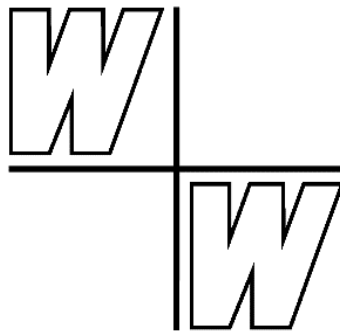


Data Collection on Intergeneric Hybrids and Basic Types: „PISCES“

Herfried Kutzelnigg & Benjamin Scholl

version 3 11.09.2026



Studiengemeinschaft Wort und Wissen

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

„PISCES“

3 classes, 88 orders, 554 families, 5340 genera, 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

* = sole family of the order

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:

472 intergeneric hybrids (nothogenera) (incl. **17 IT + 31 ISF + 79 IF + 11 ISO**) in 53 families. – 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.

15 preliminary basic types (species number per basic type ranging from 1 to 3900, average species number $8804 / 15 = 587$ species).

Basic type level: family 9, >1 family 6.

Acestrorhamphidae (Characiformes) 54: 685. **3 IG** (incl. **2 ISF**)

Acipenseriformes families Acipenseridae + Polyodontidae 6: 29. **2 IG** (incl. **1 IF**)

Carangiformes families Pleuronectidae + Paralichthyidae 25: 166. **12 IG** (incl. **2 ISF + 1 IF**)

Centrarchidae (Centrarchiformes) 7: 34. **14 IG** (incl. **8 ISF**)

Cichlidae (Cichliformes) 200: 1500. **22 IG** (incl. **2 ISF**)

Cypriniformes suborders Cyprinoidei + Cobitoidei (all 21 families) 925: 3900. **270 IG** (incl. **62 IF + 6 ISO**)

Cyprinodontiformes (all 14 families) 150: 1500. **59 IG** (incl. **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**

Lepidogalaxiidae* (Lepidogalaxiiformes) (*Lepidogalaxias*) 1: 1. – (only species of the order)

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

Percidae (Perciformes) 10: 200. **8 IG** (incl. **5 ISF**)

Salmonidae (Salmoniformes) 10: 190. **11 IG** (incl. **4 ISF**)

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

Siluriformes families Clariidae, Claroteidae, Heteropneustidae, Pangasiidae 32: 218 (probably part of a larger basic type). **4 IG** (incl. **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 Frédéricich & Santini 2017, 22. <https://doi.org/10.26496/bjz.2017.2>)

Acanthuriformes: Moronidae 2: 6 + extinct genera

temperate basses = Wolfsbarsche, Streifenbarsche

Dicentrarchus 2, *Morone* 4.

Morone 3 **IS**.

Morone saxatilis × *Roccus*^o (= *Morone*) *americanus*, *chrysops* **IS** Schwartz 1972 (ref. 197, 338a, 785a, 1443), Schwartz 1981 (ref. 323, 1537)

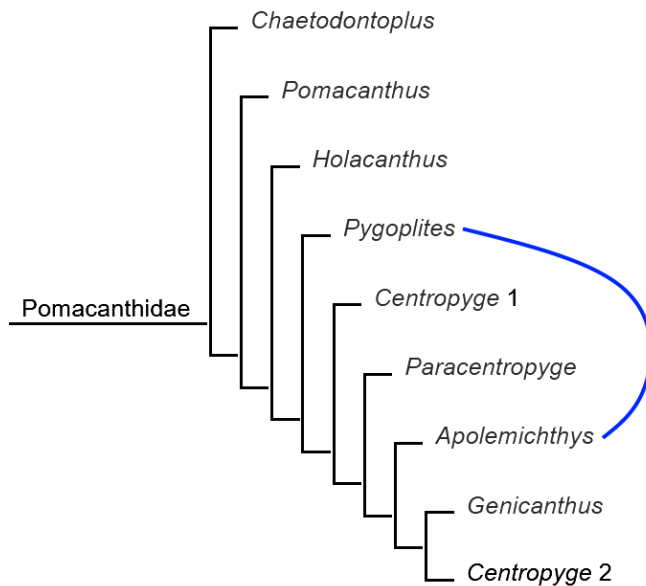
Acanthuriformes: Pomacanthidae 8: 88. 1 IG

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*^o) *crocea* × *Miichthys* ("*Sciaena*") *miuy* 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)

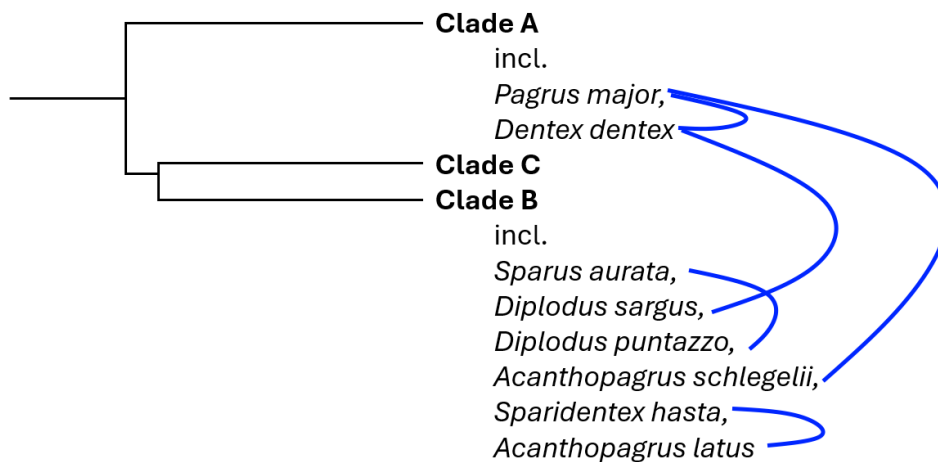
Acanthopagrus latus × *Sparidentex hasta* Bartley et al. 1997 (= Al-Abdul-Elah)

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 Bamidgah 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.sij-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 Anabantoidi)

gouramis, gouramies = Labyrinthfische p.p.

5 subfamilies:

Belontiinae 1: 2.

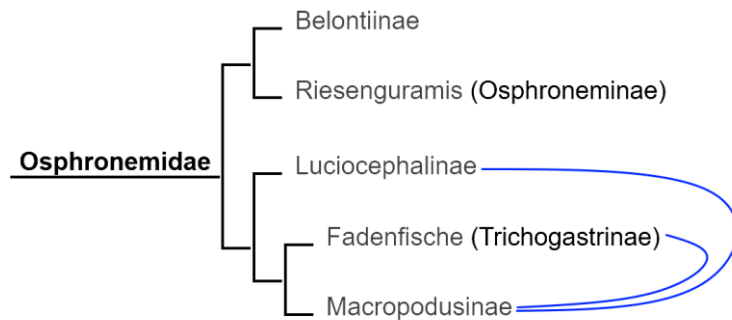
Luciocephalinae 4 *Ctenops*, ...

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 in subfamily Menidiinae (7: 80) the genera are 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

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
- Rubioff 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.angfaqlid.org.au/Hybrid.htm> For most part interspecific hybrids of *Melanotaenia*.

Batrachoidiformes only 1 family

Batrachoididae 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 sebae × *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 sebae* in captivity. *Recent Research in Science and Technology* 3 (2), 95–99.
- Mebis 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)

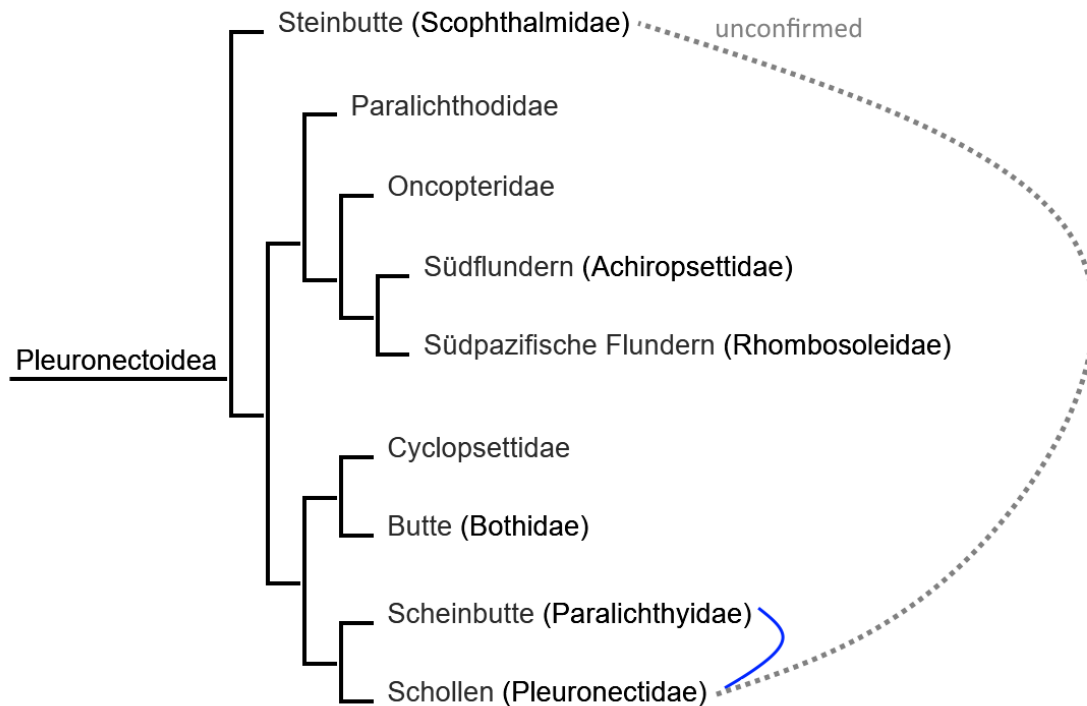
right eye flounders = Schollen, Rechtsaugenflundern

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 in the phylogeny of Atta et al. (2021) [doi: 10.1016/j.ympev.2021.107315](https://doi.org/10.1016/j.ympev.2021.107315), from de.wikipedia (2025, CC BY SA 4.0).

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

Hippoglossoides platessoides × *Pleuronectes (Platessa^o) 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 & Kurnuma 1942, Hubbs 1955, Garrett 2005

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

Platichthys (Kareius^o) 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 variegatus* **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*~~ **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. (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

References on Carangiformes:

Aron WI (1957) Cytohistological studies on the hybrid of *Platichthys stellatus* × *Parophrys vetulus*, with notes on its backcross to *P. vetulus*. M. S. thesis, Univ. Wash. 39 p. and Copeia 1958, 105–111.

Garrett DL (2005) A new intergeneric hybrid flatfish (Pleuronectiformes: Pleuronectidae) from Puget Sound and adjacent waters. Copeia 2005 (3), 673–677.
<http://www.asihcopeiaonline.org/doi/abs/10.1643/CI-04-344R?journalCode=cope>

Garrett DL, Pietsch TW, Utter FM & Hauser L (2007) The hybrid sole *Isopsetta ischyra* (Teleostei: Pleuronectiformes: Pleuronectidae): hybrid or biological species? Trans. Amer. Fisheries Soc. 136 (2), 460–468.

Hubbs CL (1955) Hybridization between fish species in nature. Syst. Zool. 4, 1–20. = [ref. 696 of Schwartz 1972](#)

Hubbs CL & Kuronuma K (1942) Hybridization in nature between two genera of flounders in Japan. Papers Michigan Acad. Sci. Arts & Lett. 27, 267–306. = [ref. 709 of Schwartz 1972](#)

- Kim KK et al. (1996) Early survival and chromosomes of intergeneric hybrids between Japanese flounder *Paralichthys olivaceus* and spotted halibut *Verasper variegatus*. Fisheries Science 62 (3), 490–491.
- Krause KEH (1881) Ein Schollen-Bastard *Platessa vulgaris* × *Rhombus maximus*. Archiv des Vereins der Freunde der Naturgeschichte in Mecklenburg 35, 119–120.
https://books.google.de/books?id=424XAAAAYAAJ&pg=PA119&redir_esc=y#v=onepage&q&f=false *Pleuronectes platessa* × *Scophthalmus maximus*
- Li J et al. (2006) Embryonic and larval development in hybrid between *Paralichthys olivaceus* ([female]) and *Verasper variegates* ([male]). J. Fishery Sciences of China 13 (5), 732–739.
- Norman JR (1934) A systematic monograph of the Flatfishes (Heterosomata), 1. British Museum of Natural History. *Scophthalmus interspecific*
- 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*.

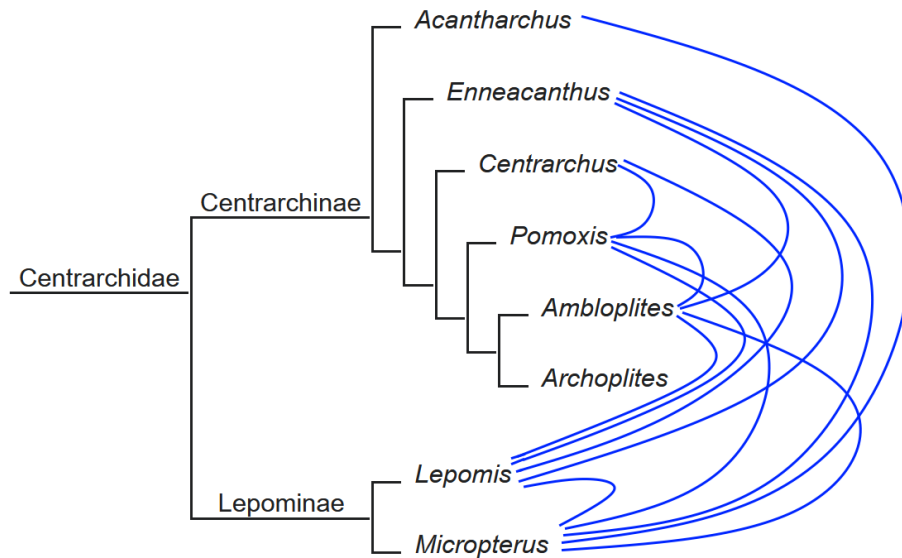
Basic type family Centrarchidae: Nearly all genera and both subfamilies are connected by hybridization, including the most distant genera.

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



Centrarchidae: hybrids in the phylogeny of Near TJ & Kim D (2021) doi: 10.1016/j.ympev.2021.107156 from de.wikipedia (2025, CC BY 4.0).

References on Centrarchidae:

- Birdsong RS & Yerger RW (1967) A natural population of hybrid sunfishes: *Lepomis macrochirus* × *Chaenobryttus gulosus*. Copeia 1967, 62–71.
- Bolnick DI (2007) ANOPA: ‘statistical’ systematics for young earth creationists. Reports of the National Center for Science Education 26, 22–31.
<https://webspace.utexas.edu/dib73/Bolnicklab/pdfs/ANOPA.pdf?uniq=-wipnum>
- Bolnick DI (2009) Hybridization and speciation in Centrarchids. In: Cooke S & Philipp D (eds.) Biology of the Centrarchids.
<https://webspace.utexas.edu/dib73/Bolnicklab/pdfs/Bolnick%202009%20in%20Biology%20of%20Centrarchid%20Fishes.pdf>
- Bolnick DI & Miller CE (2006) Intergeneric spawning between captive female Sacramento Perch (*Archoplites interruptus*) and male Rock Bass (*Ambloplites rupestris*), Teleostei: Centrarchidae. Amer. Midland Naturalist 156 (2), 299–304.
- Bolnick DI & Near TJ (2005) Tempo of hybrid inviability in Centrarchid fishes (Teleostei, Centrarchidae). Evolution 59 (8), 1754–1767.
<https://webspace.utexas.edu/dib73/Bolnicklab/pdfs/BolnickandNearEvolution.pdf>
 online appendix: Collected published data on hybrid viability in Centrarchids:
<https://webspace.utexas.edu/dib73/Bolnicklab/pdfs/Bolnick%20and%20Near%202005%20Evolution%20Suppl.pdf>
- Bolnick DI et al (2008) Accelerated mitochondrial evolution and explain ‘Darwin’s corollary’?: Asymmetric viability of reciprocal F1 hybrids in centrarchid fishes. Genetics 178, 1037–1048.
- Burr BM (1974) A new intergeneric hybrid combination in nature: *Pomoxis annularis* × *Centrarchus macropterus*. Copeia 1974, 269–271.
- Cavanaugh DP & Sternberg RV (2004) Analysis of morphological groupings using ANOPA, a pattern recognition and multivariate statistical method: a case study

- involving centrarchid fishes. J. Biological Systems 12, 137–67. [This baraminological paper has been criticized by Bolnick 2007. No data on hybrids.](#)
- Childers WF (1971) Hybridization of fishes in North America (Family Centrarchidae). In 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/B3310E10.htm>
- Childers WF, Cho P & Whitt (1972) Isozyme analysis of the green sunfish × largemouth bass F₁ intertribal hybrid (Centrarchidae). Isozyme Bull. 5, 32. = ref. 431 of Schwartz 1982
- Hester FG (1970) Phylogenetic relationships of sunfishes as demonstrated by hybridization. Trans. Amer. Fisheries Soc. 99, 100–104. = ref. 645 of Schwartz 1972.
- Merriner JV (1971) Development of intergeneric centrarchid hybrid embryos. Trans. Amer. Fisheries Soc. 100 (4), 611–618. = ref. 1083 of Schwartz 1982.
- Tyus HM (1973) Artificial intergeneric hybridization of *Ambloplites rupestris* (Centrarchidae). Copeia 1973, 428–430.
- West JL & Hester FE (1966) Intergeneric hybridization of Centrarchids. Trans. Amer. Fish. Soc. 95 (3), 280–288. = ref. 1770 of Schwartz 1972. art. hyb., often intertribal.
- West JL (1970) The gonads and reproduction of three intergeneric sunfish (family Centrarchidae) hybrids. Evolution 24, 378–394. <http://www.jstor.org/pss/2406812>
- Whitt GS, Philipp DP & Childers WF (1977) Aberrant gene expression during the development of hybrid Sunfishes (Perciformes, Teleostei). Differentiation 9, 97–109. <http://www.sciencedirect.com/science/article/pii/S0301468111611419> = ref. 1736 of Schwartz 1981
- 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 = Salmier-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 Salmier** 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

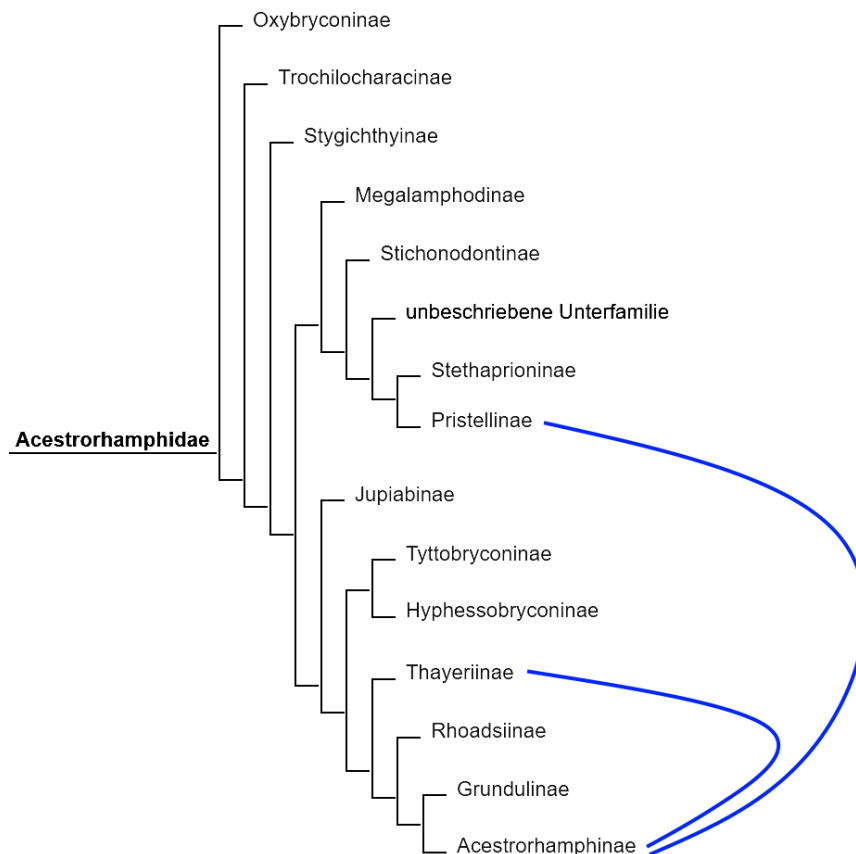
Acestrorhamphinae × Thayeriinae Schwartz 1972 (ref. 829 = Kauffeld 1954)

Gymnocorymbus ternetzi × *Psalidodon anisitsi* ("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](https://doi.org/10.1093/zoolinnean/zlae101), from de.wikipedia (2026, CC BY SA 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: Serrasalminidae 17: 107. 1 IG + 1 ISF (suborder Characoidei)

serrasalmids, Sägesalmler

Formerly part of Characidae.

3 subfamilies:

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

Myleinae (upland pacus) 9: 41.

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

Possibly **Serrasalminidae** (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:

Azuma H (1969) Crossing *Metynnis* with *Mylossoma*. Tropical Fish Hobbyist 17 (155, 5), 92–98. = ref. 91 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>

Ciasullo GM (2004) Advances in the obtaining of cariotypes [karyotypes] in species morocoto *Piaractus brachypomus*, of the hybrid F1 of *Colossoma macropomum* (female) by *Piaractus brachypomus* (male) and hybrid F2 back-crossed of hybrid F1 female by male of its parent species. III Congr. Iberoamericano Virtual de Acuicultura.

<http://www.revistaaquatic.com/civa2004/coms/resumen.asp?cod=18&i=i>

Daget J (1963) Sur plusieurs cas probables d'hybridation naturelle entre *Citharidium ansorgi* & *Citharinus distichiodoides*. Mem. Inst. Franc. Afr. Noire 68, 81–83. = ref. 333 of Schwartz 1972

David CJ & Pandian TJ (2006) Maternal and paternal hybrid triploids of tetras. J. Fish Biology 69 (4), 1102–1119.

Martins ML et al. (2002) Response of the tambacu hybrid (*Piaractus mesopotamicus* Homberg, 1887 male × *Colossoma macropomum* Cuvier, 1818 female) to single and consecutive stimuli of capture. Boletim do Instituto de Pesca (Sao Paulo) 28 (2), 195–204.

Meinken H (1967) Noch einmal die *Brachydanio frankei*-Frage. Aquar. Terr. 14 (7), 226–231.

Pfeiffer W (1967) Die Korrelation von Körperlänge, Augenlinsen und Pupillengröße bei Hybriden aus *Astyanax* × *Anoptichthys* (Characidae, Pisces). Roux Arch. Entwicklungsmechanik 158, 218–245.

Whitt GS & Maeda FS (1970) Lactate dehydrogenase gene function in the blind cave fish, *Anoptichthys jordani*, and other characins. Biochem. Genet. 4, 727–741. = ref. 1734 of Schwartz 1981. <http://link.springer.com/journal/volumesAndIssues/10528>
This paper has no information on hybrids, but obviously Schwartz 1981 has misinterpreted the summary

Wilkens H (1971) Genetic interpretation of regressive evolutionary processes: Studies on hybrid eyes of two *Astyanax* cave populations (Characidae, Pisces). Evolution 25 (3), 530–544.

Cichliformes 3 families 205: 1500

Formerly part of Perciformes.

3 families:

Cichlidae 200: 1500, Pholidichthyidae 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: 1500) as suggested by Fehrer 1997, Scherer 1998, Junker 2019.

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 × *Metriacrima*^o (= *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 × *Pelamotichromis 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 zillii*” (*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 zillii*” (*Coptodon*) Pseudocrenilabrinae Schwartz 1972
(ref. 1317, 1318), Rana et al. 1996

References:

- Albertson RC et al. (1999) Phylogeny of a rapidly evolving clade: The cichlid fishes of Lake Malawi, East Africa. *Proc. Natl. Acad. Sci.* 96, 5107–5110.
- Baroiller JF et al. (2000) Production of two reciprocal intergeneric hybrids between *Oreochromis niloticus* and *Sarotherodon melanotheron*. In: *Tilapia Aquaculture in the 21st Century*. Edited by Fitzsimmons K & Carvalho Filho J. *Proc. fifth int. Symp. on Tilapia Aquaculture*, Rio de Janeiro, Brazil.
- 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*
- Fehrer J (1997) Explosive Artbildung bei Buntbarschen der ostafrikanischen Seen. *Studium Integrale J.* 4, 51–55.
- Junker R (2019) Mit oder ohne Streifen – Evolution oder präexistente Vielfalt? *Studium Integrale J.* 26, 56–57. <https://www.sij-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.
- Meier J I et al. (2017) Ancient hybridization fuels rapid cichlid fish adaptive radiations. *Nature Communications* 8, 14363.
<https://doi.org/10.1038/ncomms14363>
- 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.pdf
<http://ideas.repec.org/b/wfi/wfbook/32678.html> *Coptodon* ("Tilapia") *zillii* × *Oreochromis* div. spec. *Tilapia zillii* × *Sarotherodon galilaeus*
- Scherer S (1998) Abnehmender Sexappeal von männlichen Buntbarschen durch Umweltverschmutzung des Viktoriasees. *Studium Integrale J.* 5, 85–86.
- Schneider RF (2017) Molecular bases of morphological diversity in cichlid fishes. Dissertation Universität Konstanz
- 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>
- Toguyeni A et al. (2009) Sexual dimorphism in two pure cichlid species, *Oreochromis niloticus niloticus* (Linnaeus 1758) and *Sarotherodon melanotheron melanotheron* (Ruppel 1852), and their intergeneric hybrid. *African J. of Aquatic Science* 34, 69–75.
- 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*^o (= *Alosa*) *aestivalis*, *pseudoharengus* **IS** Alosidae (since 2025 separate family) Schwartz 1972 (ref. 1056)

Dorosoma cepedianum × *Signalosa*^o (= *Dorosoma*) *petenensis* **IS** Dorosomatidae (since 2025 separate family) (nat. hyb.) Schwartz 1972 (ref. 1143 = Minckley & Krumholz

1960)

Cypriniformes 4 suborders, 23 families, 962: 4100 + 1

extinct family

Systematics according to fishbase (2025) 4 suborders:

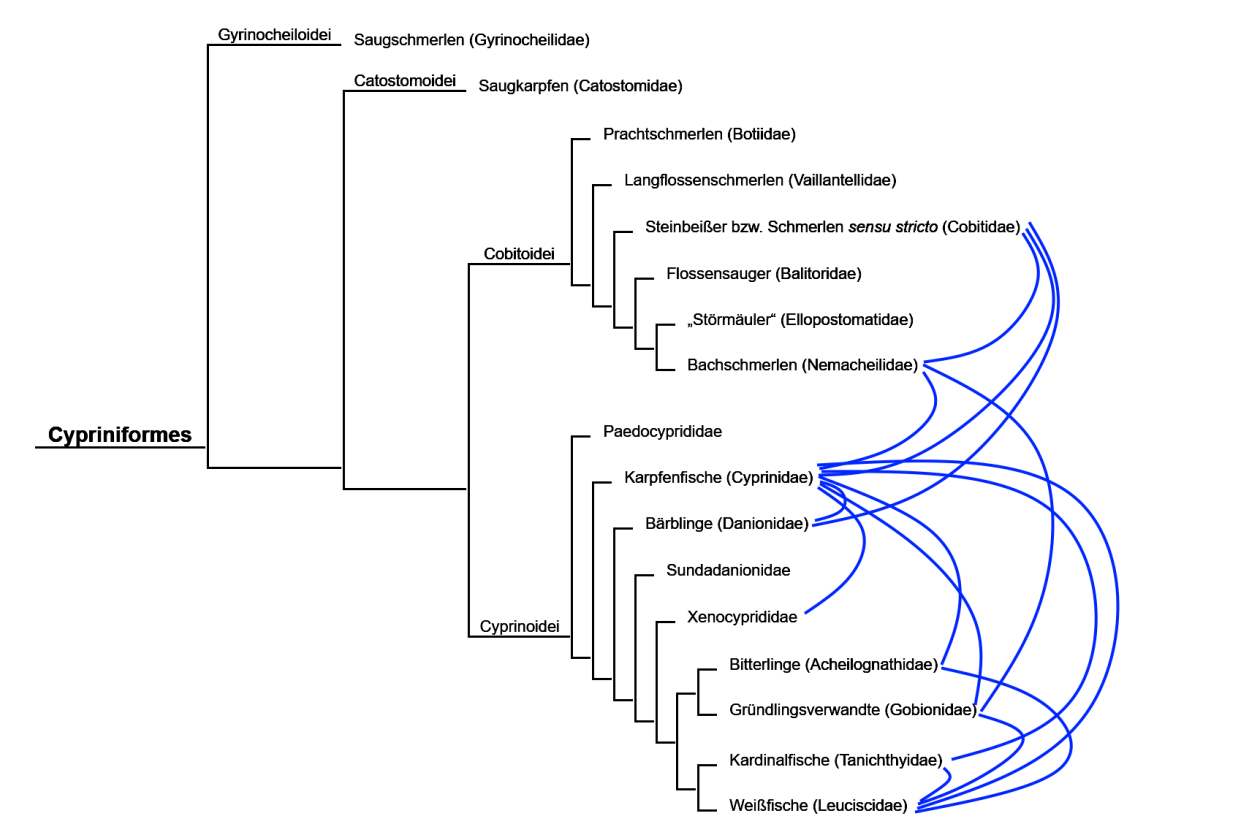
Gyrinocheiloidei 1 family: Gyrinocheilidae 2: 5.

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](https://doi.org/10.1186/s12862-016-0819-5), from de.wikipedia (2025, CC BY SA 4.0).

Cypriniformes suborder Catostomoidei 1 family 13: 80 + extinct genera

Catostomidae 13: 80 + extinct genera. 3 IG

suckers = Saugkarpfen

4 subfamilies:

Catostominae 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*^o (*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, Kusunoki 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 (*Acanthopthalmus*° *fasciatus*) *kuhlui* × *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*^o (*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 × *Leucaspis 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*^o) × *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*^o) × *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*^o) *chalcoides* × *Vimba* *Leuciscidae* (nat. hyb.) Schwartz 1972 (ref. 181, 183, 1322, 1353a, 1353b, 1548, 1549)

Aphyocypris × *Danio* (*Brachydanio*^o) *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*^o (*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, Levin et al. 2019

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 = Vutskits 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 × *Hemigrammocypripis* 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*^o) *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*^o) *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*^o) *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** *Cyprinidae* × *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*^o) *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*^o) *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*^o) *cephalus* **Leuciscidae** Schwartz 1972 (ref. 176, 423)

Chondrostoma × *Parachondrostoma* **Leuciscidae** Simkova et al. 2013 (nat. hyb. Spain)

Chondrostoma × *Phoxinellus* (*Paraphoxinus*^o) *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*^o) **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 (*Ceraticthys*^o) × *Notropis* (*Hypsilepis*^o) **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*^o (*Rutilus*) *rutilus* **IF Cyprinidae × Leuciscidae** Schwartz 1972 (ref. 227; 1480/1481 = Schreitmüller 1916), Schwartz 1981 (ref. 471, 1370)

Cyprinus × *Leuciscus*^o (= *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 schmidt* **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), Suttikus & 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 × *Hemigrammocypripis* 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. Knauth 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* *Xenocypridae* <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^o *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^o (= *Tanakia* p.p.) × *Rhodeus* **Acheilognathidae** Duyvené de Wit 1964, Schwartz 1972 (ref. 375, 672, 679), Schwartz 1981 (ref. 750)
Paracheilognathus^o (= *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*^o) × *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*^o) *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 = Nikoljugin 1935; 1223 = Nikoljugin 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*^o) *barbatula* × *Gobio fluviatilis* ISO **Nemacheilidae** × **Gobionidae** (art. hyb., confirmed) von Knauthe 1891, Schwartz 1972 (ref. 991 = Leonhardt 1903)
Barbatula (= *Nemacheilus*^o) *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 platypus*, *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 × *Pseusaspis* (*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 platypus*, *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)

References on Cypriniformes:

Adumua-Bossmann JA & Keiz G (1971) Vergleichende Untersuchungen über Wachstum und morphologische Eigenschaften von reinrassigen Karpfen (*Cyprinus carpio* L.) und Goldgiebeln (*Carassius auratus gibelio* Bloch) sowie ihrer aus reziproken Kreuzungen hervorgegangenen Bastarde. Veröff. Zool. Staatssammlung München 51, 205–307. (= Dissertation Techn. Hochschule

- München.) = ref. 131 of Schwartz 1981.
http://www.landesmuseum.at/pdf_frei_remote/VeroeffZSM_015_0203-0307.pdf
- Al-Mukhtar MA & Al-Hassan LAJ (1999) A natural intergeneric hybrid of *Barbus sharpeyi* (Günther, 1874) and *Carassius auratus* (L.) from a small water body in Khoozestan (Iran). *Acta Zoologica Bulgarica* 51 (1), 35–41.
- Amini F, Zamini AA & Ahmadi MR (2007) Intergeneric hybridization between kutum, *Rutilus frisii kutum*, and bream, *Abramis brama orientalis*, of the Caspian Sea. *J. World Aquaculture Soc.* 38 (4), 497–505.
- Arai K et al. (1994) Allozyme expression in hybrids between diploid and tetraploid races of spinous loach, *Cobitis biwae* and loach, *Misgurnus anguillicaudatus*. [Japanese with English summary]. *Suisanzushoku* 1994 (6), 585–591.
<http://www.affrc.go.jp/jasi/570394.pdf>
- Arnoult J & Spillmann CJ (1965/1966) Reproduction experimentale & hybridations nouvelles de Téléostéens 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 1981.
- Arnoult J & Spillmann CJ (1966) Hybrides des *Telestes soufia* (Risso) & de *Phoxinus Phoxinus* (L.) (Pisces, Cyprinidae) (2e note). *Bull. Mus. Natl. Hist. Nat.* 2. ser. 38 (4), 392–395.
- Balon EK (1992) How dams on the River Danube might have caused hybridization and influenced the appearance of a new cyprinid taxon. *Environmental Biology of Fishes* 33, 167–180. *Blicca × Vimba*.
- Balon EK, Duyvené de Wit JJ & Holcik J (1962) The early stages of development of the intersubfamiliar hybrid *Puntius anoplus × Rhodeus ocellatus* (Cyprinidae). *Zool. Anz.* 168 (1–4), 102–112. (1961) = ref. 115 of Schwartz 1972.
- Banister KE (1972) On the cyprinid fish *Barbus alluaudi* Pellegrin: A possible intergeneric hybrid from Africa. *Bull. British Museum Natural History Zool.* 24 (5), 263–290. = ref. 247.
- 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>
- Beck ML & C.J. Biggers CJ (1983) Erythrocyte measurements in diploid and triploid *Ctenopharyngodon idella × Hypophthalmichthys nobilis* hybrids. *J. Fish Biology* 22, 497–502.
- Berinke L (1960) Further morphological and osteological investigations on hybrids of Hungarian Cyprinids. *Ann. Hist. Nat. Mus. Natl. Hung* 52, 447–463. = ref. 290 of Schwartz 1981.
- Berry PY & Low MP (1970) Comparative studies on some aspects of the morphology and histology of *Ctenopharyngodon idellus*, *Aristichthys nobilis* and their hybrid (Cyprinidae). *Copeia* 1970 (4), 708–726.
- Billiard R (2008) Fisheries and aquaculture. Vol. III. - Warm water fish: the Carp family. <http://www.eolss.net/Sample-Chapters/C10/E5-05-03-08.pdf>

- Britz R, Conway KW & Rübel L (2014) Miniatures, morphology and molecules: *Paedocypris* and its phylogenetic position (Teleostei, Cypriniformes). Zool. J. Linn. Soc. 172, 556–615. <http://onlinelibrary.wiley.com/doi/10.1111/zoj.12184/abstract>
- Burkhead NM & Bauer BH (1983) An intergeneric cyprinid hybrid, *Hybopsis monacha* × *Notropis galacturus*, from the Tennessee River drainage. Copeia 1983 (4), 1074–1077.
- Burkhead NM & Williams JD (1991) An intergeneric hybrid of a native minnow, the golden shiner, and an exotic minnow, the rudd. Trans. Amer. Fisheries Soc. 120, 781–795.
<http://mdl.csa.com/partners/viewrecord.php?requester=gs&collection=ENV&recid=13867679&q=distant+hybrids+fishes&uid=791006700&setcookie=yes>.
Notemigonus × *Scardinius*.
- Calhoun A (1940) Note on a hybrid Minnow, *Apocope* × *Richardsonius*. Copeia 1940, 142–143.
- Chevassus B (1983) Hybridization in fish. Aquaculture 333, 245–262.
- Chiesa S et al. (2013) Molecular barcoding of an atypical Cyprinid population assessed by cytochrome b gene sequencing. Zool. Science 30 (5), 408–413.
- Cross TF (1977) Isozymes of interspecific hybrids of the fish family Cyprinidae. Proc. Royal Irish Academy B 78, 22. <http://www.jstor.org/pss/20519064>. = ref. 473 of Schwartz 1981. *Abramis* × *Scardinius*.
- Duyvené de Wit JJ (1960) Hybridization experiments in rhodeine fishes (Cyprinidae, Teleostei). The intergeneric hybrids of *Acheilognathus lanceolata* × *Acanthorhodeus atremius* ♂ and *Tanakia tanago* × *Acheilognathus rhombea* ♂. Can. J. Zool. 38, 1171–1173.
- Duyvené de Wit JJ (1961) Hybridization experiments in rhodeine fishes (Cyprinidae, Teleostei). An intergeneric hybrid between female *Rhodeus ocellatus* and male *Acanthorhodeus atremius*. Zoologica (New York) 46, 25–26.
- Duyvené de Wit JJ (1964) Hybridization experiments in Acheilognathine fishes (Cyprinidae, Teleostei). Hybrids between female *Paracheilognathus rhombeus* and male *Rhodeus ocellatus*, *Tanakia tanago*, *Acheilognathus tabira*, *A. limbatus*, and *Rhodeus spinalis*. Copeia 1964, 150–155.
- Eisenhour DJ & Piller KR (1997) Two new intergeneric hybrids involving *Semotilus atromaculatus* and the genus *Phoxinus* with analysis of additional *Semotilus atromaculatus*: *Phoxinus* hybrids. Copeia 1997, 204–209.
- Fang W et al. (2025) Phenotypic characteristics of hybrid F1 of *Opsariichthys bidens* (♀) × *Zacco*. J Fish Biol Nov 6. doi: 10.1111/jfb.70265
- Freyhof J et al. (2005) Molecules and morphology: Evidence for introgression of mitochondrial DNA in Dalmatian cyprinids. Mol. Phylogen. Evol. 37, 347–354.
<http://www.sciencedirect.com/science/article/pii/S1055790305002484>,
http://unio.igb-berlin.de/abt4/mitarbeiter/freyhof/downloads/Scardinius_hybrids.pdf.

- Gaubert P, Denys G & Oberdorff T (2009) Genus-level supertree of Cyprinidae (Actinopterygii: Cypriniformes), partitioned qualitative clade support and test of macro-evolutionary scenarios. *Biol. Rev. Camb. Philos. Soc.* 84 (4), 653–689.
- Gilbert CR (1978) The nominal North American cyprinid fish *Notropis henryi* interpreted as an intergeneric hybrid, *Clinostomus funduloides* × *Nocomis leptcephalus*. *Copeia* 1978 (1), 77–181. = ref. 622 of Schwartz 1981.
- Gilles A, Lecointre G, Faure E, Chappaz R & Brun B (1998) Mitochondrial phylogeny of the European cyprinids: Implications for their systematics, reticulate evolution, and colonization time. *Mol. Phylogenet. Evol.* 10 (1), 132–143.
- Glushankova NA et al. (1973) Expression of genes controlling FDP-aldolase in fish embryos. Thermostability as a genetic marker. p. 76-84 in *Biokhimicheskaja genetika ryb. Ves. Soveshch. Biokhim. Genet. rybn. 1st. Leningrad.* = ref. 629 of Schwartz 1981.
- Goodfellow WL Jr., Morgan RP II., Stauffer JR Jr. & Hocutt CH (1986) An intergeneric hybrid, *Campostoma anomalum* × *Rhinichthys atratulus*, from the Youghiogheny River drainage, West Virginia. *Biochemical Systematics and Ecology* 14 (2), 233–238.
- Gozlan RE & Beyer K (2006) Hybridisation between *Pseudorasbora parva* and *Leucaspis delineatus*. *Folia Zool.* 55 (1), 53–60. http://www.ivb.cz/folia/55/1/053-060_MS1130.pdf
- Grady JM & Cashner RC (1988) Evidence of extensive intergeneric hybridization among the Cyprinid fauna of Clark Creek, Wilkinson CO., Mississippi. *The Southwestern Naturalist* 33, 137–146. <http://www.jstor.org/pss/3671888>
- Greenfield DW et al. (1973) Hybridization between *Chrosomus erythrogaster* and *Notropis cornutus* (Pisces: Cyprinidae). *Copeia* 1973 (1), 54–60. = ref. 663 of Schwartz 1981.
- Gui J et al. (1993) Cytogenetic analysis of developmental difference in hybrid embryos between reciprocal crosses in distant hybridization of fishes. *Zool. Research* 1993-02. http://en.cnki.com.cn/Article_en/CJFDTOTAL-DWXY199302011.htm
- Guo H-H et al. (2018) Comparative analysis of the growth performance and intermuscular bone traits in F1 hybrids of black bream (*Megalobrama terminalis*) × topmouth culter (*Culter alburnus*). *Aquaculture* 1 July 2018. DOI:10.1016/J.AQUACULTURE.2018.03.037
- Gupta SD, Khan HA, Reddy PVGK & Kowtal GV (1986) Studies on the intergeneric hybrid, Common Carp, *Cyprinus carpio communis* L. × Mrigal, *Cirrhinus mrigala* (Hamilton). *FAO*. <http://www.fao.org/docrep/field/003/AC209E/AC209E00.htm>
- Hambrick PS (1977) The intergeneric hybrid, *Notropis cerasinus* × *Phoxinus oreas* (Pisces: Cyprinidae), in the upper Roanoke River drainage, Virginia. *American Midland Naturalist* 98 (1), 238–243. <http://www.jstor.org/pss/2424731> = ref. 693 of Schwartz 1981.

- Hart NH & Cook M (1977) Esterase isozyme patterns in developing embryos of *Brachydanio rerio* (zebra danio), *Brachydanio albolineatus* (pearl danio) and their hybrids. J. Exp. Zool. 199 (1), 109–127. = ref. 711 of Schwartz 1981.
- 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 no normal embryos.
- Housz FMI (1964) Was ist *Brachydanio frankii*? Deutsche Aqu. Terrarien-Z. 17 (1), 9–12. = ref. 758.
- Ibrahim KH, Kowtal GV & Gupta SD (1980) Embryonic and larval development among *Catla catla* (Ham.) × *Hypophthalmichthys molitrix* (Val.) hybrids. J. Inland Fisheries Soc. India. 12, 69–73.
- Jin W et al. (2003) A high survival rate of hybrid F1 was got from *Cyprinus Carpinus carpio* L. mirror (female) × *Megalobrama amblycephala* ([male]). J. Fishery Sciences of China 10 (2), 159.
- Jin W et al. (2006) Embryonic and early development of the hybrid (*Cyprinus carpio* var. *specularis* [female] × *Mylopharyngodon piceus* [male]) F₁. J. of Fisheries of China 30 (1), 21–28.
- Kasama M & Kobayasi H (1987) Hybridization experiments in Cyprinida (I). Cross between *Gnathopogon elongatus elongatus* and *Pseudorasbora parva*. Japan Women's Univ. J. 34, 107–112, see also http://www.ivb.cz/folia/55/1/053-060_MS1130.pdf.
- Kasama M & Kobayasi H (1989a) Hybridization experiments in Cyprinida (IV). Cross between *Gnathopogon elongatus elongatus* and *Squalidus gracilis*. Japan Women's Univ. J. 36, 101–106.
- Kasama M & Kobayasi H (1989b) Hybridization experiment between crucian carp *Carassius carassius* and grass carp *Ctenopharyngodon idellus* ♂. Hybridization experiments in Cyprinida (II). Nippon Suisan Gakkaishi 55 (6), 1001–1006. adult, 3n = triploid
- Kasama M & Kobayasi H (1990a) Hybridization experiment between *Carassius carassius* and *Gnathopogon elongatus elongatus* ♂. Hybridization experiments in Cyprinida (V). Japan. J. Ichthyol. 36 (4), 419–426. adult, 3n = triploid
- Kasama M & Kobayasi H (1990b) Hybridization experiments in Cyprinida (VI). Crosses with *Gnathopogon elongatus elongatus*, *Moroco steindachneri*, *Moroco jouyi*, *Zacco temminckii* and *Zacco platypus*. Japan. Women's Univ. J. 37, 103–111.
- Kasama M & Kobayasi H (1991) Hybridization experiments between *Gnathopogon elongatus elongatus* and *Carassius carassius* ♂. Japanese J. Ichthyol 38 (3), 295–300. http://www.wdc-jp.biz/pdf_store/isj/publication/pdf/38/383/38310.pdf
- Kawamura K & Hosoya K (2000) Masculinization mechanism of hybrids in bitterlings (Teleostei: Cyprinidae). J. Hered. 91, 464–473.
- Khan HA & Kowtal GV (1986) An account of naturally occurring and artificially produced Cyprinid hybrids in India. <http://www.fao.org/docrep/field/003/AC223E/AC223E00.htm>.
- Khan HA, Gupta SD, Reddy PVGK, Tania MS & Kowtal GV (1990) Production of sterile intergeneric hybrids and their utility in aquaculture and stocking. pp. 41–48

- in Keshavanath P & Radhakrishnan KV (eds.) Carp seed production technology. Special Publication of the AFS No 2. Asian Fisheries Society, Mangalor, India.
- Knauthe K von (1891) Bastarde von *Gobio fluviatilis* und *Leuciscus phoxinus* etc. Zool. Anz. 14, 258. = ref. 866 of Schwartz 1972. *Gobio fluviatilis* × *Phoxinus phoxinus* etc.
- Knauthe K von (1893) Über einen neuen fortpflanzungsfähigen Cypriniden aus Mittelschlesien *Alburnus leydighii* mihi sp. n. (*Alb. lucidus* × *Leucaspius delineatus*). Zool. Anz. 16, 18–407. = ref. 867 of Schwartz 1972. *Alburnus alburnus* × *Leucaspius delineatus*.
- Kobayashi H (1955) Comparative studies of the scales in Japanese freshwater fishes, with special reference to phylogeny and evolution. Japan. J. Ichthyol. 4(1-2-3): 64–75. ref. 871 + 872 of Schwartz 1981
- Kobayashi H (1956) Scale character of the intergeneric hybrid between *Cobitis taenia* Linne (female) and *Misgurnus fossilis anguillicaudatus* (Cantor)(male). Annotationes Zoologicae Japonenses 29 (2), 104–108.
- Kusonoki T, Arai K & Suzuki R (1994) Viability and karyotypes of interracial and intergeneric hybrids in loach species. Fisheries Science 60 (4), 415–422.
- Layman DA, Chen Y, Parmenter S, Hughson D & Pezold F (2010) Genetic characterization of invading cyprinids in the Mojave River basin using diagnostic SNP and microsatellite markers. Desert Fishes Council Meeting, Moab, Utah, 11/2010. see also http://rattler.tamucc.edu/Syllabi_Courses/CV/Chen_Yongjiu.pdf
- Levin B et al. (2019) Phylogeny, phylogeography and hybridization of Caucasian barbels of the genus *Barbus* (Actinopterygii, Cyprinidae). Mol. Phyl. Evol. 135, 31–34.
- Barbus × Capoeta. Lieder U (1954) Chromosomenstudien an Knochenfischen II. Über die Chromosomenzahl und -morphologie der Plötze und einiger ihrer Bastarde mit anderen Cypriniden. Zeit. f. Fischerei 8 (415), 375–382. = ref. 1000 of Schwartz 1972. *Rutilus*.
- Liu S et al. (2007) The formation of the polyploid hybrids from different subfamily fish crossings and its evolutionary significance. Genetics 176, 1023–1034. <http://www.genetics.org/content/176/2/1023.full.pdf>
- Liu S (2010) Distant hybridization leads to different ploidy fishes. Sci. China Life Sci. 53 (4), 416–425. Epub 2010 May 7. <https://pubmed.ncbi.nlm.nih.gov/20596907/>
- Lu T et al. (1965) Studies on the inter-subfamiliar crossing between goldfish (*Carassius auratus* L.) and Chinese bitterling (*Rhodeus sinensis* Günther). Zool. Rec. 102 (Sec. 15) 1965. = ref. 1033a of Schwartz 1972.
- Lund W Jr. (1976) Possible? Trop. Fish Hobbyist 24 (242/8), 75. = ref. 981 of Schwartz 1981.
- Maurakis EG & Woolcott WS (1992) An intergeneric cyprinid hybrid, *Phoxinus oreas* × *Semotilus atromaculatus*, from the James River drainage, Virginia. Copeia. 1992, 548–553. JSTOR
- Mayden RL & Chen WJ (2010) The world's smallest vertebrate species of the genus *Paedocypris*: A new family of freshwater fishes and the sister group to the world's

- most diverse clade of freshwater fishes (Teleostei: Cypriniformes). Mol. Phylogenet. Evol. 57, 152–175. <https://doi.org/10.1016/j.ympev.2010.04.008>
- McAllister DE & Coad BW (1978) A test between relationships based on phenetic and cladistic taxonomic methods. Can. J. Zool. 56 (10), 2198–2210. = ref. 1042 of Schwartz 1981
- Miller DL & Behnke RJ (1985) Two new intergeneric Cyprinid hybrids from the Bonneville Basin, Utah. Copeia 1985, 509–515. <http://www.jstor.org/pss/1444869>. *Gila × Iotichthys*, *Iotichthys × Rhinichthys*.
- Mir S, Al-Absy A & Krupp F (1988) A new natural intergeneric cyprinid hybrid from the Jordan River drainage, with a key to the large barbine cyprinids of the southern Levant. J. Fish Biology 32 (6), 931–936.
- Natarajan AV, Desai VR & Mishra DN (1977) On the natural occurrence of the intergeneric catla rohu hybrid in Rihand Uttar Pradesh with an account of its potential role in reservoir fisheries development in India. J. Inland Fisheries Soc. India 8, 83–90.
- Neyfakh AA (1974) Nuclear function in early development of remote hybrids of fishes. [Russian] Ontogenez 5 (6), 614–622. = ref. 1185 of Schwartz 1981
- Neyfakh AA, Glushankova MA & Burakova TA (1976) Time of the action of genes controlling the adolase action in embryogenesis of the loach (*Misgurnus fossilis*). Ontogenez 7 (3), 219–228. = ref. 1188 of Schwartz 1981
- Neyfakh AA, Kostomarova AA & Burakova TA (1973) A study of RNA transfer from nucleus to cytoplasm in early embryos of the loach (*Misgurnus fossilis*) and its hybrids (*Misgurnus fossilis* × *Carassius auratus auratus* ♂). Ontogenez 4 (4), 331–339. = ref. 1187 of Schwartz 1981.
- Nikoljukin NI (1971) Fundamentals of hybridization in fish culture. All-Union Research Institute of Marine Fisheries and Oceanography Moscow, U.S.S.R. www.fao.org/docrep/005/B3310E/B3310E24.htm. = ref. 1191 of Schwartz 1981
- Nikoljukin NI (1972) Distant hybridization in Acipenseridae and teleostei, theory and practice. Otdallenay gibrizashiy osetrovyyh i kostishyyh ryb, toriy i praktika. Moscva. Pishchevay Promyshlennosty. 335 p. = ref. 1193 of Schwartz 1981.
- Pereira CSA, Aboim MA, Ráb P & Collares-Pereira MJ (2014) Introgressive hybridization as a promoter of genome reshuffling in natural homoploid fish hybrids (Cyprinidae, Leuciscinae). Heredity 112, 343–350.
- Poly WJ (1997) Characteristics of an intergeneric cyprinid hybrid, *Campostoma anomalum* × *Luxilus* sp. indet. (Pisces: Cyprinidae), from the Portage river, Ohio. Ohio J. Science. 97 (3), 40–43. <https://kb.osu.edu/dspace/handle/1811/23742>
- Pruginin Y (1968) The culture of carp and *Tilapia* hybrids in Uganda. FAO Fish Rep. 44 (4), 223–229. = ref. 1289 of Schwartz 1981
- Qin Q et al. (2014) Abnormal chromosome behavior during meiosis in the allotetraploid of *Carassius auratus* red var. × *Megalobrama amblycephala* (♂). <http://www.biomedcentral.com/content/pdf/s12863-014-0095-6.pdf>
- Romashov DP & Golovinskaia KA (1960) Giniogenez i otdelennaia gibrizatsiia u ryb. p. 496–510 in: Otdalennia gibrizatsii rastenii i khovotnikh. [Russian]

- Moskow: Izv. Kolos, Mosk. Akad. Nauk SSSR Ves. Akad. S-kh. Nauk. = [ref. 1349 of Schwartz 1981](#).
- Ross MR & Cavender TM (1977) First report of the natural Cyprinid hybrid, *Notropis cornutus* × *Rhinichthys cataractae*, from Ohio. *Copeia* 1977, 777–780.
- Ross MR & Cavender TM (1981) Morphological analyses of four experimental intergeneric hybrid crosses. *Copeia* 1981, 377–387.
- Roule L (1925) Les poissons des eaux douces de la France. Paris: Presses Universitaires. 229 p. = [ref. 1359](#).
- Schilde W (1936) Ein Bastard zwischen Plötze und Ukelei. [German] *Zool. Anzeiger* 113, 74–75. [Alburnus lucidus](#) × [Rutilus rutilus](#).
- Simkova A, Civanova K, Gettova L et al. (2013) Genomic porosity between invasive *Chondrostoma nasus* and endangered endemic *Parachondrostoma toxostoma* (Cyprinidae): The evolution of MHC IIB genes. *PLOS ONE* 8 (6).
- Simonsen V, Hansen MM, Mensberg K-LD, Sarder RI & Alam S (2005) Widespread hybridization among species of Indian major carps in hatcheries, but not in the wild. *J. Fish Biology* 67, 794–808.
- Singh MP (1975) Studies on carp hybridization. Univ. Bombay. Ph. D. Thesis. 10 p. = [ref. 1467 of Schwartz 1981](#).
- Sizemore DR & Howell WM (1987) A natural intergeneric hybrid minnow, *Campostoma oligolepis* × *Notropis chrysocephalus* (Pisces: Cyprinidae). *J. Alabama Acad. Science*. 58 (4), 184–191.
- Stauffer JR Jr, Hocutt CH & Denoncourt RF (1977) An intergeneric hybrid, *Nocomis platyrhynchus* × *Notropis chrysocephalus*, from the Greenbrier river drainage in West Virginia. *Copeia* 1977, 172–173.
- Stauffer JR Jr, Hocutt CH & Denoncourt RF (1979) Status and distribution of the hybrid *Nocomis micropogon* × *Rhinichthys cataractae*, with a discussion of hybridization as a viable mode of Vertebrate speciation. *Amer. Midland Naturalist* 101, 355–365.
- Stoumboudi MT et al. (1992) Gonad development and somatic growth in an intergeneric cyprinid hybrid from Lake Kinneret. Israel. *J. Applied Ichthyology* 8 (1–4), 110–121.
- Suttkus RD & Casner RC (1981) The intergeneric hybrid combination, *Gila pandora* × *Rhinichthys cataractae* (Cyprinidae), and comparisons with parental species. *Southwestern Naturalist* 26 (1), 78–81.
- Suzuki R (1957) Hybridization experiments in Cobitid fishes. *Jap. J. Gen.* 32, 8–14. https://www.jstage.jst.go.jp/article/ggs1921/32/1/32_1_8/pdf = [ref. 1620 of Schwartz 1972](#)
- Suzuki R (1959) Sperm activation and aggregation during fertilization in some fishes. III. Non-species specificity of stimulating factor. *Ann. Zool. Jap.* 32 (3), 105, 105–111.
- Suzuki R (1962) Hybridization experiments in cyprinid fishes. I. *Gnathopogon elongatus elongatus* × *Pseudorasbora parva* ♂ and the reciprocal. *Bull. Fresh. Fish. Res. Lab.* 28, 992–997. = [ref. 1624 of Schwartz 1972](#)
- Suzuki R (1963a) Hybridization experiments in cyprinid fishes. II. Reciprocal crosses

- between *Pseudogobio esocinus* and *Gnathopogon elongatus elongatus*. Jap. J. Genet. 38, 89–96. = ref. 1626 of Schwartz 1972
- Suzuki R (1963b) Hybridization experiments in cyprinid fishes. IV. Reciprocal crosses between *Biwia zezera* and *Gnathopogon elongatus elongatus*. Bull. Jap. Soc. Sci. Fis. 29, 421–423. = ref. 1628 of Schwartz 1972
- Suzuki R (1964) Hybridization experiments in cyprinid fishes. VII. Reciprocal crosses between *Pseudogobio esocinus* and *Biwia zezera*. Japanese J. Ichthyology 12, 18–22. http://www.wdc-jp.biz/pdf_store/isj/publication/pdf/12/121-2/121-204.pdf
- Suzuki R (1968) Hybridization experiments in cyprinid fishes. XI. Survival rate of F1 hybrids with special reference to the closeness of taxonomical position of combined fishes. Bull. Freshwater Fish. Res. Lab. 18 (2), 113–155. = ref. 1636 of Schwartz 1972
- Suzuki R (1968) Hybridization experiments in cyprinid fishes. XI. Survival rate of F1 hybrids with special reference to the closeness of taxonomical position of combined fishes. Bull. Fresh Fish. Res. Lab. 18, 113–155. = ref. 1636 of Schwartz 1972
- Suzuki R (1973a) On the sterile F₁ hybrids between the genera *Pseudogobia* and *Gnathopogon*. Japanese J. Ichthyol. 20, 235–238. http://www.wdc-jp.biz/pdf_store/isj/publication/pdf/20/204/20406.pdf
- Suzuki R (1973b) Hybridization of freshwater fishes. Anim. Nat. 3 (10), 10–14. = ref. 1554 of Schwartz 1981
- Ünver B & Erk'akan F (2005) A natural hybrid of *Leuciscus cephalus* (L.) and *Chalcalburnus chalcoides* (Güldenstädt) (Osteichthyes Cyprinidae) from Lake Tödürge (Sivas, Turkey). J. Fish Biology 66 (4), 899–910. http://www.trifas.org/pdf/issue_8_2/207_213.pdf
Alburnus chalcoides × *Squalius cephalus*
- Ünver, B, Tatlıdil, H & Erk'akan F (2008) Biometrical features of intergeneric hybrid between *Leuciscus cephalus* (L.) and *Chalcalburnus chalcoides* (G.) (Osteichthyes-Cyprinidae) distributed in Lake Tödürge (Sivas-Turkey). Turkish J. Fisheries and Aquatic Sciences 8 (2), 207–213. *Alburnus chalcoides* × *Squalius cephalus*.
- Vasil'ev VP, Makeeva AP & Riabov IN (1975) Triploidy in hybrids of carp with other representatives of the Cyprinidae family. [Russian.] Genetika 11, 49–56.
- Victorovsky RM (1966) Morphologicheskaya kharakteristika gibridov mezhdud karpom (*Cyprinus carpio* L.) i linem (*Tinca tinca* L.). Genetika 9, 92–98. = ref. 1715 of Schwartz 1972
- Vladimirov MZ (1978) Early postembryonal development and morphology of new intergeneric hybrid of cyprinids *Rutilus frisii* (Nord.) (female) × *Vimba vimba* (L.) (male). Voprosy Ikhtiologii 18 (5/112), 963–965. = ref. 1673 of Schwartz 1981.
- Vutskits G (1907) Halfaunank egy új korcsa. [A new fish hybrid of the Hungarian fauna.] [Hungarian] Allatt. Kozlem. (Budapest) 1907, 120–128. *Blicca argyroleuca* × *Leuciscus rutilus*

- Weisel GF (1954) A rediscovered cyprinid hybrid from western Montana, *Mylocheilus caurinum* × *Richardsonius balteatus balteatus*. *Copeia* 1954, 278–282. = ref. 1758 of Schwartz 1972
- Weisel GF (1955) Three new intergeneric hybrids of Cyprinid fishes from Western Montana. *American Midland Naturalist* 53, 396–411.
<http://www.jstor.org/pss/2422076> = ref. 1762 of Schwartz 1972.
- Wells AW (1981) Possible occurrence of hybridization between *Couesius plumbeus* and *Semotilus marginata*. *Copeia* 1981, 487–489.
- Wood AB & Jordan DR (1987): Fertility of roach × bream hybrids, *Rutilus rutilus* (L.) × *Abramis brama* (L.), and their identification. *Journal of Fish Biology* 30, 249–261.
- Yakolev VN, Slyn'ko YV, Grechanov IG & Krysanov EY (2000) Distant hybridization in fish. *J. Ichthyol.* 40, 298–311.
- Yates S (1940) A *Tanichthys* × *Aphyocypris* hybrid. *The Aquarium* 8 (12), 204. = ref. 1801 of Schwartz 1972.
- You C, Yu X & Tong J (2009) Detection of hybridization between two loach species (*Paramisgurnus dabryanus* and *Misgurnus anguillicaudatus*) in wild populations. *Environmental Biology of Fishes* 86, 65–71.
<http://www.springerlink.com/content/x571q56878853453/>
- Zhou Z et al. (2025) The formation of a novel intergeneric hybrid fish derived from *Megalobrama amblycephala* (♀) × *Culter dabryi* (♂). *Animals* 2025, 15 (22), 3302.
<https://doi.org/10.3390/ani15223302>

Cyprinodontiformes 2 suborders, 14 families, 150: 1500

+ extinct families. 28 IG + 16 IT + 10 IF + 5 ISO

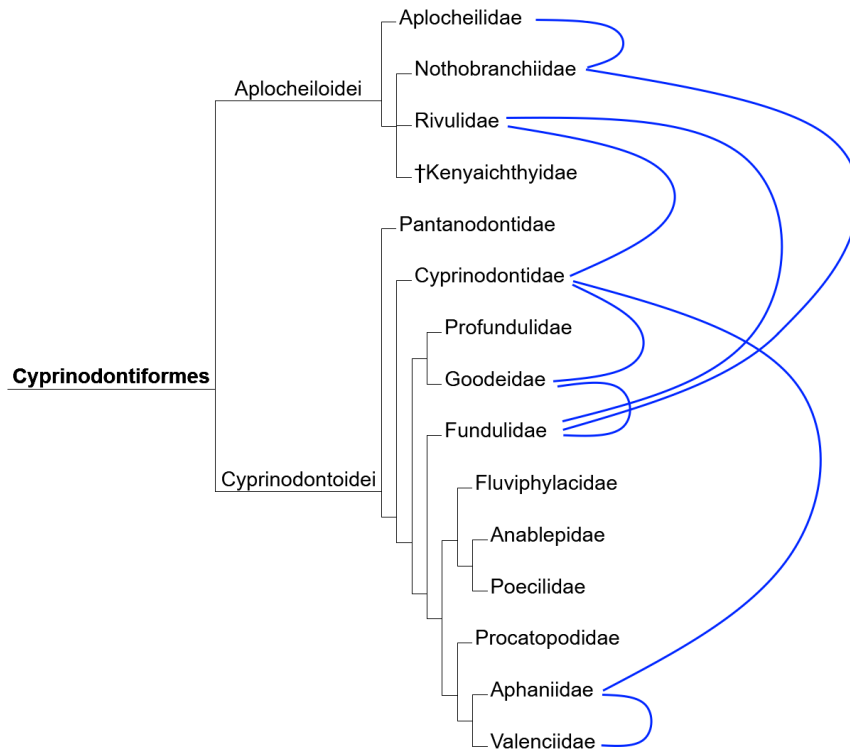
toothcarps = Zahnkärpflinge

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* (= *magdaleneae*) IF **Nothobranchiidae** × **Rivulidae** Schwartz 1981 (ref. 1386 = Scheel 1974)

Aplocheilus lineatus, *panchax* × *Epiplatys* (= *Aplocheilus*^o) *fasciolatus*, *sexfasciatus*, *spilargyreus* 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*[°] *bualanusi, calliurus, cameronensis, ...*), *Callopanchax*, *Epiplatys* (e.g. *fasciatus, sexfasciatus, spilargyreus*), *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)

References on Cyprinodontiformes:

Anonymus (1974) Hybrid committee report. J. Amer. Killifish Assoc. 7 (8) 300–301.
ref. 91 of Schwartz 1981.

Anonymus (1975) Hybrid committee report. J. Am. Killifish Assoc. 8 (7), 219. = ref. 92 of Schwartz 1981.

Anonymus (1976) Hybrid register report. J. Am. Killifish Assoc., with Killie Notes 9 (8), 244–245. = ref. 94 of Schwartz 1981.

Brüggemann U (1998) Beschleunigte Mikroevolution bei Guppys. Stud. Integrale J. 5 (1).

Cokendolpher JC (1980) Hybridization experiments with the genus *Cyprinodon* (Teleostei: Cyprinodontidae). Copeia 1980, 173–176. = ref. 449 of Schwartz 1981.
http://www.desertfishes.org/cuatro/literature/pdf/Cokendolpher_1980_Hybridization_experiments_Cyprinodon.pdf interspecific only.

Drewry GE (1967) Studies of relationships within the family Cyprinodontidae. Ph. D. Thesis, Univ. Texas, Austin. = ref. 528 of Schwartz 1981.

Fitzsimons JM (1972) A revision of two genera of goodeid fishes (Cyprinodontiformes, Goodeidae) from the Mexican Plateau. Copeia 1972 (4), 728–756. = ref. 579 of Schwartz 1981.

Haas R (1979) Intergeneric hybridization in a sympatric pair of Mexican cyprinodontid fishes. Copeia 1979 (1), 149–152. = ref. 679 of Schwartz 1981.
Cyprinodon alvarezi × *Megupsilon aporus*.

Hubbbs CL & Drewry GE (1959b) Survival of F₁ hybrids between cyprinodont fishes, with discussion of the correlation between hybridization and phylogenetic relationships. Publ. Inst. Mar. Sci. Univ. Texas 6, 81–91. = ref. 744 of Schwartz 1972.
<http://www.nativefishlab.net/library/textpdf/14248.pdf> pdf

Hubbbs CL & Drewry GE (1962) Artificial hybridization of *Crenichthys baileyi* with related Cyprinodont fishes. Texas J. Sci 14, 107–110. = ref. 745 of Schwartz 1972.

- Hubbs C (1971a) Teleost hybridization studies. Proc. California Academy of Science 38, 289–297 (1970).
<http://ia902609.us.archive.org/29/items/proceedingsofcal0438cali/proceedingsofcal0438cali.pdf> mainly Cyprinodontidae and interfamilial hybrids
- Kosswig C (1928) Über Kreuzungen zwischen den Teleostiern *Xiphophorus helleri* × *Platypoecilus maculatus*. Z. Ind. Abst. Vererbungslehre 47, 150–158. = ref. 906 of Schwartz 1972.
- Miller RR & Fitzsimons JM (1971) *Ameca splendens*, a new genus and species of Goodeid fish from western Mexico, with remarks on the classification of the Goodeidae. Copeia 1971 (1), 1–13. = ref. 1127 of Schwartz 1972.
- Morris M (1914) The behavior of the chromatin in hybrids between *Fundulus* and *Ctenolabrus*. J. Exp. Zool. 16, 501–521. = ref. 1159 of Schwartz 1972.
- Reagan FP & Thorington JM (1915) The vascularization of the embryonic body of hybrid teleosts without circulation. Anat Rec. 10 (2), 79–98. = ref. 1388 of Schwartz 1972, ref. 1319 of Schwartz 1981.
- Russell A (1939) Pigment inheritance in the *Fundulus-Scomber* hybrid. Biol. Bull. 77 (3), 423–431. = ref. 1441 of Schwartz 1972.
- Scheel J (1968) Rivulins of the old world. N. J.: Trop. Fish Hobbyist Publ. 450 p. = ref. 1467 of Schwartz 1972.
- Scheel JJ (1974) Rivuline studies: Taxonomic studies of rivuline cyprinodonts from tropical Atlantic Africa (Rivulinae, Cyprinodontidae, Atheriniformes, Pisces). Annales, Musée Royal de l'Afrique Centrale, Tervuren, Sciences Zoologiques 211. 150 p. = ref. 1386 of Schwartz 1981.
- Schreibman MP, Kallman KD & Benevento M (1973) Genetic control of sexual maturation in female platyfish (*Xiphophorus maculatus*). Amer. Zool. 13 (4), 1283–1284.
- Serchuk FM & Frame DW (1973) An annotated bibliography of the cunner *Tautogolabrus adspersus* (Walbaum). US Dep. Commerce, NOAA Tech. Rep. NMFS SSRF-668. 43 p. = ref. 1431 of Schwartz 1981.
- Terceira AC (1974) Killifish, their care and breeding. Pisces Publ. Co., Norwalk, Conn., 143 p. = ref. 1582 of Schwartz 1981.
- Villwock W (1958) Weitere genetische Untersuchungen zur Frage der Verwandtschaftsbeziehungen anatolischer Zahnkarpfen. Mitt. Hamb. Zool. Mus. Inst. 56, 81–152. = ref. 1669 of Schwartz 1981. cf.
<http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0469.1964.tb00722.x/abstract>
- Villwock W (1960) Über Bastarde zwischen Angehörigen zweier Subfamilien oviparer Zahnkarpfen (Microcyprini, Cyprinodontidae). Zool. Anz. 165, 349–352. = ref. 1717 of Schwartz 1972.
- Wilk SJ (1979) Biological and fisheries data on weakfish, *Cynoscion regalis* (Bloch & Schneider). Sandy Hook Lab. Rep. 21. 40 p. = ref. 1744 of Schwartz 1981.

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. Gobioidae. Leiden: E. J. Brill. 423 p.

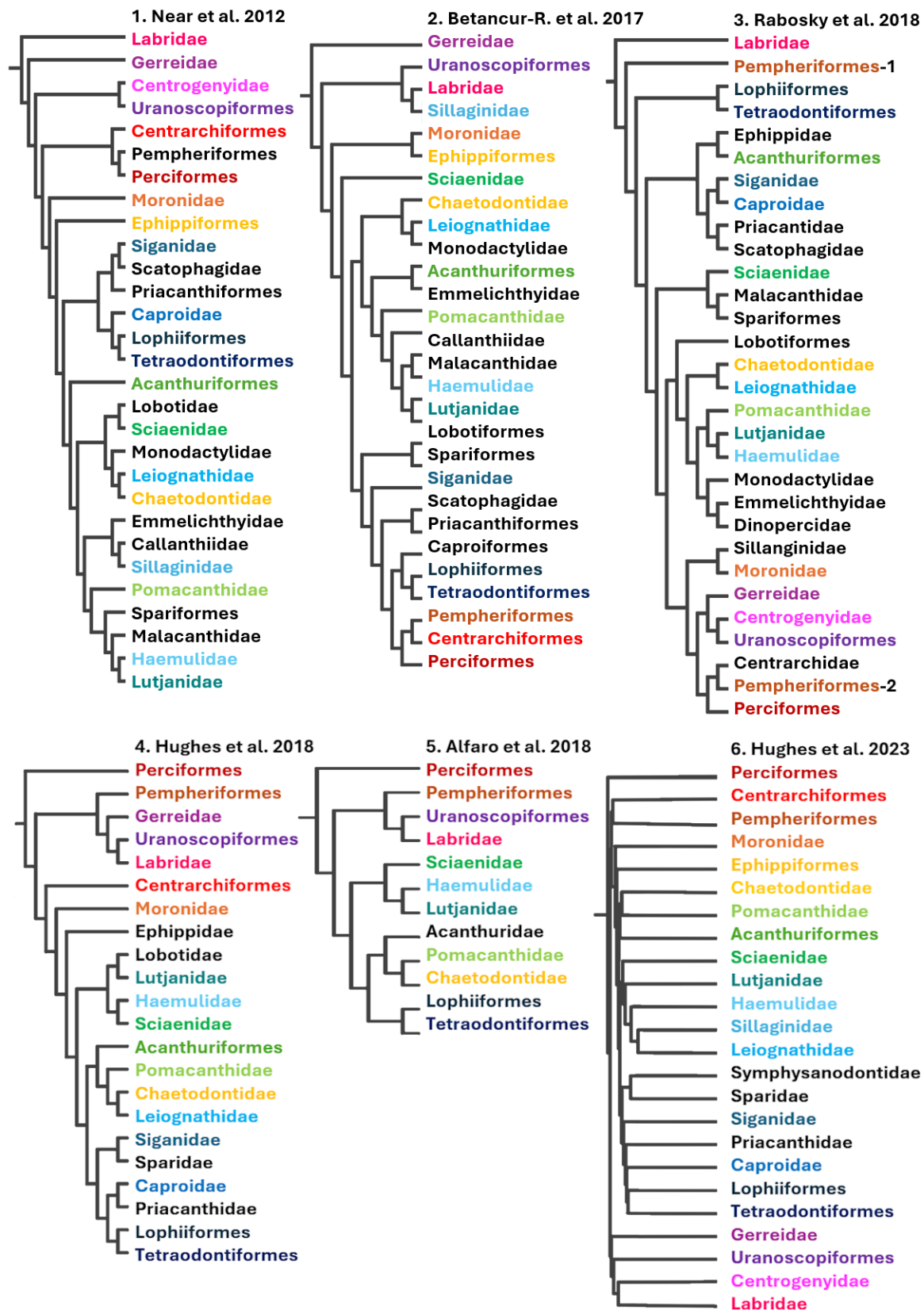
Labriformes 2 suborders, 8 families

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 the 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*^o (= *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*^o) *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 adspersus* (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.

Lepidogalaxiiformes 1 family 1: 1

Lepidogalaxiiformes: Lepidogalaxiidae* 1: 1 (Teleostii

Euteleostiomorpha Lepidogalaxii)

salamander fish = Salamanderfisch

Endemic in Australia.

Lepidogalaxias 1 salamandroides.

Basic type Lepidogalaxiidae* (*Lepidogalaxias*) (1: 1). Only one species exists in the whole order. Fossil taxa are currently unknown. The order is very isolated and separated from all other Euteleostiomorpha.

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 the 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. Integr. 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.wikipedia 2025 2 families: Ambassidae: 8: 75, Mugilidae 26: 80.

Mugiliformes: Mugilidae 26: 80. 1 ISF

mulletts = 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.

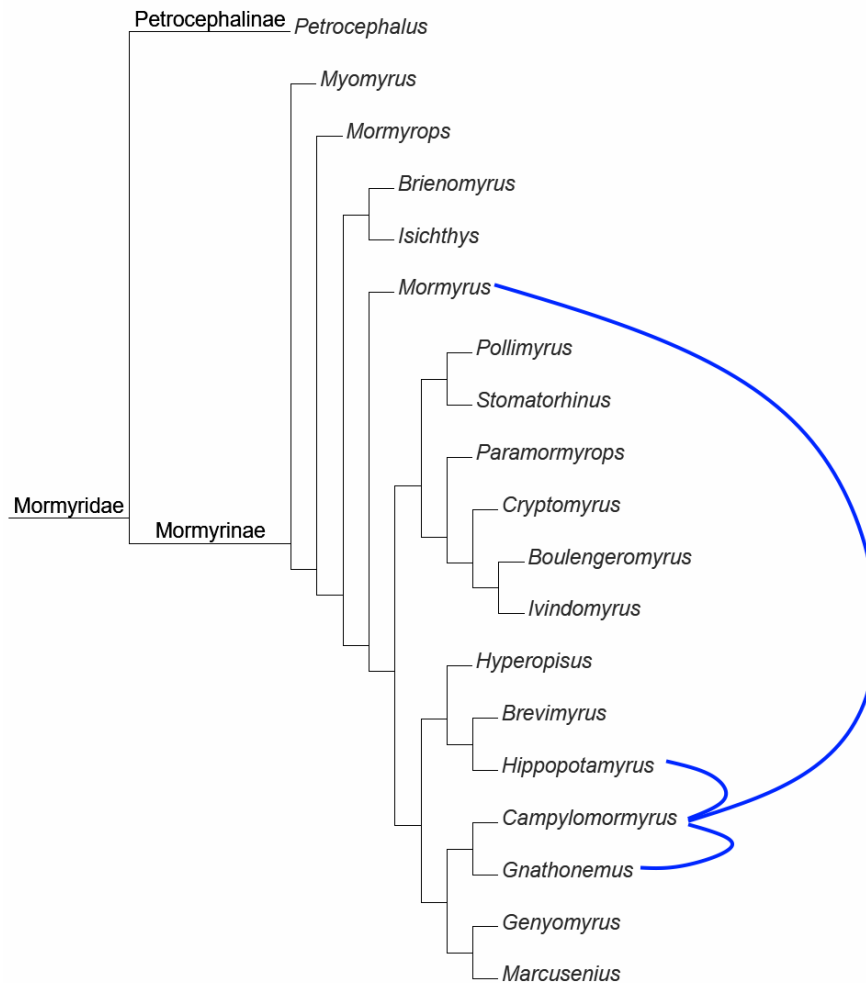
Petrocephalinae 1: 30.

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](https://doi.org/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) Intergenous 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, ...

Gasterosteoidae 3 families: Aulorhynchidae, Gasterosteidae, ...

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.**

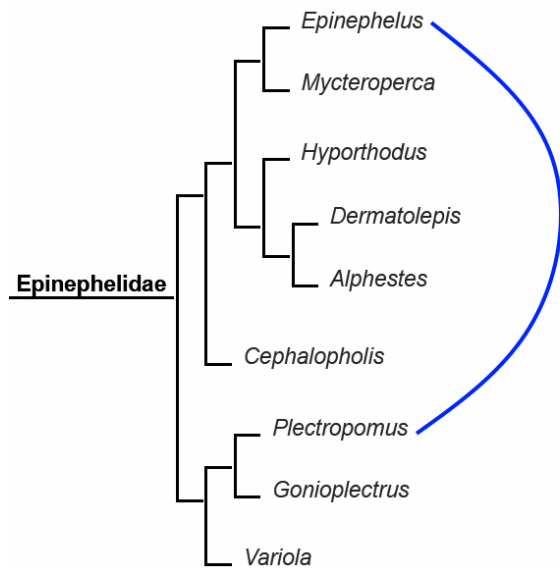
Cephalopholis fulva × *Paranthias (Cephalopholis) furcifer* (nat. hyb.) Schwartz 1972 (ref. 1554b, 1555 = Smith 1966: hybridogeneous origin of *Menephorus* **HY**), Schwartz 1981 (ref. 1476), Bostrom et al. 2002

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 Gasterosteioidei)

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.

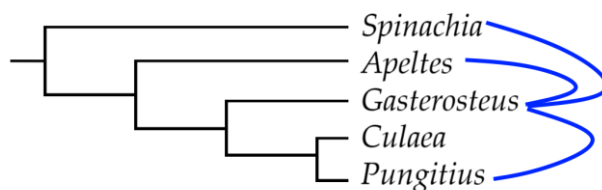
Possibly **basic type family Gasterosteidae** (5: 18): well-defined family. 4 of the 5 genera are connected by hybridization, but only 1 of 3 intergeneric hybrids has been

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*^o).

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*^o) **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*^o *cernua*) × *Perca fluviatilis* **Percinae** (fertile) Schwartz 1972 (ref. 590; 815 = Kammerer 1907; 1219 etc.)

Hadropterus^o *aspro* (= *Percina maculata*) × *Percina caprodes* **IS Percinae** Schwartz 1972 (ref. 1149), Schwartz 1981 (ref. 528, 1760)

Hadropterus^o *scierus* (= *Percina sciera*) × *Percina caprodes* **IS Percinae** Hubbs & Laritz 1961

Sander (= *Lucioperca*^o) *sandra* × *Zingel asper* (= *Aspro*^o *zingel*) **IS Luciopercinae** Schwartz 1972 (ref. 1101 = Merriner 1966)

Perca × *Sander* (incl. *Lucioperca*^o, *Stizostedion*^o) **ISF Percinae × Luciopercinae** Schwartz 1972 (ref. 113, 227, 352, 815), Schwartz 1981 (ref. 1249)

Percina caprodes × *Sander*^o (= *Stizostedion*) *vitreum* **ISF Etheostomatinae ×**

Luciopercinae Schwartz 1981 (ref. 767 = Hubbs 1971b)

Stizostedion^o subgen. *Cynoperca* (= *Sander*) × *Stizostedion*^o (= *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 Etheostomine 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 11: 49 + extinct taxa

superclass Agnatha, class Cyclostomata or infraphylum

Agnatha, superclass Cyclostomi, class Petromyzontida)

lampreys and allies = Neunaugenartige

fishbase (2025) 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 × *Lampetra* **Lampetrinae** Schwartz 1972 (ref. 667a)

Ichthyomyzon × *Lampetra* **ISF Petromyzontinae** × **Lampetrinae** Schwartz 1972 (ref.

1337), Schwartz 1981 (ref. 1270 = Piavis 1971); Piavis et al. (1971, Tab. 1):

Ichthyomyzon fosser / *unicuspis* × *Petromyzon marinus* 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): *Ichthyomyzon castaneus* / *fosser* /

unicuspis × *Lampetra lamottenii* 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* 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 = Rubashev 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.)

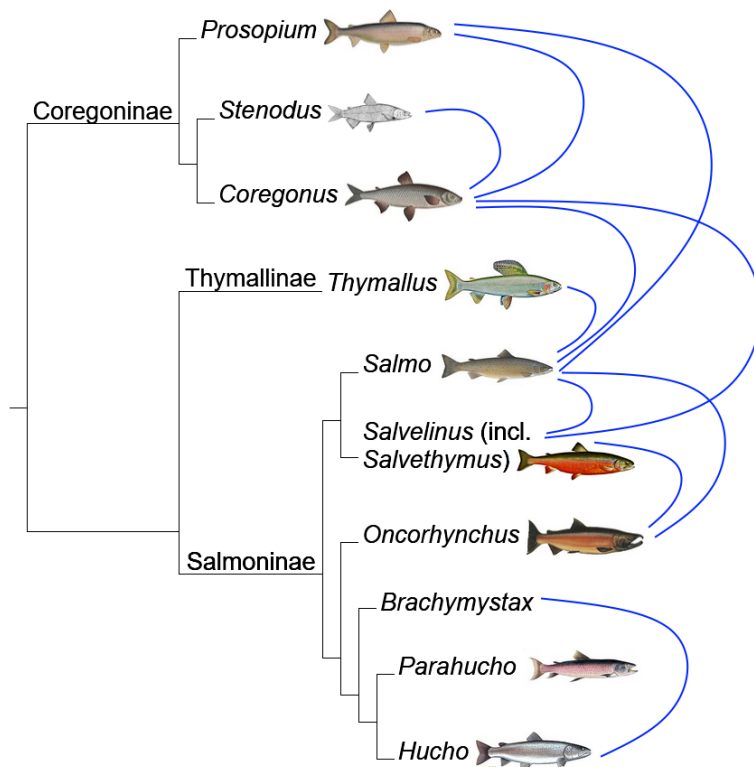
Oncorhynchus × *Salvelinus* *Salmoninae* (art. hyb., nat. hyb.) Smirnov 1959, Crossman & Buss 1966, Schwartz 1972 (ref. 765, 1101, 1554a), Kato 1977 (nat. hyb.), Schwartz 1981 (ref. 304, 425, 1233, 1380, 1575, 1576, 1634), Bartley et al. 1997, Gillett 2004, Koizumi et al. 2005, Sato et al. 2008 (nat.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

- Aras-Hisar S, Yanik T & Hisar O (2003) Hatchery and growth performance of two trout pure breeds, *Salvelinus alpinus* and *Salmo trutta fario*, and their hybrid. Israeli J. Aquaculture Bamidgeh 55 (3), 154–159.
- Balakirev ES et al. (2013) Mitochondrial DNA variation and introgression in Siberian taimen *Hucho taimen*. PloS One Aug 12; 8 (8): e71147. doi: [10.1371/journal.pone.0071147](https://doi.org/10.1371/journal.pone.0071147)
- 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>
- 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>
- Booke HE (1974) A cytotaxonomic study of the round whitefishes, genus *Prosopium*. Copeia 1974 (1), 115–119. = ref. 315 of Schwartz 1981, not yet seen.

- Capanna E et al. (1973) Some remarks on the karyotype of an intergeneric hybrid, *Salmo trutta* × *Salvelinus fontinalis* (Pisces: Salmoniformes). *Genetica* 44, 194–206.
- 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.
- Miyazawa S, Okamoto M & Kondo S (2010) Blending of animal colour patterns by hybridization. *Nature Communications* 1, Article number: 66. doi:10.1038/ncomms1071. <http://www.nature.com/ncomms/journal/v1/n6/full/ncomms1071.html>
- Nygren A, Nilsson B & Jahnke M (1972) Cytological studies in Atlantic salmon from Canada, in hybrids between Atlantic salmon from Canada and Sweden, and in hybrids between Atlantic salmon and sea trout. *Hereditas* 70 (2), 295–306. = ref. 1213.
- Rubashev SJ (1935) Abweichungen von den Elternformen in der embryonalen Entwicklung der Bastarde von *Coregonus baeri* Kessl. × *Salmo fario* L. *Acta Zool. (Stockholm)* 16 (3), 387–408. = ref. 1434 of Schwartz 1972.
- Rubinoff I (1961) Artificial hybridization of some Atherinid fishes. *Copeia* 1961 (2) 242–244. = ref. 1434 of Schwartz 1972.
- Russell A (1939) Pigment inheritance in the *Fundulus-Scomber* hybrid. *Biol. Bull.* 77 (3), 423–431. = ref. 1441 of Schwartz 1972.
- Sato T et al. (2008) Intergeneric hybridization between sympatric Kirikuchi char and red-spotted masu salmon in a small Japanese mountain stream. *North Amer. J. Fisheries Management* 28 (2), 547–556.
- Smirnov AI (1959) Hybridization of pacific Salmonidae of various genera. *Referat. Zhur. Biol. (Translation). Priroda* 6, 98–100.

Wang J et al. (2011) Genetic analysis on incompatibility of intergeneric hybridizations between *Hucho taimen* ♂ and *Brachymystax lenok* by using 30 polymorphic SSR markers. J. Fish. Sci. China 18, 547–555.

Scombriformes 2 suborders, 16 families.

formerly part of Perciformes

Scombriformes: Scombridae 15: 51. 1 IG (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, Auchenoglanidae,

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 SA 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, *Pyloodictis* 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.

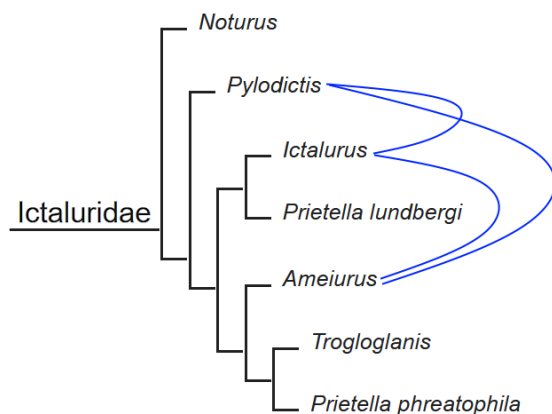
Gutiérrez-Barragán et al. (2025).

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* × *Pyloodictis olivaris* (nat. hyb.) Schwartz 1972 (ref. 65, 1548, 1549, 1568), Zhang & Tiersch 1997

Ictalurus punctatus × *Pyloodictis 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*^o (*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 hemiliopterus* Hashimoto et al., distant hybrid

References on Siluriformes:

Akinwande AA et al. (2013) Phenotypic characterisation in interspecific and intergeneric hybrids of the clariid catfishes *Heterobranchius longifilis*, *Clarias*

- gariepinus* and *Clarias anguillaris* in Nigeria. African Journal of Aquatic Science 38 (1), 109–113.
- Aluko PO & Ali MH (2001) Production of eight types of fast growing intergeneric hybrids from four clariid species. J. Aquaculture in the Tropics 16 (2), 139–147.
- Coelho GCZ et al. (2021) Comparative post-hatching ontogeny of *Pseudoplatystoma reticulatum* (Eigenmann & Eigenmann 1889) and *Leiarius marmoratus* (Gill, 1870) and their hybrid. J. Applied Ichthyology 37, 449.
- Goudie CA et al. (1993) Early growth and morphology among hybrids of ictalurid catfishes. J. Applied Aquaculture 3, 235–256.
- Gutiérrez-Barragán A. et al. (2025). A review of catfish (Siluriformes) hybridization. Rev Fish Biol Fisheries (2025). 1–30. <https://doi.org/10.1007/s11160-024-09919-2>
- Hashimoto DT et al. (2016) Molecular identification of intergenus crosses involving catfish hybrids: risks for aquaculture production. Neotropical Ichthyology, 14 (2): e150139, DOI: 10.1590/1982-0224-20150139
- Lutz CG (1997) What do you get when you cross. Aquaculture Magazine 23 (3) March/April, 84–90.
- Mukhopadathy SM & Dehadrai PV (1987) Survival of hybrids between air-breathing catfishes *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (Linn.). Matsya 12–13, 162–164.
- Na-Nakorn U et al. (1993) Chromosome study of hybrid and gynogenetic offspring of artificial crosses between members of the catfish families Clariidae and Pangasiidae. Environ. Biol. Fishes 37, 317–322.
- Nwadukwe FO (1995) Hatchery propagation of five hybrid groups by artificial hybridization of *Clarias gariepinus* (B) and *Heterobranchus longifilis* (Val.) (Clariidae) using dry, powdered carp pituitary hormone. J. Aquacult. Trop. 10, 1–11.
- Otémé ZJ, Hem S & Legendre M (1996) New catfish species for the development of fish culture in Africa. Aquatic Living Resources 9, Sp. Iss. SI, 207–217.
- Ryoce WF (ed., 1996) Introduction to the practice of fishery science. chapter 5.3.12 Siluroidei—Catfishes. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/siluridae> .
- Schedel et al. (2022) New phylogenetic insights into the African catfish families Mochokidae and Austroglanididae. J. of Fish Biology 100, 1171–1186. <https://doi.org/10.1111/jfb.15014>
- Smitherman RO, Dunham RA & Whitehead PK (1996) Selection, hybridization and genome manipulation in Siluroidei. Aquatic Living Resources 9 (Special Issue), 93–102. http://journals.cambridge.org/download.php?file=%2FALR%2FALR9_S1%2FS0990744096000447a.pdf&code=d2e27973af3e405e4579326df0a7aa58
- 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).
- Tarnchalanukit W (1986) Experimental hybridization between catfishes of the family Clariidae and Pangasiidae in Thailand. Environ. Biol. Fishes 16, 317–320.

Teugels GG (2003) *Clarias lamottei* (Siluriformes, Clariidae), a natural intergeneric hybrid from West Africa. *Cybiu* 27 (1), 11–15.

<http://www.mnhn.fr/sfi/cybiu/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.

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* × *Thalassoma 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, *microlophus* × *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 smarís (= *Smarís*° *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 × *Tautoglabrus asdspersus* **IO Acanthuriformes Sparidae × Labriformes Labridae** Schwartz 1972 (ref. 1203 = Newman 1914)

Abramis abramis, brama × *Sander* (= *Lucioperca*^o) *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*^o) *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*^o (= *Carcharhinus*) *longimanus* **IO/IC Acipenseriformes Acipenseridae × Carcharhiniformes Carcharhinidae** Schwartz 1981 (ref. 1064 = DNA-hybridization!)

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

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

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

Alosa (= *Caspialosa*^o) *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*^o) **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*^o) *rerio* **IO Characiformes Characidae × Cypriniformes Danionidae** Schwartz 1981 (= Meinken 1967)
Atherina pontica × *Diplodus* (= *Sargus*^o) *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*^o) *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)
- Clinocottus 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 pallasii* × *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 baileyi* × *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*^o (= *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*^o) *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*^o) **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*^o) *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 heteroclitus*, *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*^o) *gurnardus* **IO Gadiformes Gadidae × Scorpaeniformes Triglidae** 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*^o) *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 × *Thalassoma pavo* **IO Cypriniformes Gobionidae × 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*^o) *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*^o (= *Carcharhinus*) *longimanus* **IO/IC Salmoniformes Salmonidae** × **Carcharhiniformes Carcharhinidae** Schwartz 1981 (ref. 1064 = DNA-hybridization)

Opsanus (= *Batrachus*^o) *tau* × *Tautoglabrus* **IO Batrachoidiformes Batrachoididae** × **Labriformes Labridae** Schwartz 1972 (ref. 1154 = Moenkhaus 1911), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Peprilus (*Poronotus*^o) *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*^o) *lucioperca* **IO Cypriniformes Cyprinidae** × **Perciformes**

Percidae Schwartz 1972 (ref. 1219)
Sander (= *Stizostedion*) *vitreus* × *Xiphophorus* (= *Platypharodon*) *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)

References on interordinal fish hybrids (selected):

- Jin-Long W (2007) Study on fertilization cytology in distant hybridization between *Oreochromis aurea* (♀) and *Siniperca chuatsi* (♂) and some biology traits of hybrid offsprings. PhD Thesis Nanjing. <http://www.dissertationtopic.net/doc/1640644>
- Jin-Long W, Hong Y & Ting-Ting W (2007) Comparison of percentages of tissues and nutrients between parents and F₃ offspring of *Oreochromis aurea* × *Siniperca chuatsi*. Chinese J. Agricultural Biotechnology 4, 121–125
<http://journals.cambridge.org/action/displayAbstract?sessionId=E529900E9A3ECE8A3D7398046ABD1FBA.tomcat1?fromPage=online&aid=1278088>
- Kasansky WJ (1929) Die Kreuzung von *Esox lucius* L. mit den Arten der Cyprinidae und Percidae. Zool. Anz. 80 (1/2), 1–5. = ref. 824 of Schwartz 1972.
- Kryzanovskij SG (1968) Aspects of the development of fish hybrids between various taxa. [Russian] Moscow, Nauka. 220 p. = ref. 950 of Schwartz 1972.
- Moenkhaus WJ (1903) On the individuality of the maternal and paternal chromosomes in the development of the hybrid between *Fundulus heteroclitus* and *Menidia notata*. Science n. s. 17 (430), 487–488. = ref. 1150 of Schwartz 1972.
- Moenkhaus WJ (1911) Cross fertilization among fishes. Proc. Indiana Acad. Sci. 1910, 353–393. = ref. 1154 of Schwartz 1972.
- Newman HH (1915) Development and heredity in heterogeneric teleost hybrids. J. Exp. Zool. 18 (4), 511–576. = ref. 1203 of Schwartz 1972.
- Nikoljukin (1972) Distant hybridization in Acipenseridae and teleostei, theory and practice. Otdalennay gibrizashiy osetrovyyh i kostishtykh ryb, toriy i praktika. Moscva, Pishchevay Promyshlennosty, 335 p. = ref. 1193 of Schwartz 1981
- Pinney E (1928) The early mitotic behavior in the cross between *Menidia menidia notata* female and *Prionotus carolinus* male. J. Morph. 45, 579–592. = ref. 1347 of Schwartz 1972.
- Terao A (1934) Cross between the cod *Gadus macrocephalus* TILESIIUS ♂ and the salmon, *Oncorhynchus keta* (WALBAUM) . [Japanese] Jap. J. Genetics 9 (3), 183.
https://www.jstage.jst.go.jp/article/ggs1921/9/3/9_3_183/pdf = ref. 1668 of Schwartz 1972.
- 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](https://doi.org/10.1016/j.aquaculture.2021.737547) only partial hybrid!