotropheus fuelleborni* (Teleostei, Cichlidae) from Lake Malawi, Africa. *Copeia* 1993, 933–945.

Rana KJ, McAndrew BJ, Wohlfarth G & Mac Gowan I (1996) Observations on intergeneric hybrids in tilapias. Working Papers, The World Fish Center, number 32678, May-June. http://www.worldfishcenter.org/resource_centre/WF_2332.pdfhttp://ideas.repec.org/b/wfi/wfbook/32678.html *Coptodon* ("*Tilapia*") *zilii* × *Oreochromis* div. spec. *Tilapia zilii* × *Sarotherodon galilaeus*

Scherer S (1998) Abnehmender Sexappeal von männlichen Buntbarschen durch Umweltverschmutzung des Viktoriasees. Studium Integrale J. 5, 85–86.

Stauffer JR et al. (1996) Evidence of hybridization between *Cynotilapia afra* and *Pseudotropheus zebra* (Teleostei: Cichlidae) following an intralacustrine translocation in lake Malawi. Copeia 1996, 203–208.

Stelkens RB, Schmid C, Selz O & Seehausen O (2009) Phenotypic novelty in experimental hybrids is predicted by the genetic distance between species of cichlid fish. BMC Evol. Biol. 9, 283–296. http://www.biomedcentral.com/content/pdf/1471-2148-9-283.pdf

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You-Ling C et al. (2009) Chromosomes of *Cichlasoma trimaculatum* (male), *Heros managuense* (female) and their hybrid offspring. Chinese J. Agric. Biotech. 6, 265–270. https://doi.org/10.1017/S1479236209990118

Clupeiformes 2 suborders, 10 families, 405 species and

extinct taxa

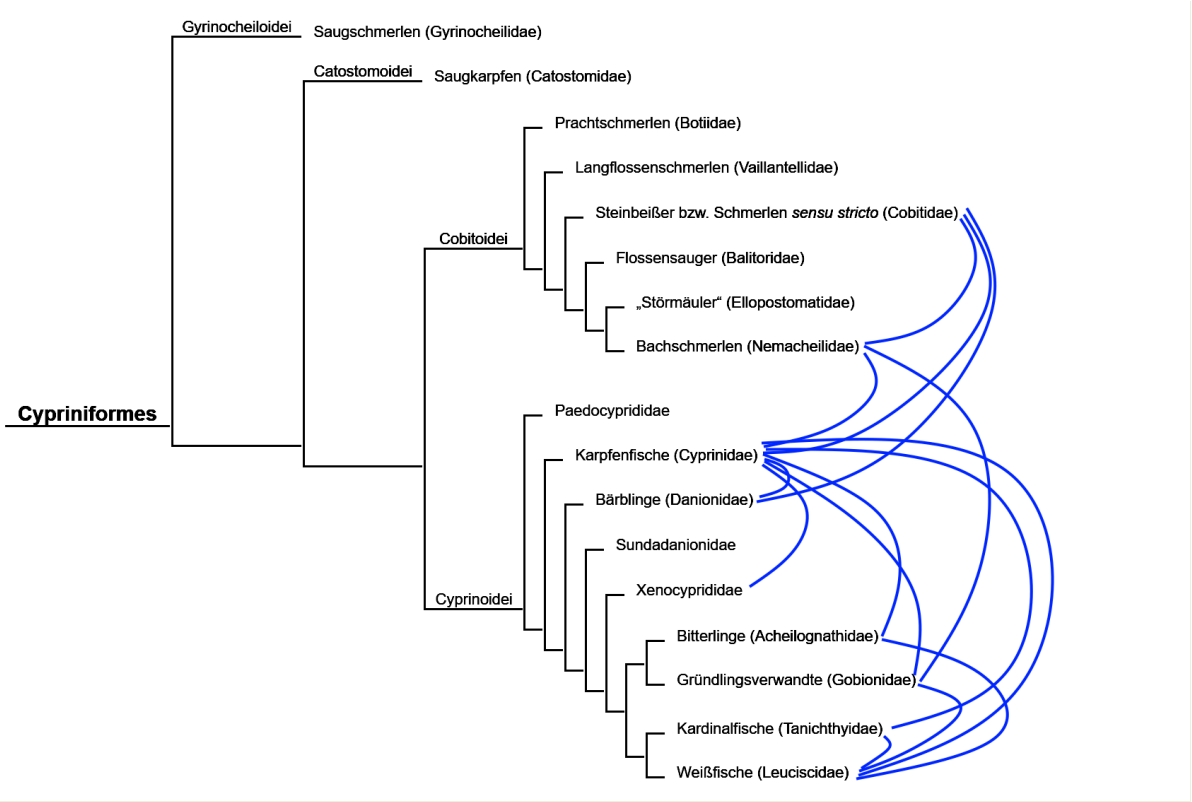
2 suborders:
Clupeoidei 9 families: Alosidae 4: 32, Dorosomatidae 31: 110, …
Denticipidoidei 1 family: Denticipidae.

Alosa sapidissima × *Pomolobus*° (= *Alosa*) *aestivalis, pseudoharengus* **IS** Alosidae (since 2025 separate family) Schwartz 1972 (ref. 1056)
Dorosoma cepedianum × *Signalosa*° (= *Dorosoma*) *petenensis* **IS** Dorosomatidae (since 2025 separate family) (nat. hyb.) Schwartz 1972 (ref. 1143 = Minckley & Krumholz 1960)

Cypriniformes 4 suborders, 23 families, 962 genera, 4100 species + 1 extinct family.

Systematics according to fishbase (2025) 4 suborders:
Gyrinocheiloidei 1 family: Gyrinocheilidae 2: 5.
Catostomoidei 1 family: Catostomidae 35: 202.
Cobitoidei 9 families 187: 402.
Cyprinoidei 12 families 738: 3500.

Probably **basic type order Cypriniformes suborders Cyprinoidei + Cobitoidei**. (425: 3900). Considering the manifold crosses between the families of these two suborders, obviously all members of these two suborders belong to the same basic type (see the figure below and the separate listing of intersubordinal hybrids below) with a total of about 3900 species and 270 intergeneric hybrid combinations, 62 of them interfamilial and 6 intersubordinal. This is so far the most species-rich basic type at all. – It is unresolved if the two basal suborders Gyrinocheiloidei and Catostomoidei with one family each belong to this basic type, too. Proving phylogenies are: Slechtová et al. (2007, fig. 1–2. https://www.researchgate.net/publication/6394139), Stout et al. (2016, fig. 2. doi: 10.1186/s12862-016-0819-5), Tao et al. (2019, fig. 1–4. https://doi.org/10.1007/s11427-019-9480-3), Chen Y et al. (2025, Fig. 3. https://doi.org/10.3390/fishes10030121), Oliveira et al. (2025, fig. 5. https://doi.org/10.3390/taxonomy5020033): even in two different phylogenies which result from different gene loci; and Integrated Taxonomic Information System (https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=162846#null). Divergence time of this basic type: ca. 100 mya (Tao W et al. 2019, Fig. 3. https://doi.org/10.1007/s11427-019-9480-3; cf. Chen Y et al. 2025, Fig. 3. https://doi.org/10.3390/fishes10030121).



Cypriniformes: hybrids in the phylogeny of Stout et al. (2016) doi:10.1186/s12862-016-0819-5, from de.wikipedia (2025, CC BY 4.0).

Cypriniformes suborder Catostomoidei 1 family 13: 80 + extinct genera

Catostomidae 13: 80 + extinct genera. **3 IG**

suckers = Saugkarpfen

4 subfamilies:

Catostomnae 9: 69, Cycleptinae 1: 2, Ictiobinae 2: 8, Myxocyprinae 1: 1.

In family **Catostomidae** possibly the species of tribe Catostomini (5: 39) belong to the same basic type, if compared with the phylogeny of Yang et al. (2024, fig. 1. https://doi.org/10.3390/biology13121072), but possibly the basic type covers the whole family or it is even included in the more extensive basic type **Cyprinoidei + Cobitoidei** as in some phylogenies (e.g. in Chen Y et al. 2025, Fig. 3. https://doi.org/10.3390/fishes10030121; but see other phylogenies above)?

IS: Schwartz (1981): *Carpiodes 1 IS.*

Catostomus × *Chasmistes* Catostominae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 717, 1548, 1549)

Catostomus × *Pantosteus* ("*Catostomus*") Catostominae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 97, 420a, 707, 708, 1533, 1535, 1548, 1549), Schwartz 1981 (ref. 1105)

Catostomus × *Xyrauchen* Catostominae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 717 = Hubbs & Miller 1953; 1129, 1142, 1533, 1548, 1549), Schwartz 1981, Scribner et al. 2001

Ictiobus bubalus × *Megastomatobus*° (*Ictiobus*) *cyprinellus* **IS** Ictiobinae Schwartz 1972 (ref. 708, 1276)

Cypriniformes suborder Cobitoidei 9 families, 187 genera, 402 species. 2 IG, 4 IF

loaches = Schmerlenartige

9 families:
Balitoridae 20: 142, Barbuccidae 1: 2, Botiidae 10: 102, Cobitidae 46: 354, Ellopostomadidae 1: 2, Gastromyzontidae 27: 173, Nemacheilidae 80: 1002, Serpenticobitidae 1: 3, Vaillantellidae 1: 4.

As for basic type considerations see order Cypriniformes (above). The 2 large families Cobitidae and Nemacheilidae of suborder Cobitoidei are connected by hybridization, and they are also connected with suborder Cyprinoidei.

Barbatula („*Cobitis*") *toni* × *Misgurnus anguillicaudatus* **IF** Nemacheilidae × Cobitidae Schwartz 1972 (p. 238 sub Cobitidae: ref. 883 = Kobayasi 1957; 884 = Kobayasi 1962; ref. 1620 = Suzuki 1957; ref. 1792)

Barbatula oreas × *Misgurnus anguillicaudatus* **IF** Nemacheilidae × Cobitidae Yamabayasi 1954 (see Suzuki 1957: „none of the embryos produced has developed beyond 20 hours after hatching; all showed deformation.")

Cobitis biwae × *Lefua echigonia* Cobitidae × Nemacheilidae **IF** Schwartz 1972 (ref. 1620 = Suzuki 1957 („none of the embryos went further than the pulsation stage of the heart."); ref. 1636 = Suzuki 1968)

Cobitis biwae, taenia, striata × *Misgurnus anguillicaudatus* Cobitidae Kobayasi 1956, Schwartz 1972 (ref. 739 = Hubbs 1967, 830; ref. 1133 = Minamori 1950; 1140, 1616, 1620 = Suzuki 1957: „the hybrid larvae took food well and grew into the same size as those of pure-bred *C. biwae*. The one-year hybrid larvae were intermediate in body-color pattern."; 1636 = Suzuki 1968 etc.), Schwartz 1981 (ref. 1103, 1545), Arai et al. 1994, Kusonoki et al. 1994

Lefua echigonia, nikkonis × *Misgurnus anguillicaudatus* **IF** Nemacheilidae × Cobitidae Schwartz 1972 (ref. 883 = Kobayasi 1957 („Most of the cross-bred eggs between *Cobitis biwae and Lefua echigonia*, and those between *M. anguillicaudatus* and *L. echigonia* died either during the gastrula period or early embryonic life, but 10 to 25 per cent of them developed in to advanced embryos. In the earlier stages the heart pulsation was not observable, and blood circulation was feeble, or not fully established. The eggs from *C. biwae* × *L. echigonia* showed the highest mortality and

none of the embryos went further than the pulsation stage of the heart."); ref. 884 = Kobayasi 1962; 1133, 1140; ref. 1620 = Suzuki 1957; ref. 1636 = Suzuki 1968)

Misgurnus anguillicaudatus × *Misgurnus (Paramisgurnus°) dabryanus* **IS** Cobitidae (nat. hyb.) You et al. 2009

Pangio (*Acanthophthalmus° fasciatus*) *kuhlii* × *Misgurnus anguillicaudatus* Cobitidae Neyfakh 1974

Cypriniformes suborder Cyprinoidei 12 families, 738 genera, 3500 species. **200 IG, 60 IF**

carp or minnow fishes = Karpfenfische

12 families:

Acheilognathidae 10: 128, Cyprinidae 293: 3051, Danionidae 75: 578, Gobionidae 55: 360, Leuciscidae 216: 1564, Paedocyprididae 1: 3, Psilorhynchidae 1: 33, Sundadanioidae 2: 9, Leptobarbidae 1: 7, Tanichthyidae 1: 13, Tincidae 1: 13, Xenocyprididae 82: 345.

For basic type considerations see order Cypriniformes (above).

In total: 292 entries, 25 questionable, 7 now interspecific, 200 IG + 60 IF.

Abramis × *Alburnus* Leuciscidae Schwartz 1972 (ref. 252, 485, 946 etc.), Schwartz 1981, Scribner et al. 2001

Abramis × *Blicca* Leuciscidae Schwartz 1972 (ref. 2, 394, 876, 1037 etc.), Schwartz 1981, http://pir.uniprot.org/taxonomy/564289 2012

Abramis × *Carassius* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968, 1219), Schwartz 1981 (ref. 1193)

Abramis × *Cyprinus* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 950 = Kryzanovski 1968, 1219), Schwartz 1981 (ref. 1396, 1516)

Abramis × *Gobio* **IF** Leuciscidae × Gobionidae Schwartz 1981 (ref. 1193)

Abramis × *Leuciscus* Leuciscidae Schwartz 1972 (ref. 602, 633, 1771 etc.), Schwartz 1981 (ref. 289, 961)

Abramis × *Pelecus* Leuciscidae Schwartz 1972 (ref. 146)

Abramis × *Rutilus* Leuciscidae (fertile) Schwartz 1972 (ref. 158 etc., etc.), Schwartz 1981 (ref. 289 etc.), Wood & Jordan 1987, Yakolev et al. 2000, Amini et al. 2007,

Abramis × *Scardinius* Leuciscidae Schwartz 1972 (ref. 871, 876, 1219 etc.), Schwartz 1981 (ref. 473 = Cross 1977)

Abramis × *Tinca* **IF** Leuciscidae × Tincidae Schwartz 1972 (ref. 946, 1219), Schwartz 1981

Acanthobrama ("Acanthalburnus") × *Squalius* ("*Leuciscus*") *cephalus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 176, 183, 1548, 1549)

Acanthorhodeus° (Acheilognathus) × *Acheilognathus* **IS** Acheilognathidae Schwartz 1972 (ref. 361 etc.), Duyvené de Wit 1960

Acanthorhodeus° (Acheilognathus) × *Rhodeus* Acheilognathidae Duyvené de Wit 1961, Schwartz 1972 (ref. 372, 667etc.), Schwartz 1981

Acheilognathus × *Carassius* **IF** Acheilognathidae × Cyprinidae Schwartz 1972 (ref. 1261, 1636 = Suzuki 1968), Schwartz 1981 (ref. 131 = Aduma-Bossmann & Keiz 1971) (not beyond the larvae stage)

Acheilognathus × *Cyprinus carpio* **IF** Acheilognathidae × Cyprinidae Schwartz 1972 (ref. 1044 = Makaeva 1968; 1618, 1621 = Suzuki 1959, 1636 = Suzuki 1968)

Acheilognathus × *Gnathopogon* **ISF** Acheilognathidae × Leuciscidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968)

Acheilognathus × *Paracheilognathus*° *(Acheilognathus)* **IS** Acheilognathidae (fertile) Duyvené de Wit 1964, Schwartz 1972 (ref. 337, 377 etc.), Schwartz 1981 (ref. 750)

Acheilognathus × *Pseudorasbora* **IF** Acheilognathidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Acheilognathus × *Rhodeus* (→ „*Acanthorhodeus atremius*") Acheilognathidae (fertile) Duyvené de Wit 1964, SK 366, 367, 1621 = Suzuki 1959 etc.), Schwartz 1981 (ref. 1743)

Acheilognathus × *Sarcocheilichthys* **IF** Acheilognathidae × Gobionidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968)

Acheilognathus × *Tanakia* Acheilognathidae Duyvené de Wit 1960, Schwartz 1972 (ref. 227, 367, 378 etc.), Kawamura & Hosoya 2000

Achondrostoma (*"Chondrostoma"*) × *Pseudochondrostoma* (*"Chondrostoma"*) (*A. oligolepis* × *P. duriense*) Leuciscidae Pereira et al. 2014

Alburnoides × *Alburnus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 183, 1548, 1549)

Alburnoides × *Squalius* (*"Leuciscus"*) *cephalus* Leuciscidae Schwartz 1972 (ref. 176)

Alburnus × *Blicca* Leuciscidae Schwartz 1972 (ref. 164, 181, 873 = Kobayasi 1965, 991, 1299), Schwartz 1981, Scribner et al. 2001

Alburnus × *Cyprinus* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968), Schwartz 1981 (ref. 1369, 1370 = Ryabov 1973)

Alburnus alburnus × *Leucaspius delineatus* Leuciscidae (fertile) Schwartz 1972 (ref. 181, 867 = von Knauthe 1893; 870, 991 etc.), Schwartz 1981 (ref. 290, 869)

Alburnus × *Leuciscus* Leuciscidae (fertile) Schwartz 1972 (ref. 666, 1519 etc.), Schwartz 1981, Scribner et al. 2001

Alburnus × *Rutilus* Leuciscidae Schilde 1936, Schwartz 1972 (ref. 181 etc.), Schwartz 1981 (ref. 290, 1253), Scribner et al. 2001

Alburnus (incl. *Chalcalburnus*°) × *Rutilus* Leuciscidae Schwartz 1972 (ref. 181, 1180 etc.)

Alburnus × *Scardinius* Leuciscidae Schwartz 1972 (ref. 72, 181, 1299 etc.), Schwartz 1981, Scribner et al. 2001

Alburnus (incl. *Chalcalburnus*°) × *Squalius* Leuciscidae Schwartz 1972 (ref. 2, 181, 424, 777, 992 etc.), Schwartz 1981, Ünver & Erk'akan 2005, Ünver et al. 2008

Alburnus × *Tinca* **IF** Leuciscidae × Tincidae Schwartz 1972 (ref. 946 = Kryzanovskij 1947), Schwartz 1981 (= Nikoljukin 1972)

Alburnus (*Chalcalburnus*°) *chalcoides* × *Vimba* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 181, 183, 1322, 1353a, 1353b, 1548, 1549)

Aphyocypris × *Danio* (*Brachydanio*°) *rerio* **IF** Xenocyprididae × Danionidae Schwartz 1972 (ref. 768?)

Aphyocypris × *Tanichthys* **IF** Xenocyprididae × Tanichthyidae (art. hyb.) Schwartz 1972 (ref. 1420; 1604 = Stolzenhain 1940; 1801 = Yates 1940)

Barbus × *Brachydanio*° (*Danio*) *rerio* **IF** Cyprinidae × Danionidae Schwartz 1972 (ref. 1473 = Schmidt 1930, 1485)

Barbus × *Capoeta* Cyprinidae (nat. hyb.) Schwartz 1972 (ref. 173), Mir et al. 1988, Stoumboudi et al. 1992, Scribner et al. 2001

Barbus × *Carassius* Cyprinidae Schwartz 1972 (ref. 828, 1473 = Schmidt 1930, 1474), Al-Mukhtar & Al-Hassan 1999

Barbus × *Chondrostoma* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 227, 1519, 1731)

Barbus × *Cyprinus* Cyprinidae Schwartz 1972 (ref. 357 = Defay 1785; 991)

Barbus × *Danio* **IF** Cyprinidae × Danionidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Barbus × *Esomus* Cyprinidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Barbus × *Scardinius* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 1731 = Vutskrits 1910/1911)

Barbus × *Schizothorax* Cyprinidae Schwartz 1972 (ref. 682, 1256 etc.), Schwartz 1981 (ref. 1595)

Barbus × *"Varicorhinus"* Cyprinidae Banister 1972, Schwartz 1972 (ref. 216, 946, 1113, 1589)

Biwia × *Gnathopogon* Gobionidae Suzuki 1963b, Schwartz 1972 (ref. 1071 = Masai & Sato 1966; 1628, 1629, 1633, 1636 = Suzuki 1968), Schwartz 1981 (ref. 405)

Biwia × *Hemigrammocypris* **IF** Gobionidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Biwia zezera × *Pseudogobio esocinus* Gobionidae Schwartz 1972 (ref. 1631 = Suzuki 1964 („ ... morphologically intermediate ... embryos hatch and resulted fry grow normally. Six hybrids reach the five-month old and then three of them can be reared until one-year old .... male sterile ..."), 1636 = Suzuki 1968), Schwartz 1981 (ref.405)

Biwia × *Pseudorasbora* Gobionidae (Chaudhuri 1971: intermediate, sterile), Schwartz 1972 (ref. 1632, 1633, 1636 = Suzuki 1968), Schwartz 1981 (ref. 405, 491 = Dangel et al. 1973)

Biwia × *Sarcocheilichthys* Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Blicca bjoerkna × *Carassius* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 227, 946, 1219), Schwartz 1981 (ref. 1193)

Blicca × *Chondrostoma* Leuciscidae Schwartz 1972 (ref. 1418), Schwartz 1981 (ref. 1341

Blicca bjoerkna × *Cyprinus carpio* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 1219), Schwartz 1981 (ref. 1193)

Blicca × *Leuciscus* Leuciscidae Vutskits 1907, Schwartz 1972 (ref. 92, 1519 etc.), Schwartz 1981 (ref. 961)

Blicca × *Rutilus* (incl. *Gardonus*°) Leuciscidae (fertile) Schwartz 1972 (ref. 113, 826, 991, 1225, 1299 etc.), Schwartz 1981 (ref. 290, 1193, 1359 etc.)

Blicca (*Abramis*) *bjoerkna* × *Scardinius* Leuciscidae (fertile) Schwartz 1972 (ref. 778, 991, 1036, 1219, 1252, 1519, 1730 etc.), Schwartz 1981 (ref. 290, 1193, 1253, 1698)

Blicca × *Squalius* (= *Leuciscus*°) *cephalus* Leuciscidae Schwartz 1972 (ref. 92)
Blicca × *Tinca* IF Leuciscidae × Tincidae Schwartz 1972 (ref. 946, 1219), Schwartz 1981 (ref. 1193)
Blicca × *Vimba* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 155, 181, 183, 227, 1549, 1658 etc.), Schwartz 1981, Balon 1992
Campostoma × *Chrosomus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 667, 698, 1330, 1548, 1549, 1560), Schwartz 1981 (ref. 1042)
Campostoma × *Clinostomus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1330. 1374), Schwartz 1981 (ref. 1042)
Campostoma × *Dionda* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1330), Schwartz 1981 (ref. 1042)
Campostoma × *Gila* Leuciscidae Schwartz 1981 (ref. 1105)
Campostoma × *Hybopsis* Leuciscidae Schwartz 1972 (ref. 227, 278)
Campostoma × *Luxilus* Leuciscidae (nat. hyb.) Hubbs 1955, Poly 1997, Scribner et al. 2001
Campostoma × *Nocomis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 963, 965, 1548, 1549 etc.), Schwartz 1981 (ref. 1042, 1743), Grady & Cashner 1988, Scribner et al. 2001
Campostoma × *Notropis* Leuciscidae Schwartz 1972 (ref. 335, 963), Schwartz 1981 (ref. 665, 1042), Sizemore & Howell 1987, Grady & Cashner 1988 (nat. hyb.)
Campostoma × *Phoxinus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 963), Schwartz 1981, Grady & Cashner 1988, Scribner et al. 2001
Campostoma × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 97 etc.), Schwartz 1981 (ref. 1042), Goodfellow et al. 1986, Scribner et al. 2001
Campostoma × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 324), Ross & Cavender 1981, Schwartz 1981 (ref. 1042, 1352, 1353)
Carassius × *Cirrhinus* Cyprinidae Schwartz 1981 (ref. 1565)
Carassius × *Ctenopharyngodon* **IF** Cyprinidae × Xenocyprididae Kasama & Kobayasi 1989b (adult 3n), Scribner et al. 2001
Carassius × *Cyprinus* Cyprinidae (some are fertile, nat. hyb., art. hyb.) Adumua-Bossmann & Keiz 1971, Schwartz 1972 (ref. 24, 190, 697, 1243, 1252, etc., etc.), Schwartz 1981, Scribner et al. 2001, Liu 2010
Carassius × *Gnathopogon* **IF** Cyprinidae × Gobionidae (Chaudhuri 1971: intermediate, sterile), Schwartz 1972 (ref. 1044a, 1068 = Maso & Sato 1965; 1629, 1636 = Suzuki 1968), Schwartz 1981, Kasama & Kobayasi 1990, 1991 (adult, 3n = triploid)
Carassius × *Gobio* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 885, 946), Schwartz 1981 (ref. 1193, 1369, 1370)
Carassius × *Hemibarbus labeo* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 946, 947, 950 = Kryzanovski 1968), Schwartz 1981 (ref. 720)
Carassius × *Hypophthalmichthys* **IF** Cyprinidae × Xenocyprididae Gui et al. 1993
Carassius × *Leuciscus* **IF** Cyprinidae × Leuciscidae Nikoljukin 1971 (*Carassius carassius* × *Leuciscus cephalus*: „... only a small part of the offspring was viable, and these were matrilinear, i.e. gynogenetic due to the exclusion of the male chromosome

complex during development."), Schwartz 1972 (ref. 80 = Arnoult & Spillman 1966), Schwartz 1981 (ref. 188 = Arnoult & Spillman 1965)

Carassius × *Megalobrama* **IF** Cyprinidae × Xenocyprididae Cultrinae Liu et al. 2007, Qin et al. 2014

Carassius × *Phoxinus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 80, 176, 1582)

Carassius × *Pseudogobio* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968), Schwartz 1981 (ref. 131 = Aduma-Bossmann & Keiz 1971)(not beyond the larval stage)

Carassius × *Rasbora* Cyprinidae Schwartz 1981 (ref. 629)

Carassius × *Rhodeus* **IF** Cyprinidae × Acheilognathidae Schwartz 1972 (ref. 1033a = Lu et al. 1965; 1636 = Suzuki 1968)

Carassius × *Rhynchocypris (Morocco°) percnurus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. p. 240 sub Cobitidae: 885; 1636 = Suzuki 1968)

Carassius × *Rutilus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 946, 1423), Schwartz 1981 (= Romashov & Golovinskaia)

Carassius × *Sarcocheilichthys* Cyprinidae × Gobionidae **ISF** Schwartz 1972 (ref. 950 = Kryzanovski 1968, 1621, 1636 = Suzuki 1968), Schwartz 1981 (ref. 875, 1369, 1370)

Carassius × *Scardinius* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 352, 946, 1219, 1423), Schwartz 1981 (ref. 1193, 1369, 1370)

Carassius × *Squalius cephalus* **IF** Cyprinidae × Leuciscidae Nikoljukin 1971 (gynogenetic!), Schwartz 1972 (ref. 946, 1423, 1636 = Suzuki 1968)

Carassius × *Telestes* **IF** Cyprinidnae × Leuciscidae Schwartz 1972 (ref. 80 = Arnoult & Spillman 1966)

Carassius × *Tinca* **IF** Cyprinidae × Tincidae Nikoljukin 1971 (only viable, if *Carassius* is the partner), Schwartz 1972 (ref. 24, 825 = Kasansky 1930a; 946, 1225, 1423, 1425 etc.), Schwartz 1981 (ref. 1349 = Romashov & Golovinskaia)

Carassius × *Pseudaspius (Tribolodon°) hakonensis* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 885, 1636 = Suzuki 1968), Schwartz 1981 (ref. 782)

Carassius × *Vimba* **IF** Cyprinidae × Leuciscidae Schwartz 1981 (ref. 1193)

Carassius × *Zacco* **IF** Cyprinidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Catla × *Cirrhinus* Cyprinidae Chaudhuri 1971, Schwartz 1972 (ref. 284), Schwartz 1981, Khan & Kowtal 1986, Scribner et al. 2001

Catla × *Ctenopharyngodon* Cyprinidae Schwartz 1981 (ref. 139, 728, 1565)

Catla × *Cyprinus* Cyprinidae (sterile) Bartley et al. 1997

Catla × *Hypophthalmichthys* **IF** Cyprinidae × Xenocyprididae Ibrahim et al. 1980, Schwartz 1981, Scribner et al. 2001

Catla × *Labeo* Cyprinidae Chaudhuri 1971, Schwartz 1972 (ref. 284), Natarajan et al. 1977, Schwartz 1981 Scribner et al. 2001, Simonsen et al. 2005

Catla × *Labeo (Morulius°)* Cyprinidae Khan & Kowtal 1986, Scribner et al. 2001 (art. hyb.)

Chondrostoma × *Gobio* **IF** Leuciscidae × Gobionidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968), Schwartz 1981 (ref. 1341)

Chondrostoma × *Leuciscus* Leuciscidae Schwartz 1972 (ref. 1430 etc.), Schwartz 1981 (ref. 290, 1253, 1341, 1359)
Chondrostoma × *Squalius* (*Leuciscus*°) *cephalus* Leuciscidae Schwartz 1972 (ref. 176, 423)
Chondrostoma × *Parachondrostoma* Leuciscidae Simkova et al. 2013 (nat. hyb. Spain)
Chondrostoma × *Phoxinellus* (*Paraphoxinus*°) *alepidotus* Leuciscidae Schwartz 1972 (ref. 1728, 1383
Chondrostoma × *Rutilus* Leuciscidae Schwartz 1972 (ref. 946, 1225), Schwartz 1981 (ref. 1193, 1341), Gilles et al. 1998, Scribner et al. 2001
Chondrostoma × *Squalius* Leuciscidae Schwartz 1972 (ref. 991, 1173, 1519, 1722, 1731)
Chondrostoma × *Telestes* Leuciscidae Schwartz 1972 (ref. 2, 592, 779, 991, 995, 1611 etc.), Schwartz 1981 (ref.1253)
Chondrostoma × *Vimba* Leuciscidae Schwartz 1972 (ref. 227, 1722)
Chrosomus × *Clinostomus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)
Chrosomus × *Dionda* Leuciscidae Schwartz 1981 (ref. 1042)
Chrosomus × *Margariscus* Leuciscidae Schwartz 1981 (ref. 1042)
Chrosomus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 324, 713, 1330, 1383), Greenfield et al. 1973, Schwartz 1981 (ref. 665, 1042)
Chrosomus × *Phoxinus* (*Pfrille*°) Leuciscidae Schwartz 1972 (ref. 94)
Chrosomus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 324, 1330), Schwartz 1981 (ref. 1042)
Cirrhinus × *Ctenopharyngodon* Cyprinidae Schwartz 1981 (ref. 694, 728, 798)
Cirrhinus × *Cyprinus* Cyprinidae Schwartz 1981, Gupta et al. 1986
Cirrhinus × *Labeo* Cyprinidae Chaudhuri 1971, Schwartz 1972 (ref. 284, 764), Schwartz 1981, Khan & Kowtal 1986, Simonsen et al. 2005
Cirrhinus × *Sinilabeo* Cyprinidae Scribner et al. 2001
Clinostomus × *Nocomis* Leuciscidae Schwartz 1972 (ref. 963, 965, 1777a)
Clinostomus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 579, 926, 963, 1548, 1549), Schwartz 1981 (ref. 665), Sizemore & Howell 1987, Grady & Cashner 1988
Clinostomus × *Phoxinus* Leuciscidae Schwartz 1981, Grady & Cashner 1988 (nat. hyb.), Scribner et al. 2001
Clinostomus × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Goodfellow et al. 1986, Scribner et al. 2001
Clinostomus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 579, 584, 926), Ross & Cavender 1981, Schwartz 1981 (ref. 1352)
Couesius (*Ceratichthys*°) × *Notropis* (*Hypsilepis*°) Leuciscidae Schwartz 1972 (ref. 311a)
Couesius × *Margariscus* Leuciscidae Schwartz 1972 (ref. 693)
Couesius × *Rhinichthys* Leuciscidae Schwartz 1972 (ref. 637, 1535), Schwartz 1981 (ref. 1042)
Couesius plumbeus × *Semotilus margarita* Leuciscidae Schwartz 1981 (ref. 1042), Wells 1981
Ctenopharyngodon × *Cyprinus* **IF** Xenocyprididae × Cyprinidae Schwartz 1972 (ref. 894,

953, 1044, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981 (= Vasil'ev et al. 1975: „28% normal hybrids")

Ctenopharyngodon × *Hypophthalmichthys* Xenocyprididae Schwartz 1972 (ref. 19, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981, Beck et al. 1983, Scribner et al. 2001

Ctenopharyngodon × *Labeo* **IF** Xenocyprididae × Cyprinidae Schwartz 1981 (ref. 728)

Ctenopharyngodon × *Megalobrama* Xenocyprididae Schwartz 1981, Scribner et al. 2001

Ctenopharyngodon × *Mylopharyngodon* Xenocyprididae Schwartz 1972 (ref. 1044a), Schwartz 1981 (ref. 996, Scribner et al. 2001

Ctenopharyngodon × *Parabramis pekinensis* **IF** Xenocyprididae × Cyprididae Schwartz 1981 (ref. 728)

Culter (Chanodichthys) dabryi × *Megalobrama amblycephala* Xenocyprididae (art. hyb.) Guo et al. 2018, Zhou et al. 2025 (art. hyb. *C. dabryi* × *M. amblycephala*; in this study only a partial hybrid resulted with gene fragments of *Culter* as the male parent)

Culter alburnus × *Megalobrama amblycephala* Xenocyprididae (art. hyb.) Guo et al. 2018,

Cyprinus × *Gnathopogon* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cyprinus × *Hemiculter* **IF** Cyprinidae × Xenocyprididae Vasil'ev et al. 1975, Schwartz 1981 (ref. 355, 996, 1644)

Cyprinus × *Hypophthalmichthys* **IF** Cyprinidae × Xenocyprididae Schwartz 1972 (ref. 1044, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981, Gui et al. 1993

Cyprinus × *Labeo* Cyprinidae (sterile) Schwartz 1981 Khan & Kowtal 1986, Bartley et al. 1997

Cyprinus × *Leuciscus*° (*Rutilus*) *rutilus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 227; 1480/1481 = Schreitmüller 1916), Schwartz 1981 (ref. 471, 1370)

Cyprinus × *Leuciscus*° (= *Squalius*) *cephalus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 184)

Cyprinus × *Megalobrama* **IF** Cyprinidae × Xenocyprididae Jin et al. 2003

Cyprinus × *Mylopharyngodon* **IF** Cyprinidae × Xenocyprididae Schwartz 1972 (ref. 1044a), Schwartz 1981 (ref. 996), Jin et al. 2006

Cyprinus × *Phoxinus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 128, 946, 950 = Kryzanovski 1968, 1044), Schwartz 1981 (ref. 1370)

Cyprinus × *Pseudogobio esocinus* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1618, 1636 = Suzuki 1968)

Cyprinus × *Pseudorasbora parva* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cyprinus × *Puntius* Cyprinidae Schwartz 1981 (ref. 410, 412)

Cyprinus × *Rhodeus* **IF** Cyprinidae × Acheilognathidae Schwartz 1972 (ref. 1621, 1636 = Suzuki 1968)

Cyprinus × *Rutilus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 320, 1044, 1044a), Schwartz 1981 (ref. 471)

Cyprinus × *Sarcocheilichthys* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1044 = Makaeva 1968; 1618, 1621, 1636 = Suzuki 1968)

Cyprinus × *Scardinius* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 184, 227, 875, 946, 950 = Kryzanovski 1968, 1044, 1611 etc.), Schwartz 1981 (ref. 398, 1193, 1369, 1370)

Cyprinus × *Tinca* **IF** Cyprinidae × Tincidae Schwartz 1972 (ref. 842, 855, 1709; 1715 = Victorovsky 1966; etc.), Schwartz 1981 (ref. 398, 721, 1193, 1369, 1370, 1667)

Cyprinus × *Capoeta ("Varicorhinus") capoeta* Cyprinidae Schwartz 1981 (ref. 247)

Cyprinus × *Zacco* **IF** Cyprinidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Danio (Brachydanio°.) × *Danio malabaricus* Danionidae Schwartz 1972 (ref. 227, 1448)

Danio (Brachydanio°) × *Esomus danricus* Danionidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Danio × *Esomus* Danionidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Danio (Brachydanio°) × *Tanichthys albonubes* **IF** Danionidae × Tanichthyidae Schwartz 1981 (= Housz 1964)

Dionda × *Hybopsis* Leuciscidae Schwartz 1972 (ref. 1330)

Dionda × *Luxilus* Leuciscidae (nat. hyb.) Hubbs 1955

Dionda × *Nocomis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 863, 965), Schwartz 1981 (ref. 1042)

Dionda × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 963, 1157, 1330, 1548, 1549 etc.), Schwartz 1981 (ref. 1042, 1338, 1496)

Diptychus dybowski × *Leuciscus schmidti* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968, 1423), Schwartz 1981 (ref. 1349 = Romashov & Golovinskaia)

Eremichthys × *Rhinichthys* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 716, 1548, 1549), Schwartz 1981 (ref. 1042)

Extrarius° (= *Macrhybopsis*) × *Macrhybopsis* **IS** Leuciscidae Schwartz 1981 (ref. 1042)

Extrarius° (= *Macrhybopsis*) × *Platygobio* Leuciscidae Schwartz 1981 (ref. 1042)

Gila (incl. *Siphateles°*) × *Hesperoleucus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 580), Hubbs 1955, Schwartz 1981 (ref. 663, 664, 665, 1212)

Gila × *Iotichthys* Leuciscidae Schwartz 1981 (ref. 1042), Miller & Behnke 1985

Gila × *Lavinia* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 1122, 1123), Schwartz 1981 (ref. 1042, 1496), Layman et al. 2010

Gila × *Leuciscus* Leuciscidae Schwartz 1981 (ref. 768)

Gila ("Acrocheilus") × *Mylocheilus* Leuciscidae Schwartz 1972 (ref. 1493)

Gila × *Orthodon* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 278), Schwartz 1981 (ref. 206, 1042)

Gila ("Acrocheilus") × *Ptychocheilus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 694, 698, 1303, 1548, 1549 etc.), Schwartz 1981 (ref. 1042)

Gila (incl. *Siphateles°*) × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 227, 324, 680), Schwartz 1981 (ref. 1042, 1496), Suttkus & Cashner 1981

Gila ("Acrocheilus") × *Richardsonius* Leuciscidae Schwartz 1981 (ref. 1042)

Gila × *Richardsonius* Leuciscidae Schwartz 1972 (ref. 419), Schwartz 1981 (ref. 206, 1042, 1496)

Gila × *Siphateles* (“*Gila*”) Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 82, 324, 1116, 1549 etc.), Schwartz 1981 (ref. 1193), Layman et al. 2010

Gnathopogon × *Hemigrammocypris* **IF** Gobionidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Gnathopogon × *Pseudogobio* Gobionidae (nat. hyb.) Schwartz 1972 (ref. 1069, 1626 = Suzuki 1963a (art. hyb., up to the adult stage, intermediate in morphology and behavior), 1627, 1629, 1636 = Suzuki 1968), Suzuki 1973a, Schwartz 1981 (ref. 264, 1543, 1545, 1549, 1554)

Gnathopogon × *Pseudorasbora* Gobionidae Suzuki 1962, Schwartz 1972 (ref. 457, 1070, 1071, 1624, 1627, 1628, 629, 1632, 1634, 1636 = Suzuki 1968), Schwartz 1981 (ref. 405, 1543), Kasama & Kobayasi 1987

Gnathopogon × *Rhodeus* **IF** Gobionidae × Acheilognathidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Gnathopogon × *Sarcocheilichthys* Gobionidae Schwartz 1972 (ref. 1621, 1636 = Suzuki 1968)

Gnathopogon × *Squalidus* Gobionidae Kasama & Kobayasi 1989a

Gnathopogon × *Zacco* **IF** Gobionidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Gobio × *Phoxinus* (“*Leuciscus*”) *phoxinus* **IF** Gobionidae × Leuciscidae (art. hyb.) Schwartz 1972 (ref. 176; 866 = von Knauthe 1891; 1000 = Lieder 1954), Schwartz 1981 (ref. 1193, 1370)

Gobio × *Rutilus* **IF** Gobionidae × Leuciscidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968, 1000 = Lieder 1954), Schwartz 1981 (ref. 1193, 1369, 1370)

Gobio × *Scardinius* **IF** Gobionidae × Leuciscidae Schwartz 1972 (ref. 946), Schwartz 1981 (ref. 1193)

Gobio × *Squalius* (= *Leuciscus*°) *cephalus* **IF** Gobionidae × Leuciscidae Schwartz 1972 (ref. 946)

Hemiculter × *Hypophthalmichthys* Xenocyprididae Schwartz 1981 (ref. 996)

Hesperoleucus (= *Lavinia* p. p.) × *Lavinia* Leuciscidae Schwartz 1972 (ref. 753, 1117 etc.), Schwartz 1981 (ref. 1042), Scribner et al. 2001

Hesperoleucus × *Pogonichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)

Hesperoleucus × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)

Hybognathus × *Luxilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 991)

Hybognathus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 237, 695, 1548, 1549 etc.)

Hybognathus × *Pimephales* Leuciscidae Schwartz 1981 (ref. 1042)

Hybognathus × *Rhinichthys* Leuciscidae Schwartz 1981 (ref. 1170)

Hybognathus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)

Hybopsis × *Macrhybopsis* Leuciscidae Schwartz 1981 (ref. 1041)

Hybopsis × *Notropis* Leuciscidae Schwartz 1972 (ref. 278, 1663), Burkhead & Bauer 1983

Hybopsis × *Phenacobius* Leuciscidae (nat. hyb.) Hubbs 1955
Hybopsis × *Rhinichthys* Leuciscidae Schwartz 1972 (ref. 278 etc.), Schwartz 1981 (ref. 1170)
Hybopsis × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 278)
Hypophthalmichthys (Aristichthys°) × *Catla* Xenocyprididae × Cyprinidae Schwartz 1981 (ref.139, 728)
Hypophthalmichthys (Aristichthys°) × *Ctenopharyngodon* Xenocyprididae Schwartz 1972 (ref. 19; 191 = Berry & Low 1970; 1044a), Schwartz 1981, Bartley et al. 1997, Scribner et al. 2001
Hypophthalmichthys (Aristichthys°) × *Cyprinus* **IF** Xenocyprididae × Cyprinidae Schwartz 1972 (ref. 19, 1044, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981 (ref. 721, 1001, 1645)
Hypophthalmichthys (Aristichthys°) × *Hemiculter* Xenocyprididae Schwartz 1981 (ref. 996)
Hypophthalmichthys (Aristichthys°) × *Hypophthalmichthys* **IS** Xenocyprididae (fertile) Schwartz 1981 (ref. 139, 728, 1565, 1646), Bartley et al. 1997, Scribner et al. 2001
Hypophthalmichthys × *Labeo* **IF** Xenocyprididae × Cyprinidae Schwartz 1981 (ref. 53, 139, 694, 728, 1467, 1565)
Hypophthalmichthys × *Megalobrama* Xenocyprididae Schwartz 1981 (ref. 728)
Hypophthalmichthys (Aristichthys°) × *Mylopharyngodon* Xenocyprididae Schwartz 1972 (ref. 1044a), Schwartz 1981 (ref. 996)
Hypophthalmichthys × *Mylopharyngodon piceus* Xenocyprididae Schwartz 1981 (ref. 996)
Hypophthalmichthys × *Parabramis* Xenocyprididae Schwartz 1981 (ref. 728, 1369, 1370)
Hypophthalmichthys (Aristichthys°) × *Parabramis* Xenocyprididae Schwartz 1972 (ref. 1044a = Makeeva 1968)
Iotichthys × *Rhinichthys* Leuciscidae Miller & Behnke 1985
Lavinia × *Hesperoleucus* Leuciscidae (nat. hyb.) Hubbs 1955
Lavinia × *Orthodon* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)
Lavinia × *Pogonichthys* Leuciscidae Schwartz 1981 (ref. 1042)
Lavinia × *Pogonichthys* Leuciscidae (nat. hyb.) Hubbs 1955
Leucaspius × *Pseudorasbora* **IF** Leuciscidae × Gobionidae Gozlan & Beyer 2006 (up to the first larval stage)
Leucaspius × *Rhodeus* **IF** Leuciscidae × Acheilognathidae Schwartz 1972 (ref. 668, 872)
Leucaspius × *Rutilus rutilus* Leuciscidae v. Knauthe 1981
Leucaspius × *Scardinius* (*"Leuciscus"*) *erythrophthalmus* Leuciscidae Schwartz 1972 (ref. 866, 870, 991), Schwartz 1981 (ref. 290, 869)
Leucaspius × *Squalius* Leuciscidae (art. hyb.) Schwartz 1972 (ref. 886, 870, 991, 1731)

Leuciscus ("Aspius") × *Leuciscus* **IS** Leuciscidae Schwartz 1972 (ref. 804, 1519 etc.), Schwartz 1981 (ref. 290, 1252, 1327, 1698)
Leuciscus × *Notropis* Leuciscidae Schwartz 1972 (ref. 95)
Leuciscus × *Rutilus* Leuciscidae Schwartz 1981 (ref. 471, 1193, 1519, 1726, 1727, 1326, 1543), Scribner et al. 2001

Leuciscus ("Aspius") × *Rutilus* Leuciscidae Schwartz 1972 (ref. 426, 590; 826 = Kasansky 1930b; 946, 1292)

Leuciscus × *Scardinius* Leuciscidae (art. hyb.) Schwartz 1972 (ref. 2, 163, 394 etc., etc.), Schwartz 1981 (ref. 1252, 1253, 1326, 1383, 1727), Scribner et al. 2001

Leuciscus × *Schizothorax* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

Leuciscus ("Aspius") × *Squalius* Leuciscidae http://www.biolib.cz/en/taxon/id15529/pos200,200/ 2012

Leuciscus × *Squalius* Leuciscidae Schwartz 1972 (ref. 424, 991)

Leuciscus × *Tinca* **IF** Leuciscidae × Tincidae Schwartz 1972 (ref. 856, 946)

Leuciscus × *Tropidophoxinellus* Leuciscidae Carmona et al. 1997 = http://www.genetics.org/content/146/3/983.full.pdf+html

Leuciscus × *Vimba* Leuciscidae Schwartz 1972 (ref. 252, 946), Schwartz 1981 (ref. 1193, 1674)

Luxilus × *Chrosomus* Leuciscidae (nat. hyb.) Hubbs 1955

Luxilus × *Clinostomus* Leuciscidae (nat. hyb.) Hubbs 1955

Luxilus × *Nocomis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1032, 1276)

Luxilus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1276), Scribner et al. 2001

Luxilus × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955

Luxilus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955

Margariscus × *Notropis* Leuciscidae Schwartz 1981 (ref. 1042)

Megalobrama × *Xenocypris* Xenocyprididae http://pir.uniprot.org/taxonomy/564289

Mylocheilus × *Ptychocheilus* Leuciscidae (nat. hyb.) Weisel 1955, Hubbs 1955, Schwartz 1972 (ref. 274, 278, 1548, 1549, 1758 = Weisel 1954a, 1759 = Weisel 1954b), Schwartz 1981 (ref. 1042, 1235, 1523)

Mylocheilus × *Richardsonius* Leuciscidae (nat. hyb., fertile) Weisel 1954, Hubbs 1955, Schwartz 1972 (ref. 1548, 1549, 1759 etc.), Schwartz 1981 (ref. 191, 192, 326, 1042, 1496), Scribner et al. 2001

Mylopharodon × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)

Nocomis × *Notemigonus* Leuciscidae Schwartz 1981 (ref. 1042)

Nocomis × *Notropis* Leuciscidae Schwartz 1972 (ref. 963, 965 etc.), Stauffer et al. 1977, Schwartz 1981 (ref. 1042, 1074, 1424, 1496, 1521, 1743)

Nocomis × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1548, 1549, 1777a), Stauffer et al. 1979, Schwartz 1981 (ref. 1042, 1496, 1522, 1523)

Nocomis × *Semotilus* Leuciscidae Ross & Cavender 1981, Schwartz 1981 (ref. 1042, 1352)

Notemigonus × *Scardinius* Leuciscidae Burkhead & Williams 1991, Scribner et al. 2001

Notemigonus × *Semotilus* Leuciscidae Schwartz 1981 (ref. 1042)

Notropis × *Phenacobius* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)

Notropis × *Phoxinus* Leuciscidae Schwartz 1972 (ref. 963), Hambrick 1977, Schwartz 1981 (ref. 693 = Hambrick 1977), 1496)

Notropis × *Pimephales* Leuciscidae Schwartz 1981 (ref. 1042)

Notropis × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)
Notropis × *Rhinichthys* Leuciscidae Ross & Cavender 1977, Schwartz 1981 (ref. 1042, 1353, 1496)
Notropis × *Semotilus* Leuciscidae Schwartz 1972 (ref. 500, 963, 1378 etc.), Schwartz 1981 (ref. 665, 1042, 1496)
Opsariichthys bidens × *Zacco* Xenocyprididae Fang et al. 2025
Oregonichthys × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)
Oreinus° *sinuatus* (= *Schizothorax plagiostomus*) × *Schizothorax labiatus* **IS** Cyprinidae Barbidae Schwartz 1972 (ref. 681, 1548, 1549), Schwartz 1981 (ref. 1595)
Orthodon × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955
Orthodon × *Richardsonius* Leuciscidae (nat. hyb.) Hubbs 1955
Orthodon × *Semotilus* Leuciscidae Schwartz 1981 (ref. 1042)
Orthodon × *Siphateles* (*"Gila"*) Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 278
Paracheilognathus° (= *Tanakia* p. p.) × *Rhodeus* Acheilognathidae Duyvené de Wit 1964, Schwartz 1972 (ref. 375, 672, 679), Schwartz 1981 (ref. 750)
Paracheilognathus° (= *Tanakia* p. p.) × *Tanakia* **IS** Acheilognathidae Duyvené de Wit 1964, Schwartz 1972 (ref. 375, 377)
Pelecus cultratus × *Rutilus rutilus* Leuciscidae Schwartz 1972 (ref. 826)
Phoxinus × *Scardinius* Leuciscidae Schwartz 1972 (ref. 946)
Phoxinus × *Semotilus* Leuciscidae (fertile) Schwartz 1972 (ref. 979a, 979b), Grady & Cashner 1988 (nat. hyb.), Maurakis & Woolcott 1992, Eisenhour & Piller 1997, Scribner et al. 2001
Phoxinus × *Telestes* Leuciscidae Schwartz 1972 (ref. 80, 81), Schwartz 1981 (ref. 187, 188, 1508), Arnoult & Spillmann 1965 (adult)
Platygobio × *Rhinichthys* Leuciscidae Schwartz 1981 (ref. 1042)
Pseudogobio × *Pseudorasbora* Gobionidae Schwartz 1972 (ref. 1632, 1636 = Suzuki 1968), Schwartz 1981 (ref. 491 = Dangel et al. 1973)
Pseudorasbora × *Sarcocheilichthys* Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)
Ptychocheilus × *Rhinichthys* Leuciscidae Schwartz 1972 (ref. 1012)
Ptychocheilus × *Richardsonius* Leuciscidae Schwartz 1972, McAllister & Coad 1978 (p. 2201: „incorrectly listed by Schwartz (1972)")
Ptychocheilus × *Richardsonius* Leuciscidae (nat. hyb.) Hubbs 1955, Meisel 1955, Schwartz 1972 (ref. 274, 278), Schwartz 1981 (ref. 1042, 1235, 1496)
Pungtungia herzi × *Pseudorasbora parva* Gobionidae Kim et al. 2015 (nat. hyb.) https://koreascience.kr/article/JAKO201511742735149.page
Puntius × *Rhodeus* **IF** Cyprinidae × Acheilognathidae Schwartz 1972 (ref. 115 = Balon et al. 1962)
Rhinichthys (*Apocope*°) × *Richardsonius* Leuciscidae Calhoun 1940, Schwartz 1972 (ref. 269 = Calhoun 1940; 1012, 1493, 1536)
Rhinichthys × *Richardsonius* Leuciscidae (nat. hyb.) Calhoun 1940, Meisel 1955, Hubbs 1955, Schwartz 1972 (ref. 127a, 274, 278, 785 etc.), Schwartz 1981 (ref. 1042)
Rhinichthys × *Semotilus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 1548, 1549), Ross &

Cavender 1981, Schwartz 1981 (ref. 1042, 1352)

Rhodeus × *Sarcocheilichthys* **IF** Acheilognathidae × Gobionidae Schwartz 1972 (ref. 1621, 1636 = Suzuki 1968)

Rhodeus × *Tanakia* Acheilognathidae Schwartz 1972 (ref. 364, 367, 369, 373, 379, 1636 = Suzuki 1968), Kawamura & Hosoya 2000

Rhynchocypris (= *Morocco*°) *percnurus* × *Tribolodon hakonensis* Leuciscidae Schwartz 1972 (ref. 884)

Rutilus × *Scardinius* Leuciscidae Schwartz 1972 (ref. 1519 sub *Leuciscus*), Schwartz 1981 (ref. 176, 290, 873 = Kobayasi 1965, 1193, 1253, 1726 etc.), Gilles et al. 1998, Scribner et al. 2001

Rutilus rubilio × *Squalius squalus* Leuciscidae Chiesa et al. 2013 (nat hyb.)

Rutilus × *Tinca* **IF** Leuciscidae × Tincidae Schwartz 1972 (ref. 946, 1225), Schwartz 1981 (ref. 1193)

Rutilus rutilus × *Vimba vimba* (= *Abramis melanops*) Leuciscidae Schwartz 1972 (ref. 2, 780, 991) Schwartz 1981 (ref. 1673 = Vladimirov 1978)

Scardinius × *Squalius tenellus* Leuciscidae Freyhof et al. 2005

Scardinius × *Tinca* **IF** Leuciscidae × Tincidae Schwartz 1972 (ref. 1219 = Nikoljukin 1935; 1223 = Nikoljukin 1939; 1410), Schwartz 1981 (ref. 1193)

Squalius (= *Leuciscus*) *cephalus* × *Vimba vimba* Leuciscidae Schwartz 1972 (ref. 252, 946)

Intersubordinal hybrids within Cypriniformes: 6 ISO

Acheilognathus × *Cobitis biwae* **ISO** Acheilognathidae × Cobitidae Schwartz 1972 (ref. 1621 = Suzuki 1959; ref. 1636 = Suzuki 1968)

Acheilognathus × *Misgurnus* **ISO** Acheilognathidae × Cobitidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Acheilognathus moriokae × *Misgurnus anguillicaudatus* **ISO** Acheilognathidae × Cobitidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968), Suzuki 1973b, Schwartz 1981

Barbatula ("*Cobitis*") *barbatula* × *Gobio fluviatilis* **ISO** Nemacheilidae × Gobionidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

Barbatula („*Cobitis*") *barbatula* × *Phoxinus phoxinus* („*laevis*") **ISO** Nemacheilidae × Leuciscidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

Barbatula ("*Cobitis*", *Nemacheilus*°) *barbatula* × *Gobio fluviatilis* **ISO** Nemacheilidae × Gobionidae (art. hyb., confirmed) von Knauthe 1891, Schwartz 1972 (ref. 991 = Leonhardt 1903)

Barbatula (= *Nemacheilus*°) *barbatula* × *Phoxinus* **ISO** Nemacheilidae × Leuciscidae Schwartz 1981 (ref. 290 = Berinkey 1960)

Barbatula toni × *Carassius auratus* **ISO** Nemacheilidae × Cyprinidae Kobayasi & Yamabayashi 1958 (see Kobayasi 1963: „a part of the eggs showed no observable abnormality in the course of their development; the larvae hatched and grew normally, with general external features characteristic of the funa."), Schwartz 1972 (p. 238 sub Cobitidae: ref. 885 = Kobayasi 1963)

Barbatula toni × *Carassius carassius* Nemacheilidae × Cyprinidae **ISO** Schwartz 1972 (p. 238 sub Cobitidae: ref. 885 = Kobayasi 1963)

Biwia zezera × *Cobitis biwae* **ISO** Gobionidae × Cobitidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Biwia zezera × *Misgurnus anguillicaudatus* **ISO** Gobionida × Cobitidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Carassius × *Cobitis* Cyprinidae × Cobitidae **ISO** Schwartz 1972 (ref. 80 = Arnoult & Spillman 1966; ref. 1636 = Suzuki 1968)

Carassius × *Lefua echigonia* **ISO** Cyprinidae: × Nemacheilidae Schwartz 1972 (ref. 1620 = Suzuki 1957; ref. 1636 = Suzuki 1968), Schwartz 1981 (885, 1636 = Suzuki 1968)

Carassius auratus × *Misgurnus anguillicaudatus, fossilis* **ISO** Cyprinidae × Cobitidae (art. hyb.) Kobayasi 1963 („a part of the eggs from the cross developed normally, and the larvae which hatched grew into fishes having the general features of the funa .... no elimination of ... paternal … chromosomes ... the cause of the maternal effect remains in doubt and a subject for future investigation". The author cites Suzuki, that the hybrid eggs showed high mortality at the gastrula and hatching stages and that some larvae survived for 24 days after hatching), Schwartz 1972 (ref. 113, 885; 886 = Kobayasi 1963: larvae with distinct maternal characters, but not parthenogenetic; ref. 888, 1614; 1615 = Suzuki 1955; 1636 = Suzuki 1968), Schwartz 1981 (ref. 720, 878, 1168; ref. 1185 = Neyfakh 1974 („The data obtained prove the participation of paternal genes in development and maintenance of viability of embryos at all developmental stages beginning from the early ones (blastula)."); ref. 1187, 1554, 1614, 1615 etc.)

Cobitis biwae × *Cyprinus carpio* **ISO** Cobitidae × Cyprinidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cobitis biwae × *Gnathopogon elongatus* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cobitis biwae × *Pseudogobio esocinus* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cobitis biwae × *Pseudorasbora parva* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cobitis biwae × *Rhodeus* **ISO** Cobitidae × Acheilognathidae Schwartz 1972 (ref. 1621 = Suzuki 1959; ref. 1636 = Suzuki 1968)

Cobitis biwae × *Sarcocheilichthys* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1621 = Suzuki 1959; ref. 1636 = Suzuki 1968)

Cobitis biwae × *Zacco platipus, temmincki* **ISO** Cobitidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Cyprinus carpio × *Misgurnus anguillicaudatus* **ISO** Cyprinidae × Cobitidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Danio rerio, malabaricus × *Misgurnus fossilis* **ISO** Danionidae × Cobitidae Neyfakh et al. 1973 („hybrid larvae survive until 3–4 days after hatching"), Neyfakh 1974 („The data obtained prove the participation of paternal genes in development and

maintenance of viability of embryos at all developmental stages beginning from the early ones (blastula)."), Schwartz 1981 (ref. 629, 711, 1185, 1188)

Gnathopogon × *Lefua echigonia* **ISO** Gobionidae × Nemacheilidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Gnathopogon elongatus × *Misgurnus anguillicaudatus* **ISO** Gobionidae × Cobitidae Schwartz 1972 (ref. 1101, 1617; 1636 = Suzuki 1968)

Leuciscus schmidti × *Triplophysa* (= *Nemacheilus*°) *dorsalis* **ISO** Leuciscidae × Nemacheilidae Schwartz 1972 (p. 240 sub Cobitidae: ref. 950 = Kryzanovski 1968)

Misgurnus × *Rhodeus* **ISO** Cobitidae × Acheilognathidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968)

Misgurnus × *Sarcocheilichthys* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968)

Misgurnus × *Pseusaspius (Tribolodon°)* **ISO** Cobitidae × Leuciscidae Schwartz 1972 (ref. 1636 = Suzuki 1968), Schwartz 1981 (ref. 629, 1185, 1188)

Misgurnus anguillicaudatus × *Pseudogobio esocinus* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Misgurnus anguillicaudatus × *Pseudorasbora parva* **ISO** Cobitidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Misgurnus anguillicaudatus × *Rhynchocypris* (*Morocco*°) *percnurus* **ISO** Cobitidae × Leuciscidae Schwartz 1972 (ref. 892

Misgurnus anguillicaudatus × *Rutilus rutilus* **ISO** Cobitidae × Leuciscidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968)

Misgurnus anguillicaudatus × *Zacco platipus, temmincki* **ISO** Cobitidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Misgurnus fossilis × *Puntigrus* (= *Barbus*) *tetrazona* **ISO** Cobitidae × Cyprinidae Schwartz 1981 (ref. 1185 = Neyfakh 1974 („The data obtained prove the participation of paternal genes in development and maintenance of viability of embryos at all developmental stages beginning from the early ones (blastula)."); ref. 1188 = Neyfakh et al. 1976)

Misgurnus fossilis × *Trigonostigma* (= *Rasbora*) *heteromorpha* **ISO** Cobitidae × Danionidae **IF** Neyfakh 1973 („the larvae ... die on the next day after hatching"), Neyfakh 1974 („The data obtained prove the participation of paternal genes in development and maintenance of viability of embryos at all developmental stages beginning from the early ones (blastula).")

Triplophysa (= *Nemacheilus*°) *dorsalis* × *Schizothorax* **ISO** Nemacheilidae × Cyprinidae Schwartz 1972 (p. 240 sub Cobitidae: ref. 950 = Kryzanovski 1968, 1423)

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Cyprinodontiformes 2 suborders, 14 families, 150: 1500 + extint families. 28 IG + 16 IT + 10 IF + 5 ISO

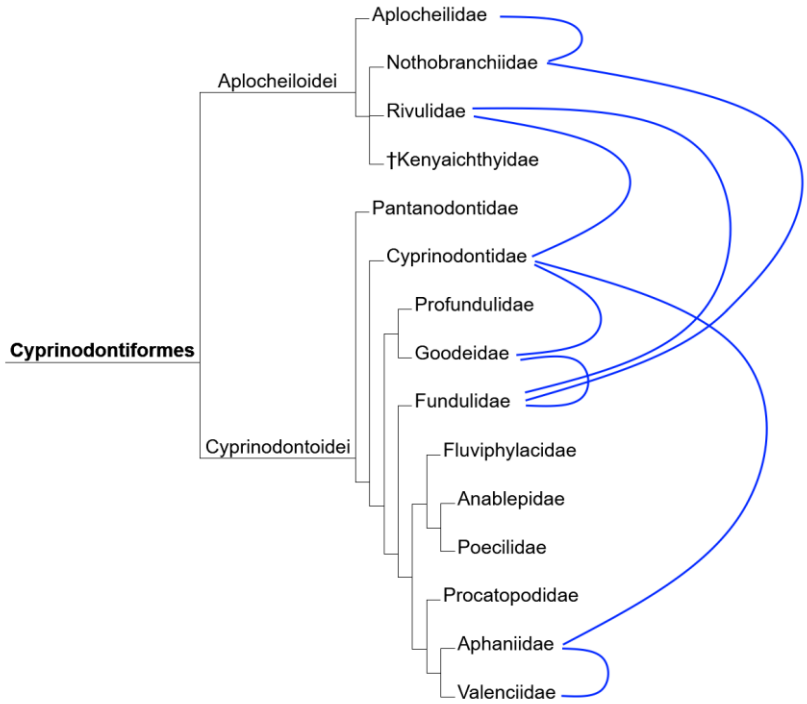
tooothcaps = Zahnkärpflinge

2 suborders:

Aplocheiloidei 3 families: Aplocheilidae 3: 15, Nothobranchiidae 8: 300, Rivulidae 36: 350.

Cyprinodontoidei 11 families: Anablepidae 3: 16, Aphaniidae 8: 42 (formerly part of Cyprinodontidae), Cyprinodontidae 11: 1209, Fluviphylacidae 1: 5, Profundulidae 1: 8, Goodeidae 20: 45, Fundulidae 5: 50, Pantanodontidae 1: 2, Poeciliidae 37: 200, Procatopodidae 14, Valenciidae (formerly part of Cyprinodontidae) 1: 3.

Probably **basic type order Cyprinodontiformes** (150: 1500), due to several interfamilial and intersubordinal hybrids, including connections between the most distant taxa, see the figure below. Calibrated age of Cyprinodontiformes as a whole: ca. 85 mya (Tagliacollo VA et al. 2024, Fig. 2. doi: 10.3389/fbinf.2024.1433995).



Cyprinodontiformes: hybrids in the phylogeny of Bragança PHN et al. (2018), doi:10.3897/zse.94.22173; Altner M & Reichenbacher B (2015) doi:10.1371/journal.pone.0123056, from en.wikipedia (2025, CC BY 4.0.

Interfamilial and intersubordinal hybrids in Cyprinodontiformes. 10 IF + 5 ISO

Adinia xenica × *Crenichthys* **IF** Fundulidae × Goodeidae (art. hyb.) Hubbs & Drewry 1962, Schwartz 1972 (p. 272 sub Cyprinodontidae: ref. 451, 745 = Hubbs & Drewry 1962)

Adinia xenica × *Cyprinodon variegatus* **IF** Fundulidae × Cyprinodontidae Schwartz 1972 (ref. 744 = Hubbs & Drewry 1959b („failed to hatch"))

Aphanius × *Valencia hispanica* **IF** Aphaniidae × Valenciidae Schwartz 1972 (ref. 451, 1717 = Villwock 1960)

Aphanius apodus × *Cyprinodon fasciatus* **IF** Aphaniidae × Cyprinodontidae Schwartz 1972 (ref. 282)

Aphyosemion × *Fundulus* **ISO** Nothobranchiidae × Fundulidae Schwartz 1972 (ref. 1467 = Scheel 1968), Schwartz 1981 (ref. 91 = Anonymus 1974)

Aphyosemion gardneri × *Procatopus aberrans* **ISO** Nothobranchiidae × Poeciliidae Schwartz 1981 (ref. 1386 = Scheel 1974)

Aphyosemion gardneri × *Rivulus milesi* (= *magdalenae*) **IF** Nothobranchiidae × Rivulidae Schwartz 1981 (ref. 1386 = Scheel 1974)

Aplocheilus lineatus, panchax × *Epiplatys* (= *Aplocheilus*°) *fasciolatus, sexfasciatus, spilargyreius* **IF** Aplocheilidae × Nothobranchiidae Schwartz 1981 (ref. 1386 = Scheel 1974)

Crenichthys × *Cyprinodon* **IF** Goodeidae × Cyprinodontidae Schwartz 1972 (ref. 745 = Hubbs & Drewry 1962)

Crenichthys × *Fundulus* **IF** Goodeidae × Fundulidae (Hubbs 1971a: mature), Schwartz 1972 (ref. 451, 740a, 745 = Hubbs & Drewry 1962)

Crenichthys bailey × *Cyprinodon* **IF** Goodeidae × Cyprinodontidae Schwartz 1972 (ref. 745 = Hubbs & Drewry 1962)

Crenichthys bailey × *Fundulus parvipennis* **IF** Goodeidae × Fundulidae (art. hyb.) Hubbs & Drewry 1962, Schwartz 1972 (ref. 739 = Hubbs 1967)

Crenichthys × *Lucania* **IF** Goodeidae × Fundulidae Schwartz 1972 (ref. 451, 745 = Hubbs & Drewry 1962)

Cynolebias° *(Austrolebias) bellottii* × *Cyprinodon dispar* **ISO** Rivulidae × Cyprinodontidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Cynolebias° (*Austrolebias*) *bellottii* × *Jordanella floridae* **ISO** Rivulidae × Cyprinodontidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Cyprinodon × *Fundulus* **IF** Cyprinodontidae × Fundulidae Newman 2014 (sub Poeciliidae: „... as for the best combination: gastrulation had begun but could not progress further"), Hubbs & Drewry 1959b („Although survival was low, one *Fundulus* by *Cyprinodon* hybrid hatched and ingested food."), Schwartz 1972 (ref. 385 = Drewry 1967; 451, 744, 1101, ref. 1201, 1202, 1203 = Newman)

Epiplatys fasciolatus × *Rivulus milesi* (= *magdalenae*) **IF** Nothobranchiidae × Rivulidae Schwartz 1981 (ref. 91 = Anonymus)

Fundulopanchax × *Fundulus* **IF** Nothobranchiidae × Fundulidae Schwartz 1972 (ref. 1467 = Scheel 1968)

Fundulus × *Jordanella* **ISO** Fundulidae × Cyprinodontidae Hubbs 1971a (mature), Schwartz 1972 (ref. 76 = Archer 1966)

Fundulus × *Nothobranchius* **IF** Fundulidae × Nothobranchiidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Fundulus × *Panchax*° *calliurus* (= *Fundulopanchax gardneri*) **ISO** Fundulidae × Nothobranchiidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Fundulus × *Panchax*° *polychromus* (= *Aphyosemion australe*) **ISO** Fundulidae × Nothobranchiidae Schwartz 1972 (ref. 1473 = Schmidt 1930)

Fundulus × *Rachovia* **ISO** Fundulidae × Rivulidae Schwartz 1972 (ref. 76 = Archer 1966)

Fundulus × *Rivulus* **ISO** Fundulidae × Rivulidae Hubbs 1971a (mature), Schwartz 1972 (ref. 76 = Archer 1966)

Jordanella × *Lucania* **ISO** Cyprinodontidae × Fundulidae Hubbs 1971a, Schwartz 1972 (ref. 76 = Archer 1966)

Jordanella × *Rivulus* **ISO** Cyprinodontidae × Rivulidae Schwartz 1972 (ref. 76 = Archer 1966)

Rivulus roloffi × *Scriptaphyosemion* (= *Aphyosemion*°) *bertholdi* **IF** Rivulidae × Nothobranchiidae Schwartz 1981 (ref. 1582)

Cyprinodontiformes: Aphaniidae 8: 42 + extinct species. **3 IG** (suborder Cyprinodontoidei)

Oriental killifishes
formerly part of family Cyprinodontidae
Anatolichthys, Aphaniops, Aphanius, Apricaphanius, Esmaeilius, Kosswigichthys, Paraphanius, Tellia.

Anatolichthys × *Aphanius* Schwartz 1972 (ref. 6, 451, 920), Schwartz 1981 (ref. 1669 = Villwock 1958)
Anatolichthys × *Kosswigichthys* Schwartz 1972 (ref. 2, 6, 1768), Schwartz 1981 (ref. 1669 = Villwock 1958)
Aphanius × *Kosswigichthys* (fertile) Schwartz 1972 (ref. 6, 451, 922, 1181, 1718, 1768), Schwartz 1981 (ref. 1669 = Villwock 1958)

Cyprinodontiformes: Aplocheilidae 3: 15 (suborder Aplocheiloidei)

Asian killifishes
Formerly including families Nothobranchiidae and Rivulidae.

IS: Schwartz 1981 (p. 354): *Aplocheilus* ca. 10 IS (but he obviously also used *Aplocheilus* as a synonym of genera which now are placed in other families of the order)

Cyprinodontiformes: Cyprinodontidae 9: 100. **2 IG** (suborder Cyprinodontoidei)

pupfishes
Cualac 1, Cubanichthys 2, Cyprinodon 48, Floridichthys 2, Garmanella 1, Jordanella 1, Megupsilon 1 (extinct in 2014), *Orestias 45.*

Cyprinodon div. spec. × *Jordanella floridae* Schwartz 1972 (ref. 76 = Archer 1966, 740a, 1473 = Schmidt 1930), Schwartz 1981 (ref. 94, 448, 449)
Cyprinodon alvarezi × *Megupsilon aporus* (fertile) Schwartz 1981 (ref. 679 = Haas 1979)

Cyprinodontiformes: Fundulidae 3: 47 + extinct species. **2 IG** (suborder Cyprinodontoidei)

topminnows and North American killifishes = Nord- und mittelamerikanische Zahnkärpflinge
part of Cyprinodontidae of Hubbs 1955
Fundulus 45 (incl. *Adinia° xenica*), *Leptolucania 1, Lucania 3.*
IS: Schwartz 1981: *Fundulus ca. 40 IS.*

Adinia° (= *Fundulus*) *xenica* × *Fundulus grandis* **IS** Hubbs 1971a (mature), Schwartz 1972 (ref. 451, 744 = Hubbs & Drewry 1959), Schwartz 1981 (ref. 528 = Drewry 1967)

Adinia° (= *Fundulus*) *xenica* × *Lucania* Schwartz 1981 (ref. 528 = Drewry 1967)
Chriopeops° (= *Lucania*) *goodei* × *Lucania parva* **IS** (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 725, 1237, 1548, 1549), Schwartz 1981 (ref. 1193)
Fundulus grandis × *Lucania goodei, parva* Schwartz 1972 (ref. 76 = Archer 1966, 385, 451, 740a, 744 = Hubbs & Drewry 1959; ref. 1417), Schwartz 1981 (ref. 528)
Fundulus × *Plancterus*° (= *Fundulus*) *kansae* **IS** Schwartz 1972 (ref. 725)

Cyprinodontiformes: Goodeidae 20: 45. 9 IG (suborder Cyprinodontoidei)

splitfins or goodeids = Hochlandkärpflinge

2 subfamilies:
Empetrichthyinae 2: 3 *Crenichthys 2, Empetrichthys 1*
Goodeinae 18: 42 *Ameca, Goodea, Xenoophorus, …*

IS: Schwartz 1981: *Xenotoca 3 IS*

Allotoca dugesi × *Characodon lateralis* Goodeinae Schwartz 1972 (ref. 1127), Schwartz 1981 (= Fitzsimons 1972)
Ameca splendens × *Characodon lateralis* Goodeinae Schwartz 1981 (= Fitzsimons 1972)
Ameca × *Xenoophorus captivus* Goodeinae Schwartz 1972 (ref. 1127)
Ameca splendens × *Xenotoca eiseni* Goodeinae Schwartz 1972 (ref. 1127), Schwartz 1981 (= Fitzsimons 1972)
Balsadichthys° (= *Ilyodon*) *xantusi* × *Ilyodon furcidens* Goodeinae Schwartz 1972 (ref. 724 = Hubbs & Turner 1939; 1127 = Miller & Fitzsimons 1971)
Characodon lateralis × *Xenoophorus captivus* Goodeinae Schwartz 1981 (= Fitzsimons 1972)
Characodon lateralis × *Xenotoca eiseni, melanosoma, eiseni* Goodeinae Schwartz 1981 (= Fitzsimons 1972)
Crenichthys bailey × *Empetrichthys* Empetrichthyinae Schwartz 1972 (ref. 739 = Hubbs 1967)
Xenoophorus captivus × *Xenotoca eiseni* Goodeinae Schwartz 1981 (= Fitzsimons 1972)

Cyprinodontiformes: Nothobranchiidae 8–15: 300. 6 IG (suborder Aplocheiloidei)

African killifishes

Schwartz 1972: p. 272 sub Cyprinodontidae.
Aphyosemion (incl. *Panchax*° *bualanus, calliurus, cameronensis, ...*), *Callopanchax, Epiplatys* (e.g. *fasciolatus, sexfasciatus, spilargyreius*), *Fenerbahce, Fundulopanchax, Nimbapanchax, Nothobranchius 54, Scriptaphyosemion, ….*

IS: Schwartz 1982 (p. 351): *Aphyosemion ca. 50 IS.*

Aphyosemion (= *Haplochilus*°, *Panchax*°) *chaperi* × *Epiplatys sexfasciatus* Schwartz 1972 (ref. 1467)
Aphyosemion × *Epiplatys* Schwartz 1972 (p. 280 sub *Panchax*: ref. 1473 = Schmidt 1930), Schwartz 1981 (ref. 91)
Aphyosemion × *Haplochilus*° (= *Aphyosemion*) **IS** Schwartz 1972 (ref. 1467)
Aphyosemion × *Nothobranchius* Schwartz 1972 (ref. 1473 = Schmidt 1930), Schwartz 1981 (ref. 91, 1344, 1386 = Scheel 1974)
Aphyosemion × *Roloffi*° (= *Scriptaphyosemion*) *bertholdi, roloffi* Schwartz 1981 (ref. 91)
Aphyosemion × *Roloffi*° (= *Callopanchax*) *occidentalis* Schwartz 1981 (ref. 91)
Epiplatys × *Haplochilus*° (= *Epiplatys* p. p.) Schwartz 1972 (ref. 1467)
Epiplatys × *Roloffi*° (= *Aphyosemion*) *petersi* Schwartz 1981 (ref. 91)

Cyprinodontiformes: Poeciliidae 30: 200 7 IG + 16 IT (suborder Cyprinodontoidei)

livebearers = Lebendgebärende Zahnkarpfen
3 subfamilies:
Poeciliinae 28: 198, Tomeurinae 1: 1, Xenodexiinae 1: 1.

Poeciliinae 8 tribes:
Alfarini 1: 2.
Cnesterodontini 4, *Cnesterodon, Phalloceros*, …
Gambusiini 4 *Belonesox, Gambusia*, …
Girardini 3 *Girardinus*, …
Heterandriini *6 Heterandria* (incl. *Pseudoxiphophorus*), *Neoheterandria, Poeciliopsis*, …
Poeciliini *6 Limia, Micropoecilia, Poecilia* (incl. *Lebistes*°, *Mollienisia*°), *Xiphophorus* (incl. *Platypoecilus*°), …
Priapellini 1 *Priapella*
Sccolichthyini 1

IS: Schwartz 1972: *Xiphophorus* ca. 100 IS, ...
Schwartz 1981: *Gambusia 4 IS, Limia 3 IS, Poecilia ca. 12 IS, Poeciliopsis ca. 20 IS, Xiphophorus* ca. *20 IS.*
Poecilia (= *Mollienisia*°) *formosa* and *Poeciliopsis lucida* are gynogenetic species.

The family **Poeciliidae** (37: 200) is part of the basic type order Cyprinodontiformes. All known hybrids are within subfamily Poeciliinae (28: 198), linking 5 of the 8 tribes. No confirmed connections exist yet of Poeciliidae with other families of the order, but from a molecular view the family is nested within the order.

Belonesox belizanus × *Heterandria* (= *Pseudoxiphophorus*°) *bimaculata* **IT** Gambusini × Heterandriini Schwartz 1972 (ref. 1473 = Schmidt 1930)
Belonesox belizanus × *Limia* **IT** Gambusiini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Belonesox belizanus × *Poecilia* (= *Mollienisia*°) **IT** Gambusiini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Belonesox belizanus × *Xiphophorus* (= *Platypoecilus*°) **IT** Gambusiini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Cnesterodon decemmaculatus × *Gambusia heterochir* **IT** Cnesterodontini × Gambusiini Schwartz 1972 (ref. 1486, 1487)

Dactylophallus° (*Girardinus*) × *Girardinus* **IS** *Girardini* (nat. hyb.) Hubbs 1955

Gambusia × *Girardinus* **IT** Gambusiini × Girardini Schwartz 1972 (ref. 1683, 1684)

Gambusia × *Phalloceros caudimaculatus* **IT** Gambusiini × Cnesterodontini Schwartz 1972 (ref. 227, 1486, 1487)

Gambusia × *Poecilia* (= *Mollienisia*°) **IT** Gambusiini × Poeceliini Schwartz 1972 (ref. 93, 131 = Aduma-Bossmann & Keiz 1971, 689, 1683, 1684)

Girardinus × *Poecilia* (incl. *Mollienisia*°) **IT** Girardini × Poeceliini Schwartz 1972 (ref. 1683, 1684)

Girardinus × *Poecilia* **IT** Girardini × Poeceliini Schwartz 1972 (ref. 1683, 1684)

Glaridichthys° (= *Girardinus* p. p.) × *Girardinus* **IS** Girardini (nat. hyb.) Hubbs 1955

Heterandria (= *Pseudoxiphophorus*°) × *Limia* **IT** Heterandriini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Heterandria formosa × *Phalloceros caudomaculatus* **IT** Heterandriini × Cnesterodontini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Heterandria (incl. *Pseudoxiphophorus*°) × *Poecilia* (incl. *Lebistes*°, *Mollienisia*°) **IT** Heterandriini × Poeceliini Schwartz 1972 (ref. 411, 1473 = Schmidt 1930), Schwartz 1981 (ref. 1261)

Heterandria × *Xiphophorus* (= *Platypoecilus*°) **IT** Heterandriini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Lebistes° (= *Poecilia* p. p.) × *Limia* Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930), Schwartz 1981 (ref. 1403)

Lebistes° × *Mollienisia*° (= *Poecilia* p. p.) Poeceliini (art. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1661)

Limia arnoldi × *Mollienisia*° (= *Poecilia*) *velifera* Poeceliini (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1473 = Schmidt 1930), Schwartz 1981 (ref. 1403)

Limia × *Phalloceros* **IT** Poeceliini × Cnesterodontini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Limia × *Poecilia* (incl. *Lebistes*°) Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930, 1606), Schwartz 1981 (ref. 1261)

Limia × *Xiphophorus* Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930, 1474, 1606)

Mollienisia° (= *Poecilia* p. p.) × *Poecilia reticulata* Poeceliini Schwartz 1981 (ref. 1261)

Phalloceros × *Poecilia* (= *Mollienisia*°) **IT** Cnesterodontini × Poeceliini Schwartz 1972 (ref. 1473 = Schmidt 1930)

Platypoecilus° (= *Xiphophorus* p. p.) × *Xiphophorus* **IS** Poeceliini (fertile) Kosswig 1928, Schwartz 1972, Schwartz 1981 (ref. 683, 1091 etc.

Poecilia (incl. *Lebistes*°, *Mollienisia*°) × *Xiphophorus* Poeceliini Schwartz 1972 (ref. 851a, 1473 = Schmidt 1930) Schwartz 1981 (ref. 1261)

Cyprinodontiformes: Rivulidae 39: 350. 2 IG (suborder Aplocheiloidei)

rivulids = New World killifishes

Formerly subfamily Rivulinae of Aplocheilidae s. l.
3 subfamilies (de.wikipedia 2025):
Cynolebiinae
Kryptolebiatinae 1 *Kryptolebias.*
Rivulinae *Austrofundulus, Pterolebias, Rivulus, Rachovia, …*

Austrofundulus × *Pterolebias* Rivulinae Schwartz 1972 (ref. 1344)
Pterolebias × *Rachovia* Rivulinae Schwartz 1972 (ref. 1344)

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Esociformes → Salmoniformes

Gadiformes 18 families

Gadiformes: Gadidae 11: 21. 1 IG

true cods = Dorsche

Gadus 3, Melanogrammus 1, …

Gadus × *Melanogrammus aeglefinus* (nat. hyb.) Schwartz 1972 (ref. 1548, 1549 = Slastenenko 1957)

Gasterosteiformes → Perciformes

Gobiiformes 3 suborders, 12 families

Formerly part of Perciformes
Family Gobiidae (based on *Gobius*) must not be confused with family Gobionidae based on *Gobio* of the order Cypriniformes.
3 suborders:
Apogonoidei 2 families.
Trichonotoidei 1 family.
Gobioidei 9 families.

Gobiiformes: Gobiidae 200: 2000. 2 IG (suborder Gobioidei)

gobies = Grundeln

Now excl. family Oxudercidae (= Gobionellidae)
no subdivision.

The former family **Gobiidae** s. l. was split into Gobiidae s. str. and Oxudercidae, but two old hybrid reports seem to show that they belong to the same basic type.

Acentrogobius × *Oxyurichthys* **IF** Gobiidae × Oxudercidae Gobiellinae (nat. hyb.) Schwartz 1972 (ref. 1741 = Weber & DeBeaufort 1953)
Acentrogobius × *Stigmatogobius* **IF** Gobiidae × Oxudercidae Gobiellinae (nat. hyb.) Schwartz 1972 (ref. 927 = Koumans 1940; 1741 = Weber & DeBeaufort 1953)

Gobiiformes: Oxudercidae = Gobionellidae 88: 600. 2 IG + 1 ISF (suborder Gobioidei)

mudskipper and allies

formerly part of Gobiidae
4 subfamilies:
Amblyopinae 15, Gobionellinae 55: 380, Oxudercinae 10, Sicydiinae 8: 118.

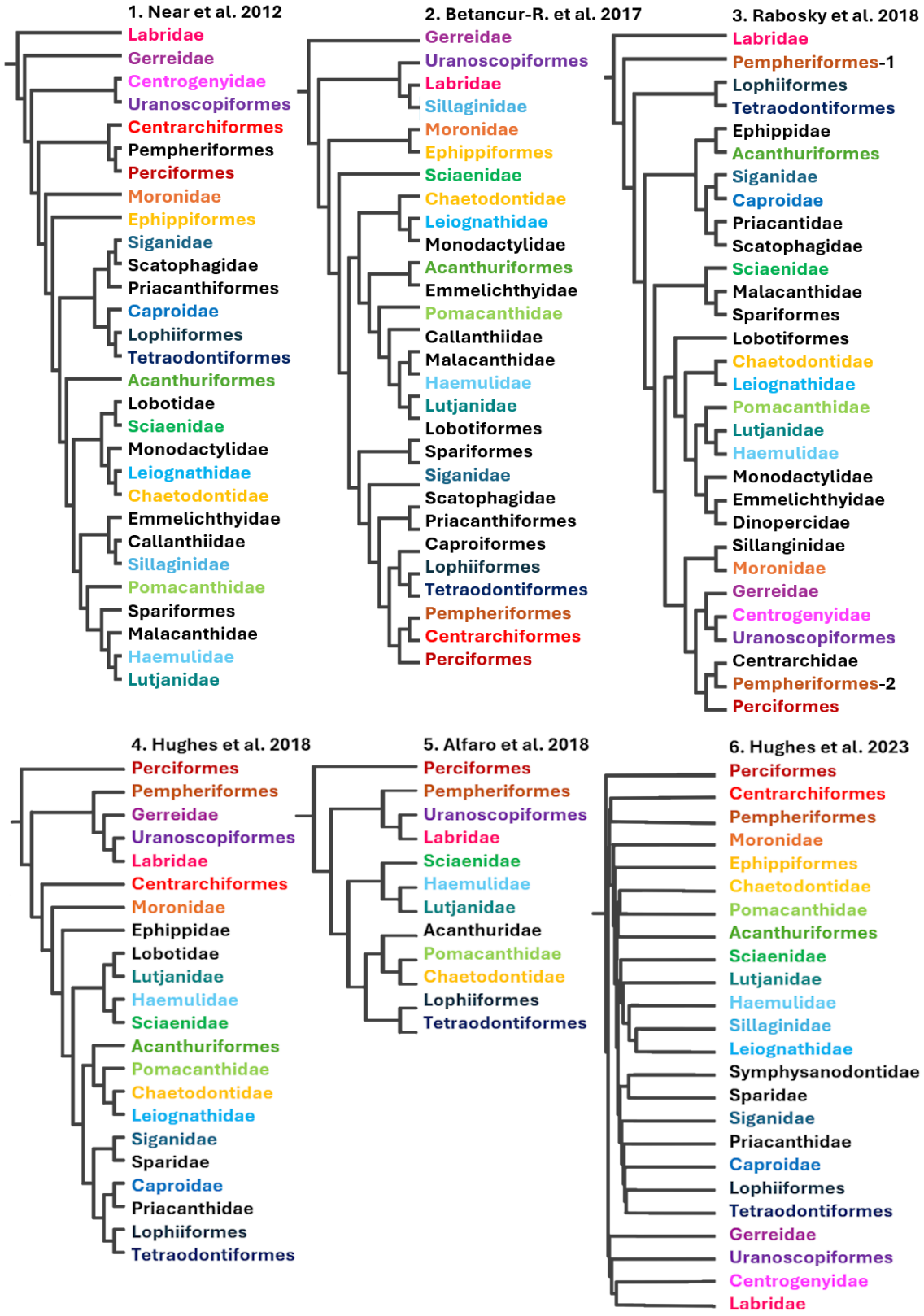
Clevelandia ios × *Ilypnus gilberti* Gobionellinae Schwartz 1972 (ref. 739 = Hubbs 1967)
Clevelandia ios × *Typhlogobius* Gobionellinae Schwartz 1972 (ref. 739 = Hubbs 1967)
Sicyopterus × *Stigmatogobius* **ISF** Sicydiinae × Gobionellinae (nat. hyb.) Schwartz 1972 (ref. 1741 = Weber & DeBeaufort 1953)

References on Gobiiformes:
Weber M & DeBeaufort LF (1953) The fishes of the Indo-Australian Archipelago. X. Gobioidea. Leiden: E. J. Brill. 423 p.

Labriformes 2 suborders, 8 families

formerly part of Perciformes
2 suborders:
Labroidei, Uranoscopoidei.

It is important to note that the molecular phylogeny of Eupercaria (incl. Labriformes) is a big mess (see figure below). Such contradictory phylogenetic reconstructions arise because different traits point in different evolutionary directions. This is a problem for evolutionary models which occurs often in phylogenies of fishes (Scholl 2024, https://www.wort-und-wissen.org/artikel/die-aeltesten-fossilen-fische/) and other animals, too (Scholl 2026 Missverständnisse über Evolution. Studium Integrale J. 33, 4–12).



Eupercaria: Different molecular phylogenies of Eupercaria after Hughes et al. (2023, Fig. 1), many abundant groups have their own color.

Labriformes: Labridae 82: 600. **4 IG + 1 IT** (suborder Labroidei)

wrasses and parrotfishes = Lippfische und Papageifische
en.wikipedia 2025: 9 tribes/subfamilies, incl. the former family Scaridae.

Centrolabrus exoletus × *Crenilabrus*° (= *Symphodus*) *melops* Labrini Schwartz 1972 (ref. 608 = Hagstrom & Wennesberg 1964)
Centrolabrus × *Labrus* Labrini Schwartz 1972 (ref. 608)
Gomphosus × *Thalassoma* Julidini Randall & Gerald 2004
Symphodus (= *Crenilabrus*°) *quinquemaculatus* (= *Symphodus roissali:* https://www.marinespecies.org/aphia.php?p=taxdetails&id=303739) × *Thalassoma pavo* **IT** Labrini × Julidini Schwartz 1972 (ref. 1013)
Tautoga onitis × *Tautogolabrus adspersus* Labrini Schwartz 1972 (ref. 1154 = Moenkhaus 1911), Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

References on Labridae:
Hagstrom BE & Wennesberg C (1964) Hybridization experiments with wrasses (Labridae). Sarsia 17, 47–54. = ref. 608 of Schwartz 1972.
Hertwig G & Hertwig P (1914) Kreuzungsversuche an Knochenfischen. Archiv für Mikroskopische Anatomie 84, Abt. 2, 49–88. + Tafel V. = ref. 643 of Schwartz 1972. interfamilial hybrids only a few days old and no normal embryos.
Serchuk FM & Frame DW (1973) An annotated bibliography of the cunner *Tautogolabrus adsperus* (Walbaum). US Dep. Commerce, NOAA Tech. Rep. NMFS SSRF–668. 43 p. = ref. 1431.
Randall JEA & Gerald R (2004) *Gomphosus varius* × *Thalassoma lunare*, a hybrid labrid fish from Australia. Aqua (Miradolo Terme) 8 (3), 135–139.

Lepisosteiformes 1 family + extinct families

Lepisosteiformes: Lepisosteidae 2: 7. 1 IG

gars = Knochenhechte

Basic type family Lepisosteidae (2: 7) Borger & Scholl 2024, 2025; Kutzelnigg unpubl. 2014 Fachtagung Biologie Wort und Wissen. Divergence time of hybridizing genera: 105 mya (Borger & Scholl 2024, 2025). Calibrated age of Lepisosteidae as a whole: ca. 300 mya (Tagliacollo VA et al. 2024, Fig. 2. doi: 10.3389/fbinf.2024.1433995).

Atractosteus spatula × *Lepisosteus osseus* (capt. hyb., adult) Herrington et al. 2008

References on Lepisosteiformes:
Borger P & Scholl B (2024) Evolutionärer Stillstand bei „lebenden Fossilien“ auch auf molekularer Ebene. Genesisnet News of 28.05.2024. https://www.genesisnet.info/index.php?News=340

Borger P & Scholl B (2025) Evolutionärer Stillstand auf molekularer Ebene bei Knochenhechten als „Lebenden Fossilien“. Stud. Integrale J. 32, 50–51.
Herrington SJ et al. (2008) Hybridization between longnose and alligator gars in captivity, with comments on possible gar hybridization in nature. Trans. Amer. Fisheries Soc. 137, 158–164. http://www.zoology.siu.edu/heist/Publications/Gar%20Hybridization.pdf pdf

Mugiliformes 2 families

en.wikpiepdia 2025 2 families: Ambassidae: 8: 75, Mugilidae 26: 80.

Mugiliformes: Mugilidae 26: 80. 1 ISF

mullets = Meeräschen

The subdivision is matter of debate.

In **Mugilidae** only one old and unconfirmed intergeneric/intersubfamilial hybrid has been reported. In the case of confirmation, the cross would connect the greatest part of the family.

Mugil cephalus × *Chelon* (= *Liza*) *ramada* **ISF** *Mugilinae* × *Cheloninae* Schwartz 1972 (ref. 1800 = Yashouv et al. 1969), Schwartz 1981 (ref. 1273 = Yashouv et al. 1969)

References on Mugilidae:

Xia et al. (2016) Multilocus resolution of Mugilidae phylogeny (Teleostei: Mugiliformes): Implications for the family’s taxonomy. Molecular Phylogenetics and Evolution 96. doi:10.1016/j.ympev.2015.12.010
Yashouv A et al. (1969) A hybrid of a female *Mugil cephalus* and male *Liza ramada* (*M. capito*). Bamidgeh 21 (4), 114–116. = ref. 1800 of Schwartz 1972

Osteoglossiformes, 6 families

Osteoglossiformes: Mormyridae 22: 200. 3 IG

freshwater elephant fish = Nilhechte, Elefantenfische

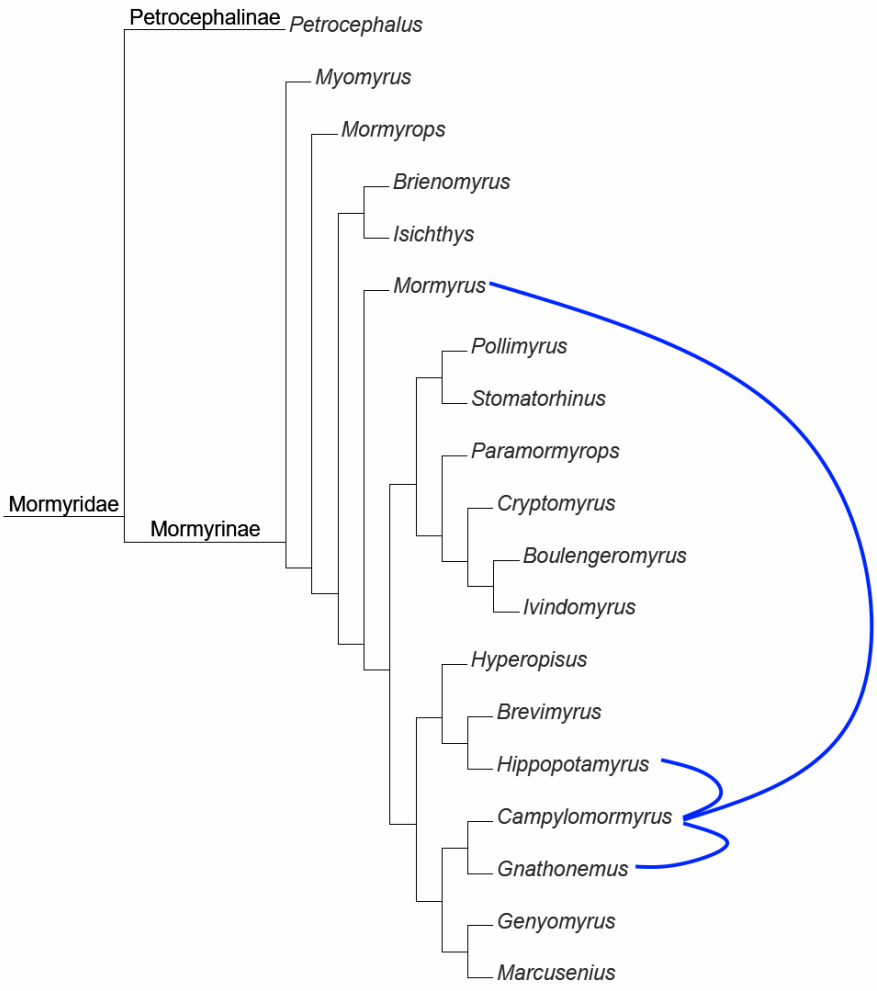
Weekly electric fish.
2 subfamilies:
Mormyrinae 19: 170.
Petrocephalinae 1: 30.

Possibly **basic type family Mormyridae subfamily Mormyrinae** (19: 170), because even distant genera are connected by hybridization.

Campylomormyrus compressirostris, tamandua × *Gnathonemus* petersii Mormyrinae (art. hyb., fertile) Kirschbaum et al. 2016, Yevheniia et al. 2022, closely related genera

Campylomormyrus rhynchophorus × *Mormyrus* spec. Mormyrinae (art. hyb., survived 42 days) Kirschbaum et al. 2016

Campylomormyrus numenius × *Hippopotamyrus pictus* Mormyrinae (art. hyb., survived 2 days during embryological development) Kirschbaum et al. 2016



Mormyridae: hybrids in the phylogeny of Lavoué et al. (2003) doi:10.1046/j.1095-8312.2003.00170.x and Sullivan et al. (2000) doi:10.1242/jeb.203.4.665, from en.wikipedia (2026, CC BY 4.0).

References:

Kirschbaum F et al. (2016) Intragenus (*Campylomormyrus*) and intergenus hybrids in mormyrid fish: Physiological and histological investigations of the electric organ ontogeny. J. Physiology-Paris 110 (3B), 281-301. https://doi.org/10.1016/j.jphysparis.2017.01.003

Yevheniia K et al. (2022) Intergenus F1-hybrids of African weakly electric fish (Mormyridae: *Gnathonemus petersii* ♂ × *Campylomormyrus compressirostris* ♀) are fertile. J Comp Physiol A 208, 355–371. https://doi.org/10.1007/s00359-022-01542-5

Perciformes 6 suborders, 56 families

Incl. Gasterosteiformes p. p. and Scorpaeniformes p. p.
Excl. Acanthuriformes, Anabantiformes, Blenniiformes, Centrarchiformes, Cichliformes, Gobiiformes, Labriformes, Pleuronectiformes, Scombriformes, …

The taxonomy of this order has been revised and is still under discussion.
We follow Eschmeyers's Catalog of fishes from en.wikipedia 2025
6 suborders:
Cottoidei 11 families: Cottidae, Jordaniidae, Liparidae, …
Gasterosteoidei 3 families: Aulorhynchidae, Gasterosteideae, …
Notothenioidei 8 families: Channichthyidae, …
Percoidei 9 families: Epinephelidae, Percidae, Serranidae, …
Scorpaenoidei 11 families: Normanichthyidae, Scorpaenidae, Triglidae, …
Zoarcoidei 14 families: Eulophiidae, Zoarcidae, ….

Perciformes: Channichthyidae 11: 20. **1 IG** (suborder Notothenioidei)

crocodile icefish, white-blooded fish = Krokodileisfische

There seems to be no subdivision.

Possibly **basic type family Channichthyidae** (11: 20). The family is well defined as the only known vertebrates lacking hemoglobin in their blood as adults.

Chaenocephalus aceratus × *Chionodraco rastrospinosus* (art. hyb.). Desvignes et al. 2019

References:

Desvignes et al. (2019) Intergeneric hybrids inform reproductive isolating barriers in the Antarctic icefish radiation. Sci. Rep. 9, 5989 z.
https://www.nature.com/articles/s41598–019-42354-z

Perciformes: Epinephelidae 9: 169. **3 IG** (suborder Percoidei)

groupers = Zackenbarsche

Also considered as a subfamily of family Serranidae.
Ma & Craig (2018) accept only 9 monophyletic taxa, see the figure below:
Cephalopholis, *Chromileptes* (or *Cromileptes*, now often part of *Epinephelus*), *Dermatolepis*, *Epinephelus*, *Paranthias* (or included in *Cephalopholis*), …

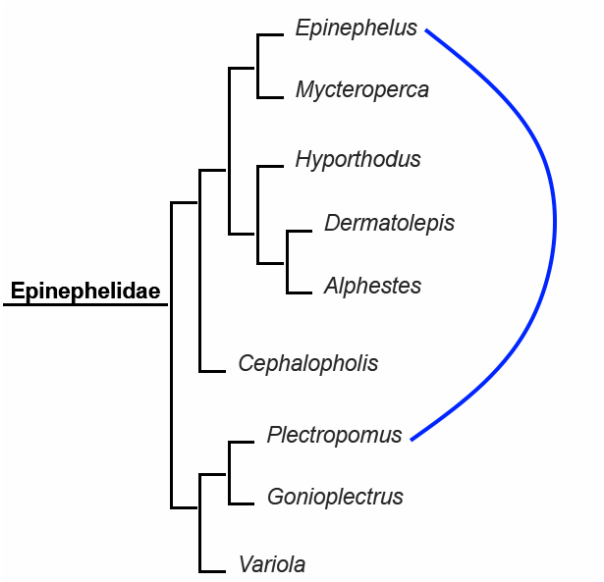
Probably **basic type family Epinephelidae** (9–16: 169): several hybrids incl. the distant cross *Epinephelus* × *Plectropomus* connect all genera, see the figure below. **3 IG.**

Cephalopholis fulva × *Paranthias (Cephalopholis) furcifer* (nat. hyb.) Schwartz 1972 (ref. 1554b, 1555 = Smith 1966: hybridogeneous origin of *Menephorus* **HY**), Schwartz 1981 (ref. 1476), Bostrom et al. 2002

Chromileptes altivelis × *Epinephelus fuscoguttatus* (art. hyb.) http://www.ums.edu.my/ipmb/bi_infra_fish.html (2014)

Chromileptes altivelis × *Epinephelus lanceolatus* Gong et al. 2025

Epinephelus fasciatus × *Plectropomus leopardus* Jiao et al. 2025



Epinephelidae: hybrids in the phylogeny of Ma & Craig (2018) https://doi.org/10.1643/CI-18-055, from de.wikipedia (2026, CC BY 4.0).

References:

Bostrom MAC et al. (2002) Hybridization between two serranids, the coney (*Cephalopholis fulva*) and the creole-fish (*Paranthias furcifer*), at Bermuda. Fishery Bull. 100 (4), 651–666.

Gong S et al. (2025) Development and characterization of a novel intergeneric hybrid grouper (*Cromileptes altivelis* × *Epinephelus lanceolatus* ♂). Aquaculture 595 (1). https://www.sciencedirect.com/science/article/abs/pii/S0044848624009542

Jiao X et al. (2025) Comparative analysis of embryonic development and mitochondrial genome of a new intergeneric hybrid grouper (*Epinephelus fasciatus* ♀ × *Plectropomus leopardus* ♂). Animals 15 (23), 3445. https://doi.org/10.3390/ani15233445

Smith CL (1966) *Menephorus* Poey, a Serranid genus based on two hybrids of *Cephalopholis fulva* and *Paranthias furcifer*, with comments on the systematic placement of *Paranthias*. Amer. Mus. Novit. 2276, 1–11. = ref. 1555 of Schwartz 1972

Perciformes: Gasterosteidae 5: 18. **3 IG** (suborder Gasterosteoidei)

sticklebacks = Stichlinge
formerly part of order Gasterosteiformes.
The subdivision is in need of revision.
Apeltes 1, Culaea 2, Gasterosteus 3, Pungitius 11, Spinachia 1.

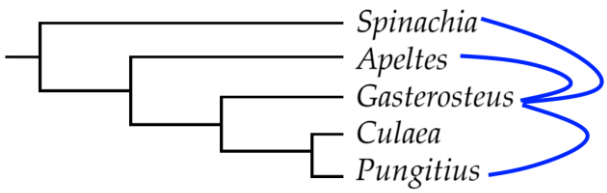
IS: Schwartz 1982: *Gasterosteus* ca. 4 IS.

Possibly **basic type family Gasterosteidae** (5: 18): well-defined family. 4 of the 5 genera are connected by hybridization, but only 1 of 3 intergeneric hybrids has been confirmed. – See also the critical comment of Wise (2020) as to the reliability of the crosses cited by Schwartz. But the distant cross *Gasterosteus* × *Pungitius* has been confirmed.

Apeltes × *Gasterosteus* Newman 1918 ("... a large percentage of healthy hybrid larvae hatch and they are by no means pure maternal ..."), Schwartz 1972 (ref. 1154 = Moenkhaus 1911 (Two tests were made. In one of them 18 per cent of the eggs were impregnated. The embryos showed the usual slowing in the rate of development after close of cleavage. The development went to the stage of hatching, two emerging but showing little vigor. They died after the second day of emergence. The embryos that failed to emerge, for the most part lived as long as the two which had hatched. The success of this cross is probably the same as that of the reciprocal.)

Gasterosteus × *Pungitius* (*Pygostegius*°) Schwartz 1972 (ref. 227, 884, 1783), Schwartz 1981 (ref. 1176, 1777, Shapiro et al. 2006, Nedoluzhko et al. 2022

Gasterosteus aculeatus × *Spinachia vulgaris* Schwartz 1972 (ref. 74, 1283), Schwartz 1981 (ref. 1193)



Gasterosteidae: hybrids in the (simplified) phylogeny of Keivany Y & Nelson JS (2004, Fig. 1. doi: 10.1163/1568539042948187)

References:

Nedoluzhko A et al. (2022) Intergeneric hybridization of two stickleback species leads to introgression of membrane-associated genes and invasive TE expansion. Front. Genet. 13. https://doi.org/10.3389/fgene.2022.863547

Shapiro MD, Bell MA & Kingsley DM (2006) Parallel genetic origins of pelvic reduction in vertebrates. Proc. Natl. Acad. Sci. 103, 13753–13758. http://www.pnas.org/content/103/37/13753.full.pdf

Wise KP (2020) Schwartz's fish hybrids in baraminology. CBS Annual Conference Abstracts 2020. J. Creation Theology Science B.

Perciformes: Percidae 10: 200. **3 IG + 5 ISF** (suborder Percoidei)

true perches = Echte Barsche

3 subfamilies based on Eschmeyer's Catalog of Fishes:
Percinae 3 *Gymnocephalus, Perca, Percarina* 2,
Luciopercinae 3 *Romanichthys, Sander* (= *Lucioperca, Stizostedion*°), *Zingel* (= *Aspro*°)
Etheostomatinae 4 *Ammocrypta, Etheostoma* 158, *Nothonotus, Percina* (incl. *Hadropterus*°).

IS: *Etheostoma ca. 10 IS*

Probably **basic type family Percidae** (10: 200): The three subfamilies are linked by hybridization.

Ammocrypta vivax × *Etheostoma* Etheostomatinae Schwartz 1972 (ref. 733)
Ammocrypta vivax × *Percina caprodes* Etheostomatinae Schwartz 1972 (ref. 733)
Etheostoma × *Perca flavescens* **ISF** Etheostomatinae × Percinae Hubbs 1971b
Etheostoma × *Percina* (incl. *Hadropterus*°) **ISF** Etheostomatinae × Percinae (nat. hyb.) Hubbs 1955, Hubbs & Strawn 1957, Schwartz 1972 (ref. 729, 730, 733, 735, 740, 743, 752, 753, 754, 1010 etc.), Schwartz 1981, Hubbs et al. 1988, Scribner et al. 2001
Etheostoma div. spec. × *Sander* (= *Stizostedion*) *vitreus* **ISF** Etheostomatinae × Luciopercinae Schwartz 1981 (ref. 767 = Hubbs 1971b)
Gymnocephalus cernuus (= *Acerina*° *cernua*) × *Perca fluviatilis* Percinae (fertile) Schwartz 1972 (ref. 590; 815 = Kammerer 1907; 1219 etc.)
Hadropterus° *aspro* (= *Percina maculata*) × *Percina caprodes* **IS** Percinae Schwartz 1972 (ref. 1149), Schwartz 1981 (ref. 528, 1760)
Hadropterus° *scierus* (= *Percina sciera*) × *Percina caprodes* **IS** Percinae Hubbs & Laritz 1961
Sander (= *Lucioperca*°) *sandra* × *Zingel asper* (= *Aspro*° *zingel*) **IS** Luciopercinae Schwartz 1972 (ref. 1101 = Merriner 1966)
Perca × *Sander* (incl. *Lucioperca*°, *Stizostedion*°) **ISF** Percinae × Luciopercinae Schwartz 1972 (ref. 113, 227, 352, 815), Schwartz 1981 (ref. 1249)
Percina caprodes × *Sander*° (= *Stizostedion*) *vitreum* **ISF** Etheostomatinae × Luciopercinae Schwartz 1981 (ref. 767 = Hubbs 1971b)
Stizostedion° subgen. *Cynoperca* (= *Sander*) × *Stizostedion*° (= *Sander*) *lucioperca* **IS** Luciopercinae (nat. hyb.) Hubbs 1955

References on Percidae:

Arnoult J & Spillmann CJ (1965) Reproduction expérimentale et hybridations nouvelles de Teleosteens d'eau douce au laboratoire. Bull. Mus. Natl. Hist. Nat. 2. ser. 37 (4), 599–609. = ref. 80 of Schwartz 1972, ref. 188 of Schwartz 1982
Hubbs C (1959) Laboratory hybrid combinations among Etheostomatine fishes. Tex. J. Sci. 11, 49–56. = ref. 733 of Schwartz 1972

Hubbs C (1971b) Survival of intergroup percid hybrids. Jap. J. Ichthyol. 18, 65–75. = ref. 767 of Schwartz 1981
Hubbs C, Cross FB & Stevens F (1988) Occurrence of natural hybrids between *Etheostoma* and *Percina* (Pisces: Percidae). The Southwestern Naturalist 33, 97–99.
Hubbs C & Laritz CM (1961) Natural hybridization between *Hadropterus scierus* and *Percina caprodes*. The Southwestern Naturalist 6, 188–192. = ref. 748 of Schwartz 1972
Hubbs C & Strawn K (1957) Relative variability of hybrids between the darters *Etheostoma spectabile* and *Percina caprodes*. Evolution 11, 1–10.
Kammerer P (1907) Bastardierung von Flussbarsch (*Perca fluviatilis* L.) und Kaulbarsch (*Acerina cernua* L.). Roux Arch. Entwicklungsmechanik 23, 511–551. = ref. 815 of Schwartz 1972

Perciformes: Serranidae 64: 450 (suborder Percoidei)

sea basses = Sägebarsche

5 subfamilies.

excl. subfamily Epinephelinae which is now considered to be its own family.

Petromyzontiformes 3 families 10: 48 + extinct taxa superclass Agnatha, class Cyclostomata)

fishbase 2025 3 families: Geotriidae 1: 2, Mordaciidae 1: 3, Petromyzontidae 8: 43

Petromyzontiformes 3 families 11: 49 + extinct taxa (superclass Agnatha, class Cyclostomata or infraphylum Agnatha, superclass Cyclostomi, class Petromyzontida)

lampreys and allies = Neunaugenartige

3 families: Geotriidae 1: 2, Mordaciidae 1: 3, Petromyzontidae 8: 43.

Petromyzontiformes: Petromyzontidae 9: 44. **2 IG +2 ISF**

lampreys = Neunaugen

3 subfamilies:

Entospheninae (or tribe of Lampetrinae) 2: 9 *Entosphenus 7, Tetrapleurodon 2.*

Lampetrinae 6: 28 *Caspiomyzon 3, Eudontomyzon 7, Lampetra 10, Lethenteron 8.*

Petromyzontinae 2: 7 *Ichthyomyzon 6, Petromyzon 1* (*marinus*).

Possibly **basic type family Petromyzontidae** (10: 44). Two of the three subfamilies are linked by hybridization (Hughes LC et al. 2025. https://doi.org/10.1098/rspb.2024.2101 or Brownstein & Near 2023 https://doi.org/10.1016%2Fj.cub.2022.12.018, from en.wikipedia.). Piavis et al. (1971) only tested embryonal development, but the paternal genetic material begins to exert its influence no earlier than stage 9 (gastrulation). The intergeneric hybrids survived longer than stage 9 but none survived until stage 18 (larva).

IS: Schwartz 1981: *Ichthyomyzon ca. 7 IS.*

Eudontomyzon mariae × *Lampetra planeri* Lampetrinae Schwartz 1972 (ref. 667a = Holčik 1970), Rembiszewski 1968 (cited after Renaud 2011, nat. hyb. Poland, 3 adult hybrids)

Ichthyomyzon × *Lampetra* **ISF** Petromyzontnae × Lampetrinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971); Piavis et al. (1971, Tab. 1): *Ichthymoyzon fosser* / *unicuspis* × *Petromyzon marinus* (art. hyb.) reached stage 12 (head formation) / stage 10 (neural plate and groove)

Ichthyomyzon × *Petromyzon* Petromyzontinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971); Piavis et al. (1971, Tab. 1): *Ichthymoyzon castaneus* / *fosser* / *unicuspis* × *Lampetra lamottenii* (art. hyb.) reached stage 14 (hatching embryo) / stage 11 (neural rod) / stage 12 (head formation)

Lampetra × *Petromyzon* **ISF** Lampetrinae × Petromyzontinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971); Piavis et al. (1971, Tab. 1): *Lampetra lamottenii* × *Petromyzon marinus* (art. hyb.) reached stage 16 (gill clefts)

References:

Piavis GW et al. (1970) Experimental hybridization among five species of lampreys from the Great Lakes. Copeia, 1970 (1), 29–37. https://doi.org/10.2307/1441972

Piavis GW (1971) Embryology. p. 361–400 in Hardesty MW & Potter EC (eds.) The biology of lampreys, vol. 1. New York: Academic Press. = ref. 1270 of Schwartz 1981, obviously same or similar results as the preceding reference.

Renaud CB (2011) Lampreys of the world. An annotated and illustrated catalogue of lamprey species known to date. FAO Species Catalogue for Fishery Purposes No. 5. ISSN 1020-8682. https://www.fao.org/4/i2335e/i2335e.pdf

Rembiszewski JM (1968) Observations on hybrids of *Lampetra* (*Lampetra*) planeri (Bloch, 1784) × *Lampetra* (*Eudontomyzon*) *mariae* Berg, 1931. Vest. Cs. Spol. Zool., 32 (4), 390–393.

Pleuronectiformes → Acanthuriformes

Salmoniformes 2 suborders, 2 families + extinct taxa

Incl. former Esociformes.
2 suborders:
Esocoidei 2 families Esocidae 3: 11, Umbridae 1: 3.
Salmonoidei 1 family Salmonidae 10: 190.

Salmoniformes: Esocidae 3: 11 (suborder Esocoidei)

pikes = Hechtartige

IS: Schwartz 1981: *Esox ca. 11 IS.*

Salmoniformes: Salmonidae 10: 190. **7 IG + 4 ISF** (suborder Salmonoidei)

trout = Forellen

3 subfamilies:
Coregoninae 3: 77 *Coregonus* (incl. *Argyrosomus*° (*Argyrosomus* is part of Sciaenidae, Perciformes), *Leucichthys*°) *70, Prosopium 6, Stenodus 1.*
Thymallinae 1: 12 *Thymallus 12.*
Salmoninae 7: 102 *Brachymastax 3, Hucho 5, Oncorhynchus 14, Parahucho, Salmo 29* (incl. *Trutta*°), *Salvelinus 49* (incl. *Cristivomer*°), *Salvethymus 1.*

Basic type family Salmonidae (10: 190): The three subfamilies and nearly all genera are linked by hybridization. The divergence time of this basic type is at least ca. 58.9 mya (cf. Lecaudey LA et al. 2018, Fig. 1. https://doi.org/10.1016/j.ympev.2018.02.022).

IS: For interspecific and some intergeneric hybrids of *Oncorhynchus, Salmo,* and *Salvelinus* see https://en.wikipedia.org/wiki/Salmonidae and Dangel 1973.

Albula° *ladogensis* (= *Coregonus albula*) × *Coregonus lavaretus* **IS** Coregoninae Schwartz 1972 (ref. 1694)
Argyrosomus° (= *Coregonus*) *artedi* × *Coregonus clupeiformis* **IS** Coregoninae Schwartz 1972 (ref. 1154 = Moenkhaus 1911 (hatched)); ref. 1445)
Brachymystax lenok × *Hucho taimen* Salmoninae Wang et al. 2011, cf. Balakirev et al. 2013
Coregonus × *Leucichthys*° (= *Coregonus* p. p.) **IS** Coregoninae (nat. hyb.) Schwartz 1972 (ref. 478, 1548, 1549), Schwartz 1981 (ref. 491 = Dangel et al. 1973); 1213)
Coregonus × *Prosopium* Coregoninae Schwartz 1972 (ref. 1101), Schwartz 1981 (ref. 608, 1213)
Coregonus × *Salmo* **ISF** Coregoninae × Salmoninae Schwartz 1972 (ref. 356, 1426; 1433 = Rubaschev 1935), Schwartz 1981 (ref. 491 = Dangel et al. 1973 (with many citations), 1346, 1543)
Coregonus × *Salvelinus fontinalis* **ISF** Coregoninae × Salmoninae Schwartz 1972 (ref. 1359, 1433), Schwartz 1981 (ref. 1004, 1005, 1029, 1433, 1543)
Coregonus × *Stenodus leucichthys* Coregoninae (nat. hyb.) Schwartz 1972 (ref. 15a, 780

etc.), Schwartz 1981 (ref. 272, 797)

Cristivomer° (= *Salvelinus*) *namaycush* × *Salvelinus alpinus, fontinalis* **IS** Salmoninae Schwartz 1972 (ref. 442, 477, 1154 = Moenkhaus 1911 (hatched); 1431, 1546, 1696)

Leucichthys° (= *Coregonus* p. p.) × *Prosopium* **IS** Coregoninae Schwartz 1972 (ref. 478), Schwartz 1981 (ref. 608)

Oncorhynchus × *Salmo* Salmoninae Schwartz 1972 (ref. 1097), Schwartz 1981 (ref. 426, 491 = Dangel et al. 1973, 678, 1380, 1550 etc.)

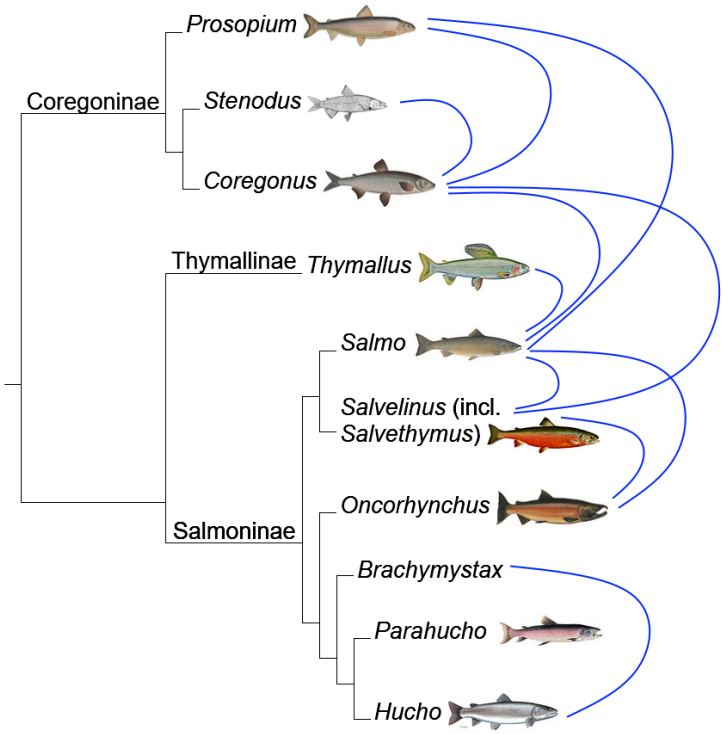
Oncorhynchus × *Salvelinus* Salmoninae (art. hyb., nat. hyb.) Smirnov 1959, Crossman & Buss 1966, Schwartz 1972 (ref. 765, 1101, 1554a), Kato 1977 (nat. hyb.), Schwartz 1981 (ref. 304, 425, 1233, 1380, 1575, 1576, 1634), Bartley et al. 1997, Gillett 2004, Koizumi et al. 2005, Sato et al. 2008 (nat. hyb.), Miyazawa et al. 2010

Prosopium × *Salmo* **ISF** Coregoninae × Salmoninae Schwartz 1981 (ref. 1022)

Salmo × *Salvelinus* (incl. *Cristivomer*°) Salmoninae Ahrens 1919 (see Aduma-Bossman & Keitz 1971), Capanna et al. 1973, Schwartz 1972 (ref. 278, 1161, 1431, 1548), Schwartz 1981 (ref. 1550 etc.), Bartley al. 1997 (sterile), Aras-Hisar et al. 2003, Gillett 2004

Salmo gairdneri × *Salvethymus obtusirostris* Salmoninae Schwartz 1981 (ref. 62, 491 = Dangel et al. 1973)

Salmo trutta × *Thymallus vulgaris* **ISF** Salmoninae × Thymallinae Schwartz 1981 (ref. 491 = Dangel et al. 1973)



Salmonidae: hybrids in the phylogeny according to en.wikipedia (2025, CC BY 4.0; cf. Crête-Lafrenière A, Weir LK & Bernatchez L (2012). doi:10.1371/journal.pone.0046662 and Shedko SV, Miroshnichenko IL, Nemkova GA (2013). doi:10.1134/S1022795413060112; picture of *Hucho hucho*: Zsoldos Márton - http://zsoldosmarton.hu/allatok.html, CC BY-SA 3.0)

References:

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Blanc JM & Chevassus B (1982) Interspecific hybridization of salmonid fish: II. Survival and growth up the 4th month after hatching in F1 generation hybrids. Aquaculture 29 (3–4), 383–387. http://www.sciencedirect.com/science/article/pii/004484868290151X

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Crossman EJ & Buss K (1966) Artificial hybrid between Kokanee (*Oncorhynchus nerka*) and Brook Trout (*Salvelinus fontinalis*). Copeia 1966, 357–359.

Dangel JR, Macy PT & Withler FC (1973) Annotated bibliography of interspecific hybridization of fishes of the subfamily Salmoninae. U. S. Department of Commerce, NOAA Tech. Memo NMFS NWFC-1. 48 p. = ref. 491 of Schwartz 1982. https://ia601201.us.archive.org/28/items/annotatedbibliog00dang/annotatedbibliog00dang.pdf

Gillet C (2004) Hybridisation between Arctic charr (*Salvelinus alpinus*) and other Salmonides. http://www.boku.ac.at/hfa/charrnet/Hybridisation.pdf

Kato K (1977) Natural hybrids of salmonid fishes from the Nippara river, Tokyo. Jap. J. Ichthyol. 23 (4), 225–232. *Oncorhynchus* × *Salvelinus.*

Koizumi I et al. (2005) Occurrence of a hybrid between endemic Miyabe charr *Salvelinus malma miyabei* and introduced masu salmon *Oncorhynchus masou masou* in the Lake Shikaribetsu system, Hokkaido, Japan. Ichthyol. Res. 52 (1), 83–85.

Ito D et al. (2006) Hybrid inviability and chromosome abnormality in salmonid fish. The Journal of Animal Genetics 34, 65–70. doi:10.5924/abgri2000.34.65 with list of all interspecific and intergeneric hybrids within *Oncorhynchus*/*Salmo*/*Salvelinus*

Meehan WE (1898) Hybrids between genera. p. 29–32 in: Report of Assistant Secretary and Statistician. Pa. Rep. State Comm. Fish 1898. = ref. 1065.

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Scombriformes 2 suborders, 16 families. **1 IG**

formerly part of Perciformes

Scombriformes: Scombridae 15: 51 (suborder Scombroidei)

mackerel, tuna and bonito family = Makrelen und Thunfische

2 subfamilies: Gasterochismatinae 1: 1, Scombrinae 14: 50.
Euthynnus × *Katsuwonus* Scombrinae Thunnini Silas et al. 1976

References:

Matsui Y & Ojima Y (1956) Some cytological observations on male sterility in the carp-funa hybrids. Jap. J. Ichth. 5 (1/2), 52–58. = ref. 1083 of Schwartz 1972
Silas EG, Pillai PP & Muthiah C (1976) *Euthynnus* sp. nov. or an inter-generic hybrid of Tuna: an enigma. J. Marine Biol. Ass. India 18 (3), 411–420. http://eprints.cmfri.org.in/1469/1/Silas_411-420.pdf

Scorpaeniformes 30 families

Siluriformes 4 suborders, 43 families, 480: 4000 + extinct

taxa. 6 IG + 3 IF

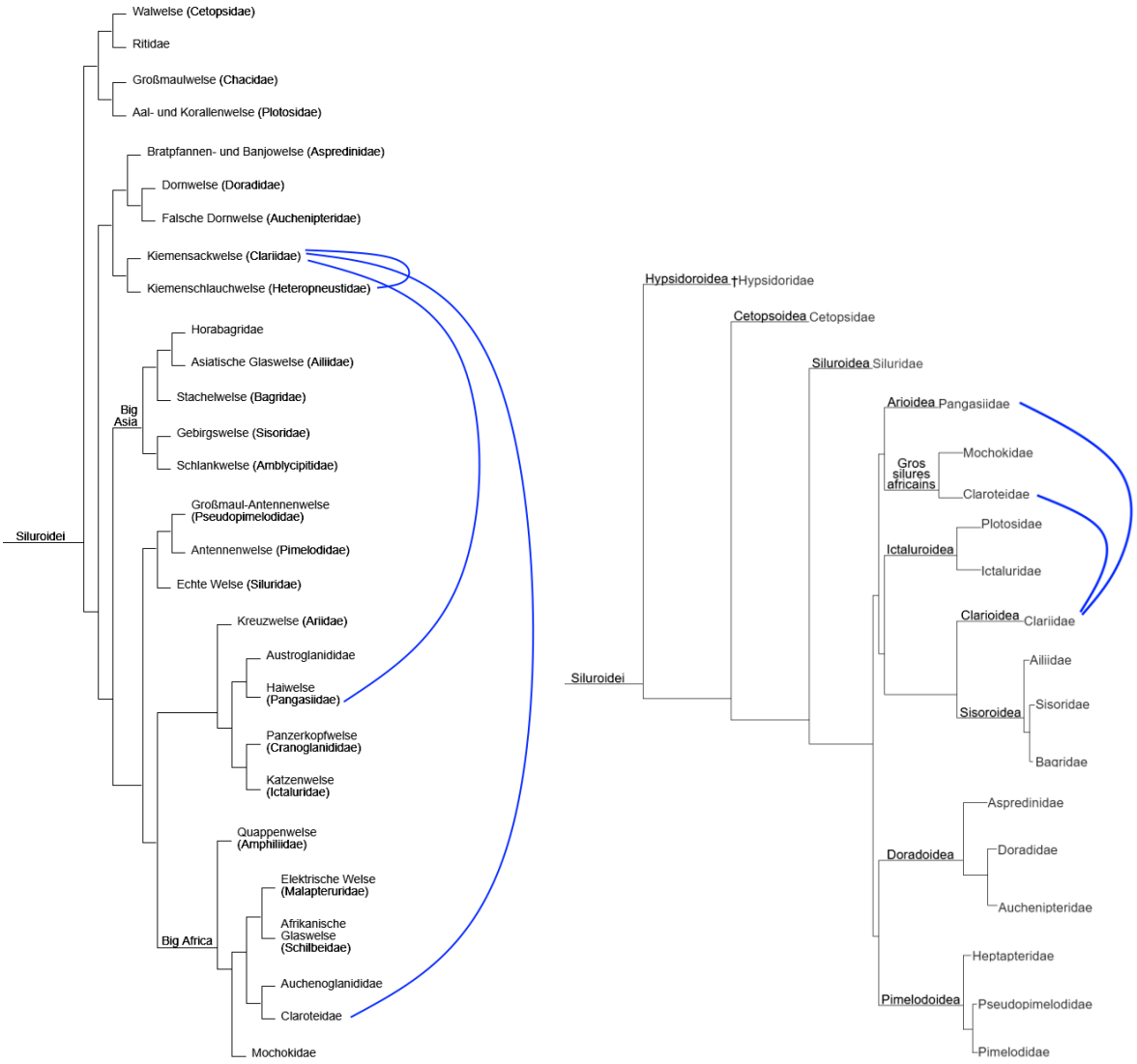
catfish = Welsartige

The internal taxonomy is matter of debate.
The order is monophyletic.
4 suborders:
Cetopsoidei 1 family Cetopsidae.
Diplomystoidei 1 family Diplomystidae.
Loricarioidei 6 families Astroblepidae, Callichthyidae, Loricariidae, Nematogenyiidae, Scoloplacidae, Trichomycteridae.
Siluroidei 35 families (335: 3400): Ailiidae, Akysidae, Amblycipitidae, Amphiliidae, Anchariidae, Ariidae, Aspredinidae, Auchenipteridae, Auchenoglaniidae, Austroglanididae, Bagridae, Chacidae, Clariidae 17: 117, Claroteidae 9: 65, Cranoglanididae, Doradidae, Heptapteridae, Heteropneustidae 2: 6, Horabagridae, Ictaluridae 7: 50, Kryptoglanidae, Lacantuniidae, Malapteruridae, Mochokidae, Pangasiidae 4: 30, Phreatobilidae, Pimelodidae, Plotosidae, Pseudopimelodidae, Ritidae, Schilbeidae, Siluridae, Sisoridae.

Siluriformes are very interesting from a basic type view**.** But the phylogeny is not yet sufficiently resolved and several proposals (e.g. Ryoce 1996, Schedel et al. 2022 and Betancur-Rodriguez et al. 2017) differ much, see the figures below. So, it is too soon for definite statements. Intergeneric hybrids are only known from the large suborder Siluroidei. The genera of **Ictaluridae** probably belong to the same basic type. Families **Clariidae, Claroteidae, Heteropneustidae and Pangasiidae** are connected by hybridization, probably including further families like Ictaluridae etc.

Interfamilial hybrids in Siluriformes suborder Siluroidei

Chrysichthys × *Heterobranchus* **IF** Claroteidae × Clariidae (art. hyb.) Otémé et al. 1996 (viable)
Clarias × *Heteropneustes* **IF** Clariidae × Heteropneustidae Mukhopadathy & Dehadrai 1987 (survival), Smitherman et al. 1996
Clarias macrocephalus × *Pangasius sutchi* **IF** Clariidae × Pangasiidae Schwartz 1981 (ref. 105), Tarnchalanukit 1986, Na-Nakorn et al. 1993 (art. hyb., viable, two morphotypes 3n, one morphotype gynogenetic = *Clarias*), Smitherman et al. 1996



Siluriformes suborder Siluroidei: the phylogenies are not well established. See on the left: hybrids in the phylogeny of Schedel FDB et al. (2022. https://doi.org/10.1111/jfb.15014, from en.wikipedia 2025, CC BY 4.0) and on the right: hybrids in a phylogeny based on Betancur-Rodriguez et al. (2017. doi: 10.1186/s12862-017-0958-3) (after fr.wikipedia 2026, CC BY 4.0)

Siluriformes: Clariidae 14: 100. 1 IG (suborder Siluroidei)

air breathing catfish = Kiemensackwelse

Bathyclarias, Channallabes, Clariallabes, Clarias, Dinotopterus, Dolichallabes, Encheloclarias, Gymnallabes, Heterobranchus, Horaglanis, Platyallabes, Platyclarias, Tanganikallabes, Uegitglanis, Xenoclarias.

Clarias × *Heterobranchus* Nwadukwe 1995, Smitherman et al. 1996 (often fertile), Bartley et al. 1997, Aluko & Ali 2001, Teugels 2003, Akinwande et al. 2013

Siluriformes: Ictaluridae 7: 50 + extinct taxa. 3 IG (suborder Siluroidei)

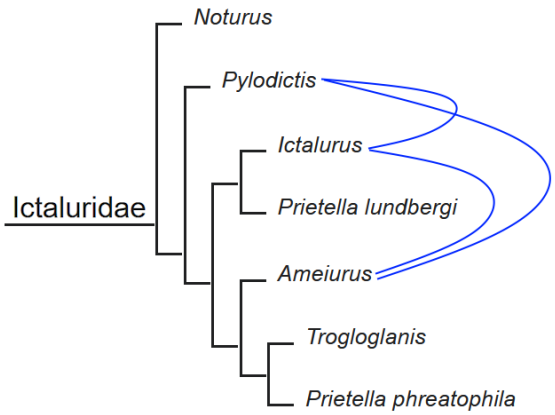
ictalurids = Katzen- und Zwergwelse

en.wikipedia 2025: no subdivision, monophyletic.
Ameiurus 7, Ictalurus 9, Noturus 29, Prietella 2, Pylodictis 1, Satan 1, Trogloglanis 1.

All genera of **family Ictaluridae** (7: 50) seem to belong to the same **basic type**. But it is probable that the basic type is much larger, see above.

IS: Schwartz 1981: *Ictalurus ca. 10 IS.*
Gutiérrez-Barragán et al. (2025).

Ameiurus catus, melas, natalis × *Ictalurus furcatus, punctatus* Sneed 1971, Schwartz 1981 (ref. 1424), Goudie et al. 1993, Zhang & Tiersch 1997 („equal contribution to the genomes of F-1 hybrids")
Ameiurus ("*Ictalurus*") *catus* × *Pylodictis olivaris* (nat. hyb.) Schwartz 1972 (ref. 65, 1548, 1549, 1568), Zhang & Tiersch 1997
Ictalurus punctatus × *Pylodictis olivaris* (nat. hyb.) Sneed 1971, Schwartz 1972 (ref. 65, 1276, 1548, 1549, 1568, 1680), Zhang & Tiersch 1997 („equal contribution to the genomes of F-1 hybrids"). Gutiérrez-Barragán et al. 2025 think this might be an erroneous report
Noturus gyrinus × *Schilbeodes*° (*Noturus*) *miurus* **IS** Schwartz 1981 (ref. 1976)



Ictaluridae: hybrids in the phylogeny of Schedel et al. (2022) https://doi.org/10.1111/jfb.15014, from en.wikipedia (2025, CC BY 4.0).

Siluriformes: Pimelodidae 30: 121. 2 IG (suborder Siluroidei)

long-whiskered catfishes = Antennenwelse

Leiarius marmoratus × *Pseudoplatystoma reticulatum* Coelho et al. 2021, distant hybrid
Pseudoplatystoma reticulatum × *Phractocephalus hemioliopterus* Hashimoto et al., distant hybrid

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Sneed KE (1971) Some current North American work in hybridization and selection of cultured fishes. http://www.fao.org/docrep/005/B3310E/B3310E00.htm#TOC 2.1 Rainbow trout breeding (Salmonidae). 3.1 Catfish hybridization (Ictaluridae).
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Teugels GG (2003) *Clarias lamottei* (Siluriformes, Clariidae), a natural intergeneric hybrid from West Africa. Cybium 27 (1), 11–15. http://www.mnhn.fr/sfi/cybium/numeros/pdf/271pdf/04-Teugels147.pdf
Zhang Q & Tiersch TR (1997) Chromosomal inheritance patterns of intergeneric hybrids of ictalurid catfishes: odd diploid numbers with equal parental contributions. J. Fish Biology 51, 1073–1085.

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Appendix: Reported interordinal fish hybrids
(132 intergeneric combinations)

Probably the majority of the hybrids listed here are not true hybrids, and often are gynogenetic or so, but possibly some of the hybrids might be correct?
Because names of fishes of the different taxonomic ranks have often changed in the last years, it is possible that some names or the attributions to a family are out of date.

Boops (= *Box*°) *boops* × *Thalassoma* (= *Crenilabrus*°) *pavo* **IO** Acanthuriformes Sparidae × Labriformes Labridae Hertwig & Hertwig 1914 (art. hyb., only a few days old), Schwartz 1972 (ref. 643 = Hertwig & Hertwig 1914)

Caulolatilus princeps × *Clevelandia ios* **IO** Acanthuriformes Latilidae × Gobiiformes Oxudercidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Cichlasoma cyanoguttatum × *Perca flavescens* **IO** Cichliformes Cichlidae × Percidae Hubbs 1971b) („only one lot gastrulated, but did not progress father")

Cichlasoma cyanoguttatum × *Sander* (= *Stizostedion*°) *vitreus* **IO** Cichliformes Cichlidae × Perciformes Percidae Schwartz 1981 (ref. 767 = Hubbs 1971b) („none of the eggs gastrulated")

Clinitrachus (= *Cristiceps*°) *argentatus* × *Thallassoma pavo* **IO** Blenniiformes Clinidae × Labriformes Labridae Schwartz 1972 (ref. 1542)

Ctenolabrus adspersus × *Stenotomus chrysops* **IO** Labriformes Labridae × Acanthuriformes Sparidae Schwartz 1972 (ref. 888 = Kobayasi 1963; 890, 891, 1645, 1647), Schwartz 1981 (ref. 873 = Kobayasi 1965)

Ctenolabrus adspersus × *Stenotomus chrysops* **IO** Labriformes Labridae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1645, 1647), Pinney 1928 (hatching embryos relatively frequent in the cross *Ctenolabrus* × *Stenotomus* ♂; real intermediate hybrids??)

Cymatogaster aggregata × *Clevelandia ios* **IO** Blenniiformes Embiotocidae × Gobiiformes Oxudercidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Elassoma zonatum × *Etheostoma spectabile* **IF** Perciformes Elassomatidae × Perciformes Percidae Schwartz 1972 (ref. 740a)

Etheostoma × *Lepomis microlophus* **IO** Perciformes Percidae × Centrarchiformes

Centrarchidae Schwartz 1972 (ref. 733 = Hubbs 1959)

Etheostoma lepidum × *Lepomis microlophus* **IO** Perciformes Percidae × Centrarchiformes Centrarchidae Schwartz 1972 (ref. 733 = Hubbs 1959, ref. 739 = Hubbs 1967)

Gobius capito, jozo (= *niger*) × *Thalassoma* (= *Crenilabrus*°) *pavo* **IO** Gobiiformes Gobiidae × Labriformes Labridae (art. hyb.) Hertwig & Hertwig 1914 (only a few days old), Schwartz 1972 (ref. 1203 = Newman 1915; 1219 = Nikoljukin 1935)

Haplochromis × *Stizostedion*° (= *Sander*) *vitreum* **IO** Cichliformes Cichlidae × Perciformes Percidae Schwartz 1981 (ref. 767 = Hubbs 1971b) („none of the eggs gastrulated")

Heliastes chromis × *Symphodus* (*Crenilabrus*°) **IF** Pomacentridae × Labriformes Labridae Schwartz 1972 (ref. 1542)

Lepomis (incl. *Chaenobryttus*° *coronarius*) × *Perca flavescens* **IO** Centrarchiformes Centrarchidae × Perciformes Percidae Hubbs 1971b („eyes formed")

Lepomis auritus, microlephus × *Stizostedion*° (= *Sander*) *vitreum* **IO** Centrarchiformes Centrarchidae × Perciformes Percidae Schwartz 1981 (ref. 767b = Hubbs 1971) („none of the eggs gastrulated")

Lepomis microlophus, punctatus × *Percina caprodes, sciera* (= *Hadropterus*° *scierus*) **IO** Centrarchiformes Centrarchidae × Perciformes Percidae Schwartz 1972 (ref. 733 = Hubbs 1959)

Morone americana × *Tautogolabrus adspersus* **IO** Acanthuriformes Moronidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1915)

Morone chrysops × *Sander vitreus* **IO** Perciformes Percidae × Acanthuriformes Moronidae Hubbs 1971b („... gastrulated eggs; ...died on day 9 or 10.")

Morone chrysops × *Stizostedion*° (= *Sander*) *vitreum* **IO** Acanthuriformes Moronidae × Perciformes Percidae Schwartz 1981 (ref. 767b = Hubbs 1971)

Oplegnathus fasciatus × *Acanthopagrus schlegelii* **IO** Centrarchiformes Oplegnathidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 616)

~~*Oreochromis* × *Siniperca*~~ **IO** Cichliformes Cichlidae × Centrarchiformes Sinipercidae Jin-Long et al. 2007 (normal zygote and normal cleavage ... partial hybrids!!)

Peprilus (= *Poronotus*°) × *Tautogolabrus* **IO** Scombriformes Stromateidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Polycentropsis abbreviata × *Polycentrus schomburgkii* **IO** Anabantiformes Nandidae × Cichliformes Polycentridae Schwartz 1972 (ref. 1473 = Schmidt 1930) (real hybrid??; *Polycentrus* was formerly included in the Nandidae family.)

Scomber scombrus × *Stenotomus chrysops* **IO** Scombriformes Scombridae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1914)

Spicaria smaris (= *Smaris*° *alcedo*) × *Thalassoma* (= *Crenilabrus*°) *pavo* **IO** Acanthuriformes Sparidae × Labriformes Labridae Schwartz 1972 (ref. 643 = Hertwig & Hertwig 1914) (art. hyb., only up to the blastula stage, no gastrulation)

Stenotomus × *Tautogolabrus* **IO** Acanthuriformes Sparidae × Labriformes Labridae Schwartz 1972 (ref. 744, 1203 = Newman 1915 (None of the ... embryos ... had

successfully closed the blastopore although considerable embryonic development had taken place.))

Stenotomus chrysops × *Scomber scombrus* **IO** Acanthuriformes Sparidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1914)

Stenotomus chrysops × *Tautogolabrus asdspersus* **IO** Acanthuriformes Sparidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1914)

Abramis abramis, brama × *Sander* (= *Lucioperca*°) *lucioperca* **IO** Cypriniformes Cyprinidae × Perciformes Percidae Schwartz 1972 (ref. 903, 946, 950 = Kryzanavski 1968, 1219, 1423), Schwartz 1981 (ref. 1349 = Romashov & Golovinskaia 1960)

Abramis brama × *Gymnocephalus cernuus* (= *Acerina*° *cernua*) Cypriniformes Cyprinidae × Perciformes Percidae Schwartz 1972 (ref. 950 = Kryzanavski 1968, ref. 1219)

Abramis brama × *Perca fluviatilis* **IO** Cypriniformes Cyprinidae × Perciformes Percidae Schwartz 1972 (ref. 1219 = Nikoljukin 1935)

Acerina: see *Gymnocephalus*

Acheilognathus × *Oryzias* Cyprinidae × Adrianichthyidae **IO** (Cypriniformes × Beloniformes) Schwartz 1972 (ref. 1636 = Suzuki 1968)

~~*Acipenser* × *Pterolamiops*° (= *Carcharhinus*) *longimanus*~~ **IO/IC** Acipenseriformes Acipenseridae × Carcharhiniformes Carcharhinidae Schwartz 1981 (ref. 1064 = DNA-hybridization!)

Alburnus alburnus × *Alosa* (= *Caspialosa*°) *kessleri* **IO** Cypriniformes Cyprinidae × Clupeiformes Clupeidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

Alburnus × *Caspialosa*° *kessleri* **IO** Cypriniformes Cyprinidae × Clupeiformes Clupeidae Schwartz 1972 (ref. 950 = Kryzanovski 1968, 1423), Schwartz 1981 (= Romashov & Golovinskaja 1960)

Alosa (= *Caspialosa*°) × *Pelecus cultratus* **IO** Clupeiformes Clupeidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 949, 950 = Kryzanovski 1968; ref. 1423 = Romaskov & Golovinskaya 1960), Schwartz 1981 (ref. 1349 = Romashov & Golovinskaia)

Alosa (= *Caspialosa*°) *kessleri* × *Vimba* **IO** Clupeiformes Clupeidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

~~*Anchoa compressa* × *Salmo gairdneri*~~ **IO** Clupeiformes Engraulidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 139), Schwartz 1981 (ref. 491 = Dangel et al. 1973 = Hubbs 1967 (no development)

Apeltes quadracus × *Cyprinodon variegatus* **IO** Perciformes Gasterosteidae × Cyprinodontiformes Cyprinodontidae Schwartz 1972 (ref. 1203 = Newman 1915)

Apeltes quadracus × *Fundulus* Perciformes Gasterosteidae × Cyprinodontidae Fundulidae **IO** Schwartz 1972 (ref. 1154 = Moenkhaus 1911, 1203 = Newman 1915)

Apeltes × *Menidia* Perciformes Gasterosteidae × Atheriniformes Atherinopsidae **IO** Schwartz 1972 (ref. 1203 = Newman 1915)

Apeltes × *Peprilus* (= *Poronotus*°) Perciformes Gasterosteidae × Scombriformes Stromateidae **IO** Schwartz 1972 (ref. 1203 = Newman 1915)

Apeltes × *Scomber* **IO** Perciformes Gasterosteidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1915)

Apeltes quadracus × *Stenotomus* **IO** Perciformes Gasterosteidae × Acanthuriformes

Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Apeltes quadracus × *Tautogolabrus* **IO** Perciformes Gasterosteidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Aphredoderus sayanus × *Etheostoma spectabile* **IO** Percopsiformes Aphredoderidae × Perciformes Percidae Schwartz 1972 (ref. 740a)

Aphredoderus sayanus × *Gasterosteus* **IO** Percopsiformes Aphredoderidae × Perciformes Gasterosteidae Schwartz 1972 (ref. 740a)

Aphredoderus sayanus × *Menidia audens* **IO** Percopsiformes Aphredoderidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Aphyocharax anisitsii (= *rubripinnis*) × *Danio* (= *Brachydanio*°) *rerio* **IO** Characiformes Characidae × Cypriniformes Danionidae Schwartz 1981 (= Meinken 1967)

Atherina pontica × *Diplodus* (= *Sargus*°) *annularis* **IO** Atheriniformes Atherinidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 950 = Kryzanovskij 1968), Schwartz 1981 (ref. 1193 = Nikoljukin 1972)

Atherinops × *Clevelandia ios* **IO** Atheriniformes Atherinopsidae × Gobiiformes Oxudercidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Atherinops affinis × *Crenichthys baileyi* Atherinopsidae × Goodeidae **IO** Atheriniformes × Cyprinodontiformes) Schwartz 1972 (p. 273: ref. 739 = Hubbs 1967)

Atherinops affinis × *Fundulus parvipinnis* **IO** Atheriniformes Atherinopsidae × Cyprinodontiformes Fundulidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Atherinops affinis × *Salmo gairdneri* Atherinopsidae × Salmonidae **IO** (Atheriniformes × Salmoniformes) Schwartz 1972 (ref. 739 = Hubbs 1967 (no development))

Belone belone × *Mugil cephalus* **IO** Beloniformes Belonidae × Mugiliformes Mugilidae Schwartz 1972 (ref. 950), Schwartz 1981 (ref. 1193)

Belone belone × *Mullus barbatus* × **IO** Beloniformes Belonidae × Perciformes Mullidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

Biwia lenoke × *Hucho taimen* **IO** Cypriniformes Cyprinidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 491 = Dangel et al. 1973)

Blicca bjoerkna × *Brama brama* **IO** Cypriniformes Cyprinidae × Perciformes Bramidae Schwartz 1981 (ref. 1359 = Roule 1925)

Blicca bjoerkna × *Sander* (= *Lucioperca*°) *lucioperca* **IO** Cypriniformes Cyprinidae × Perciformes Percidae Schwartz 1972 (ref. 1219)

Carassius × *Oryzias* × **IO** Cypriniformes Cyprinidae × Beloniformes Adrianichthyidae Schwartz 1972 (ref. 517, 1636 = Suzuki 1968), Schwartz 1981 (ref. 131 = Aduma-Bossmann & Keiz 1971, 885, 1554, 1619, 1636 = Suzuki 1968)

Carassius carassius × *Entosphenus japonicus* **IO/IC** Cypriniformes Cyprinidae × Petromyzontiformes Petromyzontidae Schwartz 1972 (ref. 885 = Kobayasi 1963)

Carassius carassius × *Pungitius tymensis* **IO** Cypriniformes Cyprinidae × Perciformes Gasterosteidae Schwartz 1972 (ref. 885)

Clevelandia ios × *Fundulus parvipennis* **IO** Gobiiformes Oxudercidae × Cyprinodontiformes Fundulidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Clinocottus analis × *Clevelandia ios* **IO** Perciformes Cottidae × Gobiiformes Oxudercidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Clinocottus × *Fundulus* **IO** Perciformes Cottidae × Cyprinodontiformes Fundulidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Clinocotttus analis × *Hypsoblennius gilberti* **IO** Perciformes Cottidae × Blenniidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Clinocottus analis × *Leuresthes tenuis* **IO** Perciformes Cottidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

Clupea × *Gasterosteus* **IO** Clupeiformes Clupeidae × Perciformes Gasterosteidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

Clupea sapidissima × *Morone saxatilis* (= *Roccus° lineatus*) **IO** Clupeiformes Clupeidae × Acanthuriformes Moronidae Schwartz 1972 (ref. 1443 = Ryder 1885)

Clupea pallasi × *Salmo gairdneri* **IO** Clupeiformes Clupeidae × Salmoniformes Salmonidae Hubbs 1967 (cleavages producing a mass of unorganized cells were noted), Schwartz 1972 (ref. 739 = Hubbs 1967)

Cottus bubalis × *Perca fluviatilis* **IF** Perciformes Cottidae × Perciformes Percidae (Scorpaeniformes × Perciformes) Schwartz 1981 (= Arnoult & Spillmann 1965 = ref. 188)

Cottus bubalis × *Salmo irideus* **IO** Perciformes Cottidae × Salmoniformes Salmonidae Schwartz 1981 (= Arnoult & Spillmann 1965 = ref. 188)

Cottus gobio × *Zingel asper* (= *Aspro° zingel*) **IO** Scorpaeniformes Cottidae × Perciformes Percidae Schwartz 1972 (ref. 815, 1101)

Crenichthys × *Clinocottus* **IO** Cyprinodontiformes Goodeidae × Perciformes Cottidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Crenichthys bailey × *Leuresthes tenuis* **IO** Cyprinodontiformes Goodeidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 739 = Hubbs 1967; ref. 991 = Leonhardt 1903)

Crenichthys baileyi × *Leuresthes tenuis* **IO** Cyprinodontiformes Goodeidae × Atheriniformes Atherinopsidae Schwartz 1972

Ctenolabrus × *Fundulus* **IO** Labriformes Labridae × Cyprinodontiformes Fundulidae Schwartz 1972 (ref. 597, 885, 1159 = Morris 1914 (art. hyb. „The eggs of *Ctenolabrus* died within 24 hours after fertilization ... They reached a stage in which the embryo was fairly well formed and the germ-ring had gone two-thirds of the way around the egg. ... There is no evidence of elimination of the paternal chromatin at any stage. etc., etc.), ref. 1345, 1347 = Pinney 1928 ("mitosis normal or abnormal ... hatching embryos very rare and only in the cross *Fundulus* × *Ctenolabrus* ♂ ..."), Schwartz 1981 (ref. 873 = Kobayasi 1965, 1193, 1431)

Ctenolabrus adspersus × *Menidia menidia* **IO** Labriformes Labridae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 885, 888, 890, 891 = Kobayasi 1951; ref. 1345, 1347 = Pinney 1928 (hatching embryos are very rare); ref. 1523a, 1573), Schwartz 1981 (ref. 873 = Kobayasi 1965)

Ctenolabrus adspersus × *Prionotus carolinus* **IO** Labriformes Labridae × Triglidae × Scorpaeniformes Schwartz 1972 (ref. 1346, 1347 = Pinney 1918)

Cyclopterus lumpus × *Pleuronectes flesus* **IO** *Scorpaeniformes Cyclopteridae* × *Pleuronectiformes Pleuronectidae* Schwartz 1972 (p. 240 sub Cyclopteridae: ref. 472)

Cynoscion × *Cyprinodon* **IO** Acanthuriformes Sciaenidae × Cyprinodontiformes Cyprinodontidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Cynoscion × *Fundulus* **IO** Acanthuriformes Sciaenidae × Cyprinodontiformes Fundulidae Moenkhaus 1911 (perfectly fertilized. The embryos may continue their development to a stage where the eyes, heart, ear vesicles, tail, etc., are more or less well formed. At this stage they remain alive until about the time that the normals hatch.), Schwartz 1981 (ref. 1744 = Wilk 1979)

Cynoscion arenarius × *Menidia beryllina* **IO** Acanthuriformes Sciaenidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Cyprinodon × *Gasterosteus* **IO** Cyprinodontiformes Cyprinodontidae × Perciformes Gasterosteidae Schwartz 1972 (ref. 1203 = see Newman 1915)

Cyprinodon variegatus × *Menidia menidia* **IO** Cyprinodontiformes Cyprinodontidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 1203 = Newman 1915)

Cyprinodon × *Scomber* **IO** Cyprinodontiformes Cyprinodontidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1915)

Cyprinodon × *Stenotomus* **IO** Cyprinodontiformes Cyprinodontidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Cyprinodon × *Tautoga onitis* **IO** Cyprinodontiformes Cyprinodontidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1915)

Cyprinodon × *Tautogolabrus adspersus* **IO** Cyprinodontiformes Cyprinodontidae × Labriformes Labridae Schwartz 1972 (ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Cyprinodon × *Trichiurus lepturus* **IO** Cyprinodontiformes Cyprinodontidae × Perciformes Trichiuridae Schwartz 1972 (ref. 1203 = Newman 1915)

Cyprinus × *Esox* **IO** Cypriniformes Cyprinidae × Salmoniformes Esocidae Schwartz 1972 (ref. 824 = Kasansky 1929)

Cyprinus × *Oryzias* **IO** Cypriniformes Cyprinidae × Beloniformes Adrianichthyidae Schwartz 1972 (ref. 1618, 1636 = Suzuki 1968), Schwartz 1981 (ref. 1554)

Cyprinus × *Pterolamiops*° (= *Carcharinus*) *longimanus* **IO/IC** Cypriniformes Cyprinidae × Carcharhiniformes Carcharhinidae Schwartz 1981 (ref. 1064 = DNA-hybridization)

~~*Cyprinus* × *Tilapia*~~ **IO** Cypriniformes Cyprinidae × Cichlidae Schwartz 1981 (ref. 1289 = Pruginin 1968 → obviously misinterpretation of Schwartz)

Esox × *Leuciscus* **IO** Salmoniformes Esocidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 824)

Esox lucius × *Perca fluviatilis* **IO** Salmoniformes Esocidae × Perciformes Percidae Hubbs 1971b („all embryos were dead by the ninth day."), Schwartz 1972 (ref. 824, 1219)

Esox × *Rutilus* **IO** Salmoniformes Esocidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 824)

Esox lucius × *Scardinius erythrophthalmus* **IO** Salmoniformes Esocidae × Cypriniformes Cyprinidae (Leuciscinae) Schwartz 1972 (ref. 1423), Schwartz 1981 (ref. 1193 = Nikoljukin 1972; 1349 = Romashov & Golovinskaia 1960)

Etheostoma × *Fundulus* **IO** Perciformes Percidae × Cyprinodontiformes Fundulidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Etheostoma × *Menidia* **IO** Perciformes Percidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 739 = Hubbs 1967; ref. 740a = Hubbs 1970)

Fundulus heteroclitus × *Gasterosteus aculeatus, bispinosus* **IO** Cyprinodontiformes Fundulidae × Perciformes Gasterosteidae Schwartz 1972 (ref. 1154 = Moenkhaus 1911 (Embryos formed but no indication of brain vesicles, etc.), 1203 = Newman 1915; 1433)

Fundulus parvipinnis × *Hypsoblennius gilberti* Cyprinodontiformes Fundulidae × Blenniiformes Blenniidae **IO** Schwartz 1972 (ref. 739 = Hubbs 1967)

Fundulus × *Lepomis* (= *Eupomotis*°) *gibbosus* **IO** Cyprinodontiformes Fundulidae × Centrarchiformes Centrarchidae Schwartz 1972 (ref. 1154 = Moenkhaus 1911 (the number of eggs impregnated was less than 1 per cent; early stages of gastrulation))

Fundulus parvipinnis × *Leuresthes tenuis* **IO** Cyprinodontiformes Fundulidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Fundulus div. spec. × *Menidia* **IO** Cyprinodontiformes Fundulidae × Atheriniformes Atherinopsidae Moenkhaus 1903 (Normal cleavage! Gastrulation begun, up to the closure of the blastopore in the gastrula. Dead after three days. „ ... the chromosomes of the two species can be readily distinguished morphologically .... The eggs of *Menidia notata* can be even more completely impregnated by the sperm of *Fundulus heteroclitus*. Under favorable circumstances 96 per cent of the eggs are fertilized. ... The normally impregnated eggs of both crosses develop normally to varying stages of embryo formation. They never go beyond the closure of the ‘‘blastopore.” ...”), Schwartz 1972 (ref. 303, 597, 739 = Hubbs 1967; 1150 = Moenkhaus 1903; 1154 = Moenkhaus 1911; 1203 = Newman 1915; 1347 = Pinney 1918, 1496)

Fundulus × *Morone americana* **IO** Cyprinodontiformes Fundulidae × Perciformes Moronidae Schwartz 1972 (ref. 1203 = Newman 1915)

Fundulus × *Notemigonus* **IO** Cyprinodontiformes Fundulidae × Cypriniformes Cyprinidae Hubbs 1971a („failure at gastrulation”), Schwartz 1972 (ref. 740a)

Fundulus × *Notropis* **IO** Cyprinodontiformes Fundulidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Fundulus heteroclitus × *Opsanus tau* **IO** Cyprinodontiformes Fundulidae × Batrachoidiformes Batrachoididae Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

Fundulus × *Peprilus* (= *Poronotus*°) **IO** Cyprinodontiformes Fundulidae × Scombriformes Stromateidae Schwartz 1972 (ref. 1203 = Newman 1915)

Fundulus × *Percina* **IO** Cyprinodontiformes Fundulidae × Perciformes Percidae Schwartz 1972 (ref. 739 = Hubbs 1967)

Fundulus × *Prionotus* **IO** Cyprinodontiformes Fundulidae × Perciformes Triglidae Pinney 1928 (mitosis abnormal, no embryos), Schwartz 1972 (ref. 885, 1346 etc.)

Fundulus × *Salmo gairdneri* **IO** Cyprinodontiformes Fundulidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 491 = Dangel et al. 1973)

Fundulus chrysotus × *Sander* (= *Stizostedion*°) *vitreum* **IO** Cyprinodontiformes Fundulidae × Perciformes Percidae Schwartz 1981 (ref. 767 = Hubbs 1971b)

Fundulus heteroclitus × *Scomber scombrus* **IO** Cyprinodontiformes Fundulidae × Scombriformes Scombridae Newman 1918 (results much differing but embryos never normal or in very rare cases maternal), (Schwartz 1972 (ref. 644 = Hertwig 1936; 739 = Hubbs 1967, 885, 1083 = Matsui & Ojima 1956; 1101, 1203 = Newman 1915; 1205, 1206, 1388 = Reagan & Thorington 1915; 1441 = Russell 1939 („the „hybrids" do not develop beyond late embryological stages ..."), Schwartz 1981 (ref. 1319 **=** Regan & Thorington 1915)

Fundulus heterocitus, majalis × *Stenotomus chrysops* **IO** Cyprinodontiformes Fundulidae × Acanthuriformes Sparidae Moenkhaus 1911 (embryos too short), Schwartz 1972 (ref. 885, 1019, 1154, ref. 1203 = Newman 1915), ref. 1259, 1346, 1347 = Pinney 1918, 1928, 1636 = Suzuki 1968)

Fundulus × *Tautoga onitis* **IO** Cyprinodontiformes Fundulidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911 = Moenkhaus 1911 (only early cleavages); 1203 = Newman 1915)

Fundulus × *Tautogolabrus adspersus* **IO** Cyprinodontiformes Fundulidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911 (only early cleavages, no embryos developed); 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Gadus merlangus × *Eutrigla* (= *Trigla*°) *gurnardus* **IO** Gadiformes Gadidae × Scorpaeniformes Triglididae Schwartz 1972 (ref. 1346, 1347 = Pinney 1918)

Gadus morrhua × *Labrus rupestris* **IO** Gadiformes Gadidae × Labriformes Labridae Schwartz 1972 (ref. 74, 643 = Hertwig & Hertwig 1914 (only up to the blastula stage); ref. 1101, 1154 = Moenkhaus 1911, ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1193)

Gadus macrocephalus × *Oncorhynchus keta* **IO** Gadiformes Gadidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 1538, 1539, 1668 = Terao 1934), Schwartz 1981 (ref. 491 = Dangel et al. 1973; ref. 1466)

Gadus morrhua × *Pleuronectes flesus, platessa* **IO** Gadiformes Gadidae × Pleuronectiformes Pleuronectidae Schwartz 1972 (ref. 74; 643 = Hertwig & Hertwig 1914 (only up to the blastula stage); 1101, 1154 = Moenkhaus 1911, ref. 1203 = Newman 1915), Schwartz 1981 (ref. 688)

Gambusia affinis × *Sander* (= *Stizostedion*° *vitreus* **IO** Cyprinodontiformes Poeciliidae × Perciformes Percidae Schwartz 1981 (ref. 767 = Hubbs 1971b) („none of the eggs gastrulated")

Gasterosteus aculeatus × *Menidia* **IO** Perciformes Gasterosteidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 740a = Hubbs 1970; 1154 = Moenkhaus 1911 („The eggs of this stickleback are practically all impregnated when placed with *Menidia* sperm. In the two experiments tried, 100 per cent, and 70 per cent, were fertilized. A small per cent, of these are polyspermic. The development keeps well

apace with the normals until toward the closure of the blastopore. The embryo is laid down, the eyes are formed, but the anterior region of body is quite heavy. Pigment forms and the heart is developed. I have never seen fins form in these hybrids. The embryos soon die, owing possibly to the fact that the eggs even normally do not do well in a fingerbowl of water."); ref. 1203 = Newman 1915)

Gasterosteus × *Peprilus* (= *Poronotus*°) **IO** Perciformes Gasterosteidae × Scombriformes Stromateidae Schwartz 1972 (ref. 1203 = Newman 1915)

Gasterosteus × *Scomber* **IO** Perciformes Gasterosteidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1915

Gasterosteus × *Stenotomus* **IO** Perciformes Gasterosteidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Gasterosteus × *Tautoga* **IO** Perciformes Gasterosteidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

Gasterosteus × *Tautogolabrus* **IO** Perciformes Gasterosteidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911, 1203 = Newman 1915), Schwartz 1981 (= Serchuk & Frame 1973 = ref. 1431)

Gobio × *Thallassoma pavo* **IO** Cypriniformes Gobioniidae × Labriformes Labridae Schwartz 1972 (ref. 643 = Hertwig & Hertwig 1914; 1203 = Newman 1915)

Gymnocephalus (= *Acerina*°) *acerina* × *Esox* **IO** Perciformes Percidae × Salmoniformes Esocidae Schwartz 1972 (ref. 1219)

Gymnocephalus (= *Acerina*°) × *Leuciscus* **IO** Perciformes Percidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 950 = Kryzanovski 1968)

Gymnocephalus (= *Acerina*°) × *Rutilus* **IO** Perciformes Percidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 113, ref. 950 = Kryzanovski 1968, 1219, 1423), Schwartz 1981 (ref. 1349 = Romashov & Govinskaia 1960)

Labeo tropheus × *Sarotherodon mossambicus* **IO** Cypriniformes Cyprinidae × Cichliformes Cichlidae Schwartz 1981 (ref. 981 = Lund 1976)

Lepomis macrochirus × *Menidia audens* **IO** Centrarchiformes Centrarchidae × Atheriniformes Atherinidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Leuresthes tenuis × *Micrometrus minimus* **IO** Atheriniformes Atherinopsidae × Blenniiformes Embiotocidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

Leuresthes tenuis × *Salmo gairdneri* **IO** Atheriniformes Atherinopsidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 491 = Dangel et al. 1973)

Leuresthes tenuis × *Salmo gairdneri* **IO** Atheriniformes Atherinopsidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

Lota marmorata (= *lota*) × *Salmo trutta* **IO** Gadiformes Lotidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 2, 454, 995, 1439, 1538), Schwartz 1981 (ref. 491 = Dangel et al. 1973 = Ackermann 1898, Simon & Noble 1968 and several other citations; ref. 923, 927, 1466

Lota marmorata × *Oncorhynchus* **IO** Gadiformes Lotidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 491 = Dangel et al. 1973; ref. 810)

~~*Megalobrama amblycephala* × *Siniperca chuatsi*~~ Cypriniformes Xenocyprididae × Centrarchiformes Sinipercidae Wang et al. 2021, only partial hybrid, nearly identical with *Megalobrama*

Menidia audens × *Notemigonus chrysoleucas* **IO** Atheriniformes Atherinopsidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Menidia audens × *Notropis cornutus* **IO** Atheriniformes Atherinopsidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 740a)

Menidia notata × *Opsanus tau* **IO** Atheriniformes Atherinidae × Batrachoidiformes Batrachoididae Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

Menidia menidia × *Peprilus* (= *Poronotus*°) *triacanthus* **IO** Atheriniformes Atherinopsidae × Scombriformes Stromateidae Schwartz 1972 (ref. 1203 = Newman 1915)

Menidia audens × *Percina caprodes* **IO** Atheriniformes Atherinopsidae × Perciformes Percidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Menidia × *Prionotus* Atheriniformes Atherinopsidae × Scorpaeniformes Triglidae **IO** Schwartz 1981 (ref. 691 = Hubbs 1936; 1347 = Pinney 1928 (mitosis abnormal, no embryos); ref. 1514)

Menidia menidia × *Scomber scombrus* **IO** Atheriniformes Atherinopsidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1915 = Newman 1915)

Menidia menidia × *Tautoga onitis* **IO** Atheriniformes Atherinopsidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911; 1203 = Newman 1915)

Menidia menidia × *Tautoglabrus adspersus* **IO** Atheriniformes Atherinopsidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911, ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Menidia menidia × *Stenotomus chrysops* **IO** Atheriniformes Atherinopsidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Misgurnus anguillicaudatus × *Oryzias latipes* **IO** Cypriniformes Cobitidae × Beloniformes Adrianichthyidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Oncorhynchus gorbuscha × *Pterolamiops*° (= *Carcharhinus*) *longimanus* **IO/IC** Salmoniformes Salmonidae × Carcharhiniformes Carcharhinidae Schwartz 1981 (ref. 1064 = DNA-hybridization)

Opsanus (= *Batrachus*°) *tau* × *Tautogolabrus* **IO** Batrachoidiformes Batrachoididae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Peprilus (*Poronotus*°) *triacanthus* × *Stenotomus chrysops* **IO** Scombriformes Stromateidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Perca fluviatilis × *Rutilus rutilus* **IO** Perciformes Percidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968)

Perca flavescens × *Salmo gairdneri* **IO** Perciformes Percidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 1065 = Meehan 1898)

Rutilus × *Sander* (= *Lucioperca*°) *lucioperca* **IO** Cypriniformes Cyprinidae × Perciformes

Percidae Schwartz 1972 (ref. 1219)

Sander (= *Stizostedion*°) *vitreus* × *Xiphophorus* (= *Platypoecilus*°) *helleri* **IO** Perciformes Percidae × Cyprinodontiformes Poeciliidae Schwartz 1981 (ref. 767 = Hubbs 1971b)

Tribolodon hakonensis × *Salmo gairdneri* **IO** Cypriniformes Cyprinidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

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Wang Y et al. (2021) The formation of hybrid fish derived from hybridization of *Megalobrama amblycephala* (♀) × *Siniperca chuatsi* (♂). Aquaculture 548 (3) 737547, DOI:10.1016/j.aquaculture.2021.737547 only partial hybrid!