Data Collection on Intergeneric Hybrids and Basic Types:

„PISCES“

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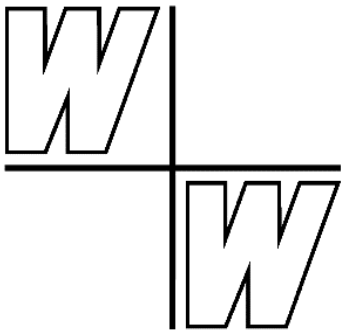


Studiengemeinschaft Wort und Wissen

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

„PISCES“

3 classes, 88 orders, 554 families, 32.000 species.

ca. 500 intergeneric hybrids (nothogenera) in 38 families (276 intergeneric hybrids alone within Cyprinidae).
In addition, ca. 105 interfamilial „hybrids”, which often do not express the characteristics of both parents, and ca. 132 interordinal „hybrids”, which normally do not develop beyond the maternal stage of embryogenesis, have been reported. For the latter see the appendix at the end of this file.

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, e. g. *Cerasus*° (= *Prunus* p. p.)
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
EC = embryo culture or ovule culture
SO = somatic hybrid by cell fusion; normally these hybrids are asymmetric
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

Colours 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.

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!

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. 1814 references! http://archive.org/stream/noaatechnical19811982unit/noaatechnical19811982unit_djvu.txt

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, Sparidae, …

Acanthuriformes: Lutjanidae 18: 110

snappers = Schnapper
4 subfamilies
Lutjaninae 6: 76 *Lutjanus 73, Ocyurus 1, …*

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

Acanthuriformes: Moronidae 2: 6 + extinct genera

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

Acanthuriformes: Sciaenidae 70: 275 + extinct genera

drums or croakers = Umberfische, Trommler

Miichthys (= Sciaena) miiuy × *Pseudosciaena (= Larimichthys) crocea* 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

seabreams and porgies = Meerbrassen
Possibly **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. 3. doi: 10.1266/ggs.84.153), except for four genera (*Calamus* 13, *Stenotomus* 2, *Archosargus* 3 and *Lagodon* 1). This includes 34 extant genera and 135 species.

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?)

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, Gorshkova G, Hadani A, Gordin H & Knibb W (1998) Chromosome set manipulations and hybridization experiments in gilthead seabream (*Sparus aurata*). I. Induced gynogenesis and intergeneric hybridization using males of the red seabream (*Pagrus major*). Israeli J. Aquaculture Bamidgeh 50, 99–110.

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

Henderson-Arzapalo A & Colura RL (1984) Black drum × red drum hybridization and growth. J. World Mariculture Society 15, 412–420.

Hertwig G & Hertwig P (1914) Kreuzungsversuche an Knochenfischen. Archiv für Mikroskopische Anatomie 84, Abt. 2, 49–88. + Tafel V. interfamilial hybrids only a few days old and without normal embryos.

Jug Dujakovic J & Glamuzina B (1990) Intergeneric hybridization in Sparidae. 1. *Sparus aurata* × *Diplodus puntazzo* ♂ and *Sparus aurata* × *Diplodus vulgaris* ♂. Aquaculture 86, 369–378.

Jug Dujakovic J & Glamuzina B (1993) Intergeneric hybridization in Sparidae. 2. *Diplodus sargus* × *Dentex dentex* ♂. J. Appl. Aquaculture 2 (1), 105–114.

Kraljevic M & Dulcic J (1999) Intergeneric hybridization in Sparidae (Pisces: Teleostei): *Dentex dentex* female × *Pagrus major* male and *P. major* female × *D. dentex* male. J. Appl. Ichthyol. 15, 171–175.
Loftus WF (1992) *Lutjanus ambiguus* (Poey), a natural intergeneric hybrid of *Ocyurus chrysurus* (Bloch) and *Lutjanus synagris* (Linnaeus). Bull. Marine Science 50 (3), 489–500.
Skakelja N et al. (2000) Implications for possible use of four genera of Sparidae family, *Dentex, Diplodus, Pagellus* and *Sparus* in breeding and hybridization – A comparative karyological approach. Periodicum Biologorum 102, Suppl. 1, 85–90.
Yaolan Z (2008) Primary study on the distant hybridization of *Pseudosciaena crocea* and *Miichthys miiuy*. http://en.cnki.com.cn/Article_en/CJFDTOTAL-JOKE200809026.htm

Acipenseriformes 2 families 6: 29 + several extinct taxa

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 Acipenseroidei families Acipenseridae + Polyodontidae (6: 29): Scholl 2024. **2 IG. 1 IF.**

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

References:

Bartley DM, Rana K & Immink AJ (1997) The use of inter-species hybrids in aquaculture and their reporting to FAO. http://www.fao.org/DOCREP/005/W7611E/W7611e7.htm
Káldy J et al. (2020) Hybridization of Russian Sturgeon (*Acipenser gueldenstaedtii*, Brandt and Ratzeberg, 1833) and American Paddlefish (*Polyodon spathula*, Walbaum 1792) and Evaluation of Their Progeny. Genes 11 (7) https://doi.org/10.3390/genes11070753
Lozovskaya MV & Lozovskii AR (2002) Free-radical lipid oxidation in intergeneric and interspecific sturgeon hybrids at early stages of ontogeny. Bull. Exp. Biol. Med. 134, 333–334.
Nikoljukin NI (1971) Acipenseridae. FAO 1971 Seminar/Study Tour in the U.S.S.R. on Genetic Selection and Hybridization of Cultivated Fishes. 19 April – 29 May 1968. http://www.fao.org/docrep/005/B3310E/B3310E25.htm

Scholl B (2024) Die Störartigen. Ein Missgeschick enthüllte einen „uralten“ Grundtyp. Studium Integrale J. 31, 124–127. https://www.si-journal.de/index2.php?artikel=jg31/heft2/sij312.html
Shivaramu S (2019) Hybridization of sturgeons. Ph.D.thesis. University of South Bohemia in České Budějovice. Faculty of Fisheries and Protection of Waters. ISBN 978-80-7514-095-1.
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. *Scaphirhynchus albus* × *S. platyrhynchus*

Anabantiformes 3 suborders, 8 families

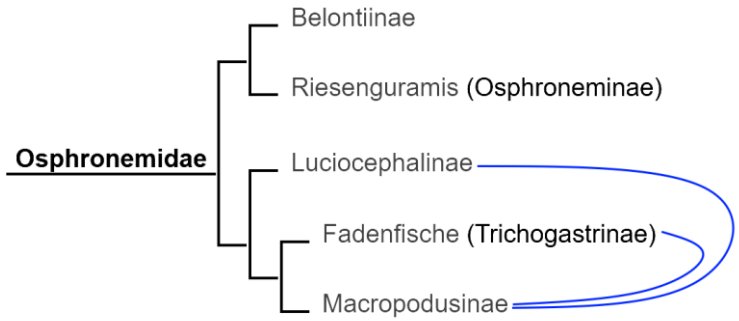
formerly part of order Perciformes

Anabantiformes: Osphronemidae 15: 135 + 1 extinct genus (suborder Anabantoidei)

gouramis = Labyrinthfische p. p.

en.wikipedia 2025 5 subfamilies:
Belontinae 1: 2
Luciocephalinae 4 *Ctenops, …*
Macropodusinae 6 *Betta 70, Macropodus, …*
Osphroneminae 1: 4
Trichogastrinae 2 *Trichogaster, Trichopodus*

Possibly **basic type family Osphronemidae** (15: 135). Three of the five subfamilies are connected by hybridization (13: 129), see the figure below. The other two subfamilies only contain a few species (2: 6), so that at least all the rest of Osphronemidae belong to the same basic type



Osphronemidae: Hybridization within the phylogeny according to de.wikipedia 2025, CC BY 4.0 (cf. Rüber L, Britz R & Zardoya R (2006). doi:10.1080/10635150500541664).

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), http://uk.ask.com/wiki/Siamese_fighting_fish, http://www.digparty.com/wiki/digplanet/Category:Agriculture/Category:Domesticated_animals/Siamese_fighting_fish

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. = ref. 1473 of Schwartz 1972.

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 (suborder Atherinopsioidei)

Neotropical silversides

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

In the family **Atherinopsidae** at least subfamily Menidiinae (7: 80) forms a basic type according to the hybridization data below based on 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) possibly also forms a basic type, but here 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 individuum lived longer than 14 days)), Schwartz 1981 (ref. 1332)

Atheriniformes: Melanotaeniidae 7: 75 (suborder Atherinoidei)

rainbow fish = Regenbogenfische

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

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

References on Atheriniformes:

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

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

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

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

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

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

Leonhardt E (1903) Die Bastarde der deutschen karpfenähnlichen Fische. Fischerei Zeitung 6 (46), 721–725, 741–743, 760–761, 775–776, 793–794, 803–804. = ref. 990/991 of Schwartz 1972.

Rubinoff I (1961) Artificial hybridization of some atherinid fishes. Copeia 1961 (2), 242–244. http://www.jstor.org/pss/1440019 = ref. 1434 of Schwartz 1972.
Tappin R (2008) Rainbowfish. Hybridisation. http://rainbowfish.angfaqld.org.au/Hybrid.htm For most part interspecific hybrids of *Melanotaenia*.

Batrachoidiformes only 1 family Batrachioididae 23: 80

4 subfamilies

Blenniiformes 3 suborders, 13 families

formerly part of Perciformes

Blenniiformes: Pomacentridae 31: 385

clown fishes = Riffbarsche

4 subfamilies

Amphiprion × *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, Kumar TTA, Vinoth R & Shunmugaraj T (2011) Influence of brooder diet and seasonal temperature on reproductive efficiency of clownfish *Amphiprion sebale* in captivity. Recent Research in Science and Technology 3 (2), 95–99.
Mebs D (2009) Chemical biology of the mutualistic relationships of sea anemones with fish and crustaceans. Toxicon 54, 1071–1074.

Carangiformes 6 suborders, 31 families + extinct taxa

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

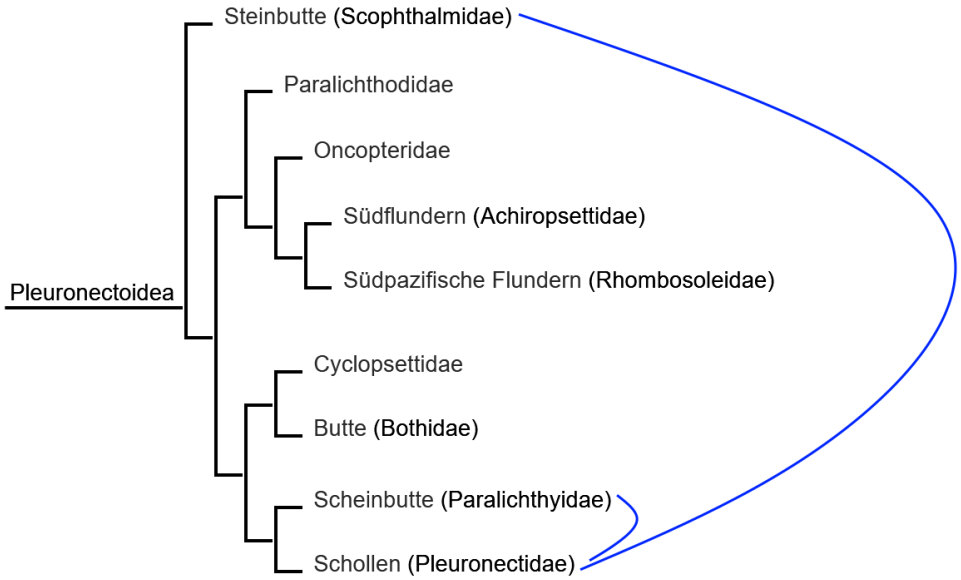
Carangiformes: Pleuronectidae 26: 101 + extinct taxa (suborder Pleuronectoidei, superfamily Pleuronectoidea)

right eye flounders = Schollen, Rechtaugenflundern

5 subfamilies:
Atheresthinae 1: 2, Hippoglossinae 7: 9, Microstominae 2: 9, Pleuronectinae 14: 33, Pleuronichthyinae 2: 9, Rhombosoleidae 9: 19

http://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.*

There is probably a **basic type superfamily Pleuronectoidea** (9 families 70: 389), because **Pleuronectidae** are linked by one hybrid each with **Paralichthyidae** and **Scophthalmidae.** The **basic type** comprises at least three families of **suborder Pleuronectoidei.**



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

Family **Pleuronectidae** is part of a larger basic type (see above). – In Pleuronectidae, several hybrids exist within the subfamilies, mainly Pleuronectinae, and even hybrids linking subfamilies Hippoglossinae, Microstominae, and Pleuronectinae.

Glyptocephalus cynoglossus × *Pleuronectes platessa* **ISF** Microstominae × Pleuronectinae (nat. hyb.) Schwartz 1972 (ref. 709, 1265, 1548, 1549)
Hippoglossoides platessoides × *Pleuronectes (= Platessa°) platessa* Pleuronectinae Schwartz 1972 (ref. 74), Schwartz 1981 (ref. 1193)

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

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

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

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

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

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

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

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

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

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

Platichthys flesus × *Pleuronectes platessa* Pleuronectinae Ubisch 1952, Riley & Thacker *1969* (nat. hyb.), Schwartz 1972 (ref. 709, 1284, 1702, 1703 etc.), Schwartz 1981 (ref. 1298, 1514 etc.)

Pleuronectes microcephalus, platessa (= *Platessa° vulgaris*) × *Scophthalmus* (= *Rhombus°*) *maximus* **IF** Pleuronectidae Pleuronectinae × Scophthalmidae (nat. hyb.) Schwartz 1972 (ref. 356, 392 = Krause 1881, 472, 709, 932, 933, 1548, 1549, 1611)

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*).

Scophthalmidae are part of a larger basic type (see above).

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

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.

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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. *Pleuronectes platessa* × *Scophthalmus maximus*.

Li J, Zhang Q, Qi J, Wang X & Wang Z (2006) Embryonic and larval development in hybrid between *Paralichthys olivaceus* ([female]) and *Verasper variegates* ([male]). J. Fishery Sciences of China 13 (5), 732–739.

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

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

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

Centrarchiformes 4 suborders, 22 families

Often considered as part of Perciformes.

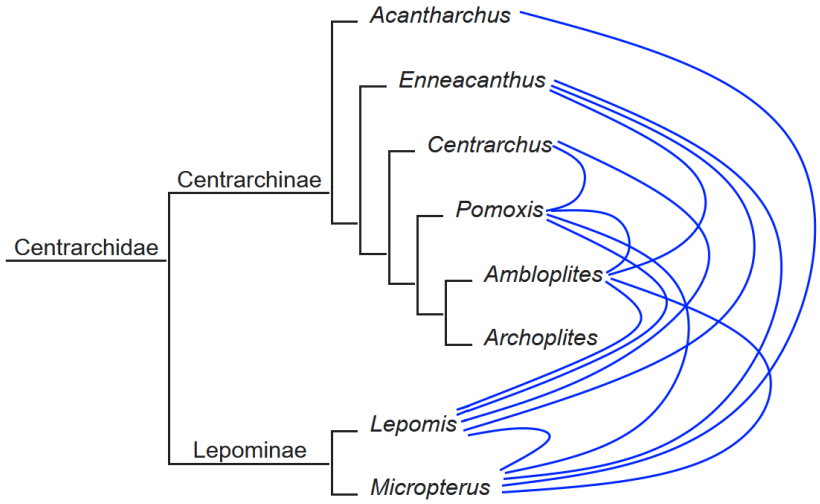
Centrarchiformes: Centrarchidae 7: 34 + extinct species (suborder Centrarchoidei)

sunfishes = Sonnenbarsche

en.wikipedia 2025: 2 subfamilies (North America):
Centrarchinae 4 *Acantharchus*, *Ambloplites*, (*Archoplites*), *Centrarchus*, *Enneacanthus*, *Pomoxis*
Lepominae 2 *Lepomis* (incl. *Allotis*°, *Apomotis*°, *Chaenobryttus*°, *Eupomotis*°, *Helioperca*°, *Xenotis*°), *Micropterus*

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

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



Centrarchidae: Hybridization within the cladogram according to de.wikipedia (2025, CC BY 4.0; cf. Near TJ & Kim D (2021). doi: 10.1016/j.ympev.2021.107156).

Acantharchus × *Micropterus* **ISF** Bolnick & Near 2005
Ambloplites × *Archoplites* (art. hyb.) Bolnick & Miller 2006 (only up to the blastula stage)
Ambloplites rupestris × *Chaenobryttus*° (= *Lepomis*) *gulosus* **ISF** (art. hyb.) Schwartz 1972 (ref. 1701 = Tyus 1969)
Ambloplites × *Enneacanthus* (art. hyb.) Tyus 1973, Schwartz 1981 (ref. 388), Bolnick & Near 2005
Ambloplites × *Lepomis* **ISF** (art. hyb.) Schwartz 1972 (ref. 645, 1701), Tyus 1973, Schwartz 1981, Bolnick & Near 2005
Ambloplites × *Micropterus* **ISF** (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** 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* p. p.) × *Pomoxis* **ISF** Schwartz 1981 (ref. 1083, 1084)

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

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

Eupomotis° (= *Lepomis*) *gibbosus* × *Helioperca*° (= *Lepomis*) *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** Hester 1970, Childers 1971, Schwartz 1972 (ref. 1768, 1770), Schwartz 1981, Bolnick & Near 2005

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

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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

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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.
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Childers WF, Cho P & Whitt (1972) Isozyme analysis of the green sunfish × largemouth bass F_1 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. ref. 1627.
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, 18 families 2000 species.

2 suborders: Characoidei, Citharinoidei

Characiformes: Characidae (s. l. incl. Acestrorhamphidae) 156: 1000 (suborder Characoidei)

characids = Echte Salmler

15 subfamilies

The taxonomy of Characidae s. l. has undergone huge revisions: Nowadays there are more families like Characidae s. str., Acestrorhamphidae and Serrasalmidae.

Basic type considerations within Characidae s.l.:
Acestrorhamphidae: 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) all Acestrorhamphidae with 15 subfamilies and 685 species form a basic type. Accoding to Oliveira (2025, fig. 8. https://doi.org/10.3390/taxonomy5020033) all Acestrorhamphidae subfamilies, except for 3 small subfamilies (6: 28), form a basic typ.
Serrasalmidae: Based on the hybrid *Metynnis altidorsalis* (*„schreitmuelleri"*) × *Mylossoma duriventre* (*„argenteum"*) in combination with the phylogeny of Kohlmann et al. (2021, fig. 2+3+4. doi: 10.1093/sysbio/syaa065) all Serrasalmidae (16: 99) with 3 subfamilies form a basic type.

Anoptichthys° (= *Astyanax*) × *Astyanax* Stethaprioninae (viable, fertile) Pfeiffer 1967, Wilkens 1971, Schwartz 1972 (ref. 456, 851a, etc.), Schwartz 1981
Astyanax (= *Anoptichthys*°) *jordani* × *Ctenobrycon spilurus* Stethaprioninae (art. hyb.) Schwartz 1972 (ref. 829)
Astyanax (= *Anoptichthys*°) *jordani* × *Moenkhausia (= Bario) oligolepis* Stethaprioninae Schwartz 1972 (ref. 829); but Tayeriinae × Acestrorhampinae according to Melo et al. (2024, fig. 6. https://doi.org/10.1093/zoolinnean/zlae101)
Colossoma macropomum × *Piaractus brachypomus, mesopotamicus* Serrasalmidae (in 2025 a separate family) Bartley et al. 1997, Martin et al. 2002, Ciasullo 2004; both in Colossomatinae Kohlmann et al. (2021, fig. 2+3+4. doi: 10.1093/sysbio/syaa065)
Gymnocorymbus ternetzi × *Hemigrammus caudovittatus (= Hyphessobrycon/Psalidodon anisitsi)* Stethaprioninae × Pristellinae David & Pandian 2006; but Pristellinae × Acestrorhampinae according to Melo et al. (2024, fig. 6. https://doi.org/10.1093/zoolinnean/zlae101)
Hemigrammus serape (= Hyphessobrycon eques) × *Macropodus*° (= *Hyphessobrycon, Megalamphodus*°) *sweglesi* Pristellinae Schwartz 1981 (ref. 118)
Metynnis altidorsalis (*„schreitmuelleri"*) × *Mylossoma duriventre* (*„argenteum"*) Serrasalmidae (since 2025 a separate family) Schwartz 1972 (ref. 91).

Characiformes: Citharinidae 3: 9 (suborder Citharinoidei)

lutefish = Geradsalmler

Citharinus 6, Citharidium 1, Citharinops 1.

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

References on Characiformes:

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, de Moraes FR, Fujimoto RY, Nomura DT & Fenerick J Jr. (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. = ref. 1069.

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. = ref. 1748.

Cichliformes 3 families 205: 1500

Formerly part of Perciformes.

Cichlidae 200: 1500, Pholidychthyidae 1: 2, Polycentridae 4: 5

Cichliformes: Cichlidae 200: 1500

cichlids = Buntbarsche

10 subfamilies.

The subdivision is matter of discussion.

Probably basic type **family Cichlidae** as suggested by Fehrer 1997, Scherer 1998. **22 IG**.

Alone some 500–700 species in lake Malawi.
Schwartz 1981: *Pseudotropheus 3 IS, Tilapia ca. 15 IS.*
Interesting link „How to breed hybrid cichlids": http://www.wikihow.com/Breed-Hybrid-Cichlids

Attention: The subfamilies listed below are provisional

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

Amphilophus × *Cichlasoma* Cichlasomatinae http://totalfish.weebly.com/flowerhorns.html

Amphilophus × *Herichthys* Cichlasomatinae http://en.wikipedia.org/wiki/Cichlidae 2012 („red Texas cichlid")

Archocentrus (= *Herotilapia*°) *multispinosa* × *Cichlasoma* Cichlasomatinae Schwartz 1981 (ref. 1591)

Astatotilapia calliptera × *Metriaclima*° (= *Maylandia*) *estherae* Pseudocrenilabrinae Stelkens et al. 2009

Astatotilapia calliptera × *Protomelas taeniolatus* Pseudocrenilabrinae Stelkens et al. 2009

Astatotilapia. calliptera × *Pundamilia nyererei* Pseudocrenilabrinae Stelkens et al. 2009

Aulonocara × *Pseudotropheus* Pseudocrenilabrinae http://therealowner.com/pets/beautiful-aquarium-world/

Aulonocara × *Trematocranus* Pseudocrenilabrinae http://therealowner.com/pets/beautiful-aquarium-world/

Cichlasoma nigrofasciatum × *Geophagus brasiliensis* **ISF** Cichlasomatinae × Geophaginae Schwartz 1981 (ref. 221, 966, 1591)

Cichlasoma nigrofasciatum × *Herichthys cyanoguttatus* Cichlasomatinae Schwartz 1972 (ref. 1416)

Cichlasoma × *Heros* Cichlasomatinae You-Ling et al. 2009

Cichlasoma octofasciatum × *Pelamotochromis kribensis* **ISF** Cichlasomatinae × Pseudocrenilabrinae Schwartz 1972 (ref. 1175)

Cynotilapia afra × *Pseudotropheus zebra* Pseudocrenilabrinae Stauffer et al. 1996

Gymnogeophagus (= *Geophagus*°) *gymnogenes* × *Heros facetus* **ISF** Geophaginae × Cichlasomatinae Schwartz 1972 (ref. 1501, 1502 = Schütz 1912)

Labeotropheus × *Pseudotropheus* **ISF** Haplochromini × 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 (= *Tilapia*°) × *Tilapia* Pseudocrenilabrinae Schwartz 1972 (ref. 1318, 1319, 1692), Rana et al. 1996, Bezault et al. 2012

Paralabidochromis chilotes, rockkribensis × *Pundamilia nyererei, pundamilia* Pseudocrenilabrinae Stelkens et al. 2009

Paralabidochromis × *Pundamilia* Pseudocrenilabrinae Stelkens et al. 2009

Sarotherodon × *Tilapia* Pseudocrenilabrinae Schwartz 1972 (ref. 1317, 1318), Rana et al. 1996

References on Cichlidae:

Albertson RC, Markert JA, Danley PD & Kocher (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/

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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.

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

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

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

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You-Ling C, Qiu-Jin Z, Yan-Yin W & Jian-Ping M (2009) Chromosomes of *Cichlasoma trimaculatum* (male), *Heros managuense* (female) and their hybrid offspring. Chinese J. Agric. Biotech. 6, 265–270. http://journals.cambridge.org/action/displayAbstract;jsessionid=DA924E1AAD423995EF5F2D3EC484508F.tomcat1?fromPage=online&aid=7174724

Clupeiformes 2 suborders, 10 families : 405 and extinct taxa

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

Alosa sapidissima × *Pomolobus*° (= *Alosa*) *aestivalis, pseudoharengus* **IS** Alosidae (since 2025 separate family) Schwartz 1972 (ref. 1056)

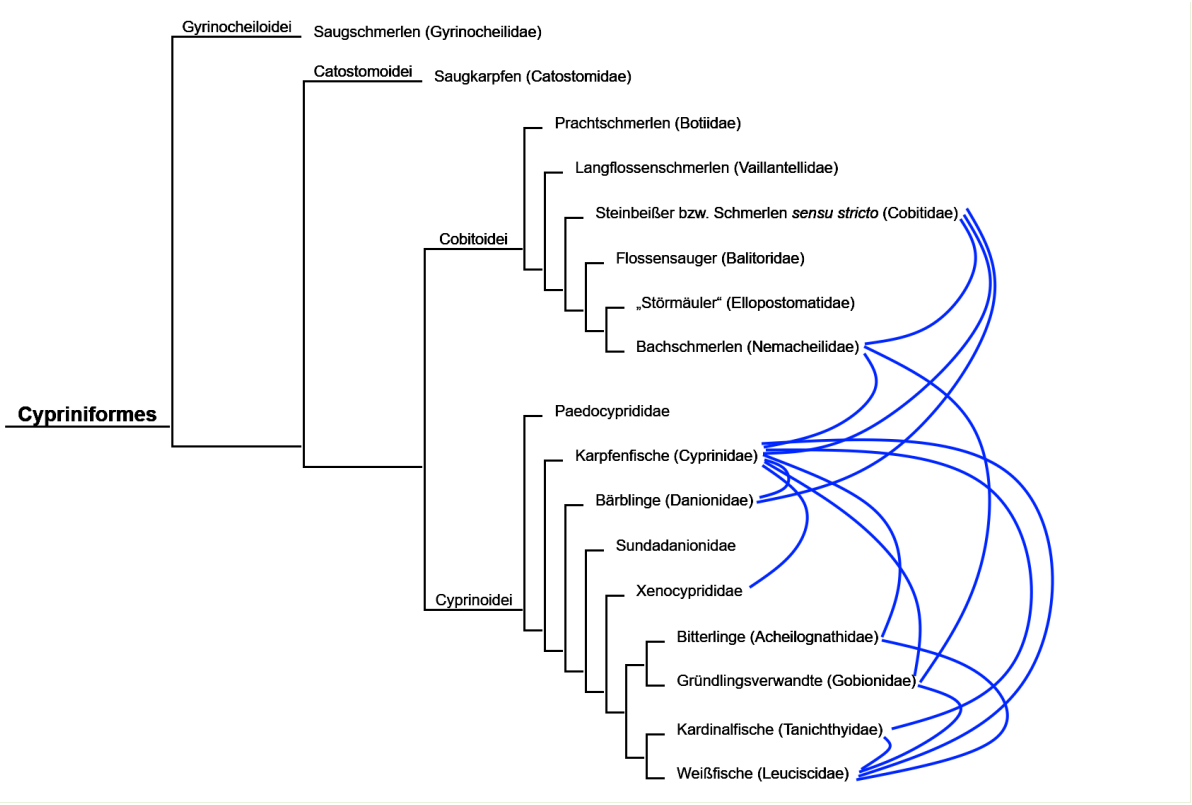
Dorosoma cepedianum × *Signalosa*° (= *Dorosoma*) *petenensis* **IS** Dorosomatidae (since 2025 separate family) (nat. hyb.) Schwartz 1972 (ref. 1143 = Minckley & Krumholz 1960)

Cypriniformes 4 suborders, 23 families 962: 4104

Systematics according to fishbase 2025. 4 suborders:
Gyrinocheiloidei 1 family Gyrinocheilidae 2: 5
Catastomoidei 1 family Catastomidae 35: 202
Cobitoidei 9 families 187: 402
Cyprinoidei 10 families 738: 3495

Probably **basic type order Cypriniformes suborders Cyprinoidei + Cobitoidei**. Considering the manifold crossings between the families of these two suborders (see also the separate listing of intersubordinal hybrids below), obviously all members of these two suborders belong to the same basic type (see the figure below) with a total of about 3900 species and 276 intergeneric hybrid combinations. This is so far the most extensive basic type at all. – It is unresolved if the two basal suborders Gyrinocheiloidei and Catastomidei with one family each belong to this basic type,

too. Proofing phylogenies: 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), 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)



Cypriniformes: Cladogram after Stout et al. 2016 (doi:10.1186/s12862-016-0819-5), from de.wikipedia 2025 and hybrid connections.

Cypriniformes suborder Catostomoidei 1 family 13: 80 + extinct genera

Catastomidae 13: 80

sucker family = Saugkarpfen

4 subfamilies: Catostominae 9: 69, Ictiobinae 2: 8, Cycleptinae 1: 2, Myxocyprinae 1: 1. Schwartz 1981: *Carpiodes 1 IS.*

According to the phylogeny of Yang et al. (2024, fig. 1. https://doi.org/10.3390/biology13121072) all species of tribe Catostomini (5: 39) could belong to the same basic type.

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

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

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

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

Cypriniformes suborder Cobitoidei 9 families 187: 402

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

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

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

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

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

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

Lefua echigonia, nikkonis × *Misgurnus anguillicaudatus* Nemacheilidae × Cobitidae **IF** 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)

Lefua echigonia, nikkonis × *Misgurnus anguillicaudatus* **IF** Nemacheilidae × Cobitidae Schwartz 1972 (ref. 883 = Kobayasi 1957; ref. 884 = Kobayasi 1962; 1133, 1140; ref. 1620 = Suzuki 1957; ref. 1636 = Suzuki 1968)

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

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

Cypriniformes suborder Cyprinoidei 10 families 360: 3000

carp or minnow fishes = Karpfenfische (s. l.)

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

For basic type considerations see order Cypriniformes (above).

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

Abramis × *"Aspius"* Leuciscidae Schwartz 1972 (ref. 991, 1519)

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

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

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

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

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

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

Acheilognathus × *Sarcocheilichthys* **ISF** 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* p. p.) × *Pseudochondrostoma* (= *Chondrostoma* p. p.) (*A. oligolepis* × *P. duriense*) Leuciscidae Pereira et al. 2014

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

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

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

Agosia × *Rhinichthys* Leuciscidae Schwartz 1981 (ref. 1042)

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

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

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

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

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

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

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

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

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

Alburnus (incl. *Chalcalburnus*°) × *Squalius* Leuciscidae Schwartz 1972 (ref. 2, 181, 424,

777, 992 etc.), Schwartz 1981, Ünver & Erk'akan 2005, Ünver et al. 2008

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

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

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

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

Apocope° (= *Rhinichthys*) × *Richardsonius* Leuciscidae Calhoun 1940, Schwartz 1972 (ref. 269 = Calhoun 1940; 1012, 1493, 1536)

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Catla* Xenocyprinae × incertae sedis Schwartz 1981 (ref.139, 728)

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Ctenopharyngodon* Xenocyprididae Schwartz 1972 (ref. 19; 191 = Berry & Low 1970; 1044a), Schwartz 1981, Bartley et al. 1997, Scribner et al. 2001

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Cyprinus* **IF** Xenocyprididae × Cyprinae Schwartz 1972 (ref. 19, 1044, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981 (ref. 721, 1001, 1645)

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Hemiculter* Xenocyprididae Schwartz 1981 (ref. 996)

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Hypophthalmichthys* Xenocyprididae (fertile) Schwartz 1981 (ref. 139, 728, 1565, 1646), Bartley et al. 1997, Scribner et al. 2001

Aristichthys° (= *Hypophthalmichthys* p. p.) × *Mylopharyngodon* Xenocyprididae Schwartz 1972 (ref. 1044a), Schwartz 1981 (ref. 996)

Aristichthys × *Parabramis* Xenocyprididae Schwartz 1972 (ref. 1044a = Makeeva 1968)

"Aspius" (*Leuciscus*) × *Leuciscus* Leuciscidae Schwartz 1972 (ref. 804, 1519 etc.), Schwartz 1981 (ref. 290, 1252, 1327, 1698)

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

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

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

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

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

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

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

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

Barbus × *Esomus* Cyprinidae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Barbus × *Scardinius* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 1731 = Vutskrits 1910/1911)
Barbus × *Schizothorax* Cyprinidae Schwartz 1972 (ref. 682, 1256 etc.), Schwartz 1981 (ref. 1595)
Barbus × *"Varicorhinus"* Cyprinidae Banister 1972, Schwartz 1972 (ref. 216, 946, 1113, 1589)
Biwia × *Gnathopogon* Gobionidae Suzuki 1963b, Schwartz 1972 (ref. 1071 = Masai & Sato 1966; 1628, 1629, 1633, 1636 = Suzuki 1968), Schwartz 1981 (ref. 405)
Biwia × *Hemigrammocypris* Gobionidae 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* Gobioninae Schwartz 1972 (ref. 1636 = Suzuki 1968)
Blicca bjoerkna × *Carassius* **IF** Leuciscidae × Cyprininae Schwartz 1972 (ref. 227, 946, 1219), Schwartz 1981 (ref. 1193)
Blicca × *Chondrostoma* Leuciscidae Schwartz 1972 (ref. 1418), Schwartz 1981 (ref. 1341
Blicca bjoerkna × *Cyprinus carpio* **IF** Leuciscidae × Cyprinidae Schwartz 1972 (ref. 1219), Schwartz 1981 (ref. 1193)
Blicca × *Leuciscus* Leuciscidae Vutskits 1907, Schwartz 1972 (ref. 92, 1519 etc.), Schwartz 1981 (ref. 961)
Blicca × *Rutilus* (incl. *Gardonus*°) Leuciscidae (fertile) Schwartz 1972 (ref. 113, 826, 991, 1225, 1299 etc.), Schwartz 1981 (ref. 290, 1193, 1359 etc.)
Blicca (= *Abramis*°) *bjoerkna* × *Scardinius* Leuciscidae (fertile) Schwartz 1972 (ref. 778, 991, 1036, 1219, 1252, 1519, 1730 etc.), Schwartz 1981 (ref. 290, 1193, 1253, 1698)
Blicca × *Squalius* (= *Leuciscus*°) *cephalus* Leuciscidae Schwartz 1972 (ref. 92)
Blicca × *Tinca* IF Leuciscidae × Tincidae Schwartz 1972 (ref. 946, 1219), Schwartz 1981 (ref. 1193)
Blicca × *Vimba* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 155, 181, 183, 227, 1549, 1658 etc.), Schwartz 1981, Balon 1992
Brachydanio° (= *Danio* p. p.) × *Danio malabaricus* Cyprinidae Schwartz 1972 (ref. 227, 1448)
Brachydanio° (= *Danio* p. p.) × *Esomus danricus* Cyprinidae Schwartz 1972 (ref. 1473 = Schmidt 1930)
Brachydanio° (= *Danio* p. p.) × *Tanichthys albonubes* **IF** Cyprinidae × Tanichthyidae Schwartz 1981 (= Housz 1964)
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 × Gobioninae (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** Cyprininae × Gobioninae Schwartz 1972 (ref. 885, 946), Schwartz 1981 (ref. 1193, 1369, 1370)
Carassius × *Hemibarbus labeo* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 946, 947, 950 = Kryzanovski 1968), Schwartz 1981 (ref. 720)
Carassius × *Hypophthalmichthys* **IF** Cyprinidae × Xenocyprididae Gui et al. 1993
Carassius × *Leuciscus* **IF** Cyprinidae × Leuciscidae Nikoljukin 1971 (*Carassius carassius* × *Leuciscus cephalus*: „... only a small part of the offspring was viable, and these were matrilinear, i. e. gynogenetic due to the exclusion of the male chromosome complex during development."), Schwartz 1972 (ref. 80 = Arnoult & Spillman 1966), Schwartz 1981 (ref. 188 = Arnoult & Spillman 1965)
Carassius × *Megalobrama* **IF** Cyprinidae × Xenocyprididae Cultrinae Liu et al. 2007, Qin et al. 2014
Carassius × *Phoxinus* **IF** Cyprinidae × Leuciscidae Schwartz 1972 (ref. 80, 176, 1582)
Carassius × *Pseudogobio* **IF** Cyprinidae × Gobionidae Schwartz 1972 (ref. 1636 = Suzuki 1968), Schwartz 1981 (ref. 131 = Aduma-Bossmann & Keiz 1971)(not beyond the

larval stage)

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

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

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

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

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

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

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

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

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

Carassius × *Tribolodon hakonensis* Cyprinidae 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 × *Morulius*° (= *Labeo* p.p.) Cyprinidae Khan & Kowtal 1986, Scribner et al. 2001 (art. hyb.)

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

Chondrostoma × *Leuciscus* Leuciscidae Schwartz 1972 (ref. 1430 etc.), Schwartz 1981 (ref. 290, 1253, 1341, 1359)

Chondrostoma × *Squalius* (=*Leuciscus*°) *cephalus* Leuciscidae Schwartz 1972 (ref. 176, 423)

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

Chondrostoma × *Phoxinellus* (= *Paraphoxinus*°) *alepidotus* Leuciscidae Schwartz 1972 (ref. 1728, 1383

Chondrostoma × *Rutilus* Leuciscidae Schwartz 1972 (ref. 946, 1225), Schwartz 1981 (ref. 1193, 1341), Gilles et al. 1998, Scribner et al. 2001
Chondrostoma × *Squalius* Leuciscidae Schwartz 1972 (ref. 991, 1173, 1519, 1722, 1731)
Chondrostoma × *Telestes* Leuciscidae Schwartz 1972 (ref. 2, 592, 779, 991, 995, 1611 etc.), Schwartz 1981 (ref.1253)
Chondrostoma × *Vimba* Leuciscidae Schwartz 1972 (ref. 227, 1722)
Chrosomus × *Clinostomus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)
Chrosomus × *Dionda* Leuciscidae Schwartz 1981 (ref. 1042)
Chrosomus × *Margariscus* Leuciscidae Schwartz 1981 (ref. 1042)
Chrosomus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 324, 713, 1330, 1383), Greenfield et al. 1973, Schwartz 1981 (ref. 665, 1042)
Chrosomus × *Phoxinus* (= *Pfrille*°) Leuciscidae Schwartz 1972 (ref. 94)
Chrosomus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 324, 1330), Schwartz 1981 (ref. 1042)
Cirrhinus × *Ctenopharyngodon* Cyprinidae Schwartz 1981 (ref. 694, 728, 798)
Cirrhinus × *Cyprinus* Cyprinidae Schwartz 1981, Gupta et al. 1986
Cirrhinus × *Labeo* Cyprinidae Chaudhuri 1971, Schwartz 1972 (ref. 284, 764), Schwartz 1981, Khan & Kowtal 1986, Simonsen et al. 2005
Cirrhinus × *Sinilabeo* Cyprinidae Scribner et al. 2001
Clinostomus × *Nocomis* Leuciscidae Schwartz 1972 (ref. 963, 965, 1777a)
Clinostomus × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 579, 926, 963, 1548, 1549), Schwartz 1981 (ref. 665), Sizemore & Howell 1987, Grady & Cashner 1988
Clinostomus × *Phoxinus* Leuciscidae Schwartz 1981, Grady & Cashner 1988 (nat. hyb.), Scribner et al. 2001
Clinostomus × *Rhinichthys* Leuciscinae (nat. hyb.) Hubbs 1955, Goodfellow et al. 1986, Scribner et al. 2001
Clinostomus × *Semotilus* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 579, 584, 926), Ross & Cavender 1981, Schwartz 1981 (ref. 1352)
Couesius (= *Ceratichthys*°) × *Notropis* (= *Hypsilepis*°) Leuciscidae Schwartz 1972 (ref. 311a)
Couesius × *Margariscus* Leuciscidae Schwartz 1972 (ref. 693)
Couesius × *Rhinichthys* Leuciscidae Schwartz 1972 (ref. 637, 1535), Schwartz 1981 (ref. 1042)
Couesius plumbeus × *Semotilus margarita* Leuciscidae Schwartz 1981 (ref. 1042), Wells 1981
Ctenopharyngodon × *Cyprinus* **IF** Xenocyprididae × Cyprinidae Schwartz 1972 (ref. 894, 953, 1044, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981 (= Vasil'ev et al. 1975: „28 % normal hybrids")
Ctenopharyngodon × *Hypophthalmichthys* Xenocyprididae Schwartz 1972 (ref. 19, 1044a, 1045, 1636 = Suzuki 1968), Schwartz 1981, Beck et al. 1983, Scribner et al. 2001
Ctenopharyngodon × *Labeo* **IF** Xenocyprididae × Cyprididae Schwartz 1981 (ref. 728)

Ctenopharyngodon × *Megalobrama* **IF** Xenocyprididae × Cyprididae 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)

Cyprinus × *Gnathopogon* Cyprininae × Gobioninae **ISF** Schwartz 1972 (ref. 1636 = Suzuki 1968)

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

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

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

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

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

Cyprinus × *Megalobrama* Cyprinidae 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 × Gobioninae 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 × Acheilognathinae 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** Cyprininae × Gobioninae 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 × *"Varicorhinus"* (*Capoeta*) *capoeta* Cyprinidae Schwartz 1981 (ref. 247)

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

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

Dionda × *Hybopsis* Leuciscidae Schwartz 1972 (ref. 1330)
Dionda × *Luxilus* Leuciscidae (nat. hyb.) Hubbs 1955
Dionda × *Nocomis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 863, 965), Schwartz 1981 (ref. 1042)
Dionda × *Notropis* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 963, 1157, 1330, 1548, 1549 etc.), Schwartz 1981 (ref. 1042, 1338, 1496)
Diptychus dybowski × *Leuciscus schmidti* Barbinae × Leuciscidae **ISF** 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* 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 × *Orthodon* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 278), Schwartz 1981 (ref. 206, 1042)
Gila (incl. *Siphateles*°) × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 227, 324, 680), Schwartz 1981 (ref. 1042, 1496), Suttkus & Cashner 1981
Gila × *Richardsonius* Leuciscidae Schwartz 1972 (ref. 419), Schwartz 1981 (ref. 206, 1042, 1496)
Gila × *Siphateles*° (= *Gila* p.p.) Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 82, 324, 1116, 1549 etc.), Schwartz 1981 (ref. 1193), Layman et al. 2010
Gnathopogon × *Hemigrammocypris* **IF** Gobionidae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)
Gnathopogon × *Pseudogobio* Gobionidae (nat. hyb.) Schwartz 1972 (ref. 1069, 1626 = Suzuki 1963a (art. hyb., up to the adult stage, intermediate in morphology and behaviour), 1627, 1629, 1636 = Suzuki 1968), Suzuki 1973a, Schwartz 1981 (ref. 264, 1543, 1545, 1549, 1554)
Gnathopogon × *Pseudorasbora* Gobioninae 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** Gobioninae × Acheilognathinae Schwartz 1972 (ref. 1636 = Suzuki 1968)
Gnathopogon × Sarcocheilichthys Gobioninae Schwartz 1972 (ref. 1621, 1636 = Suzuki 1968)
Gnathopogon × *Squalidus* Gobioninae Kasama & Kobayasi 1989a
Gnathopogon × *Zacco* **IF** Gobioninae × Xenocyprididae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Gobio × *Phoxinus* (= *Leuciscus*°) *phoxinus* **IF** Gobionidae × Leuciscinae (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* Cyprinidae 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* Leuciscinae (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 × *Labeo* **IF** Xenocyprididae × Cyprinidae Schwartz 1981 (ref. 53, 139, 694, 728, 1467, 1565)

Hypophthalmichthys × *Megalobrama* **IF** Xenocyprididae × Cyprinidae Schwartz 1981 (ref. 728)

Hypophthalmichthys × *Parabramis* **IF** Xenocyprididae × Cyprinidae Schwartz 1981 (ref. 728, 1369, 1370)

Hypophthalmichthys × *Mylopharyngodon piceus* Xenocyprididae Schwartz 1981 (ref. 996)

Iotichthys × *Rhinichthys* Leuciscidae Miller & Behnke 1985

Lavinia × *Hesperoleucus* Leuciscidae (nat. hyb.) Hubbs 1955

Lavinia × *Orthodon* Leuciscidae Schwartz 1981 (ref. 1042)

Lavinia × *Pogonichthys* Leuciscidae Schwartz 1981 (ref. 1042)

Lavinia × *Orthodon* Leuciscidae (nat. hyb.) Hubbs 1955

Lavinia × *Pogonichthys* Leuciscidae (nat. hyb.) Hubbs 1955

Leucaspius × *Pseudorasbora* **IF** Leuciscidae × Gobionidee Gozlan & Beyer 2006 (up to

the first larval stage)
Leucaspius × *Rhodeus* **IF** Leuciscidae × Acheilognathidae Schwartz 1972 (ref. 668, 872)
Leucaspius × *Rutilus rutilus* Leuciscidae v. Knauthe 1981
Leucaspius × *Scardinius* (= *Leuciscus°*) *erythrophthalmus* Leuciscidae Schwartz 1972 (ref. 866, 870, 991), Schwartz 1981 (ref. 290, 869)
Leucaspius × *Squalius* Leuciscidae (art. hyb.) Schwartz 1972 (ref. 886, 870, 991, 1731)
Leuciscus × *Notropis* Leuciscidae Schwartz 1972 (ref. 95)
Leuciscus × *Rutilus* Leuciscidae Schwartz 1981 (ref. 471, 1193, 1519, 1726, 1727, 1326, 1543), Scribner et al. 2001
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 × *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* **IF** Cyprinidae × Xenocyprididae http://pir.uniprot.org/taxonomy/564289
Mylocheilus × *Ptychocheilus* Leuciscidae (nat. hyb.) Weisel 1955, Hubbs 1955, Schwartz 1972 (ref. 274, 278, 1548, 1549, 1758 = Weisel 1954a, 1759 = Weisel 1954b), Schwartz 1981 (ref. 1042, 1235, 1523)
Mylocheilus × *Richardsonius* Leuciscidae (nat. hyb., fertile) Weisel 1954, Hubbs 1955, Schwartz 1972 (ref. 1548, 1549, 1759 etc.), Schwartz 1981 (ref. 191, 192, 326, 1042, 1496), Scribner et al. 2001
Mylopharodon × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)
Nocomis × *Notemigonus* Leuciscidae Schwartz 1981 (ref. 1042)
Nocomis × *Notropis* Leuciscidae Schwartz 1972 (ref. 963, 965 etc.), Stauffer et al. 1977, Schwartz 1981 (ref. 1042, 1074, 1424, 1496, 1521, 1743)
Nocomis × *Rhinichthys* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 1548, 1549, 1777a), Stauffer et al. 1979, Schwartz 1981 (ref. 1042, 1496, 1522, 1523)
Nocomis × *Semotilus* Leuciscidae Ross & Cavender 1981, Schwartz 1981 (ref. 1042, 1352)

Notemigonus × *Scardinius* Leuciscidae Burkhead & Williams 1991, Scribner et al. 2001
Notemigonus × *Semotilus* Leuciscidae Schwartz 1981 (ref. 1042)
Notropis × *Phenacobius* Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1981 (ref. 1042)
Notropis × *Phoxinus* Leuciscidae Schwartz 1972 (ref. 963), Hambrick 1977, Schwartz 1981 (ref. 693 = Hambrick 1977), 1496)
Notropis × *Pimephales* Leuciscidae Schwartz 1981 (ref. 1042)
Notropis × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)
Notropis × *Rhinichthys* Leuciscidae Ross & Cavender 1977, Schwartz 1981 (ref. 1042, 1353, 1496)
Notropis × *Semotilus* Leuciscidae Schwartz 1972 (ref. 500, 963, 1378 etc.), Schwartz 1981 (ref. 665, 1042, 1496)
Oregonichthys × *Ptychocheilus* Leuciscidae Schwartz 1981 (ref. 1042)
Oreinus° *sinuatus* (= *Schizothorax plagiostomus*) × *Schizothorax labiatus* Barbinae 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* p. p.) Leuciscidae (nat. hyb.) Hubbs 1955, Schwartz 1972 (ref. 278
Paracheilognathus° (= *Tanakia* p. p.) × *Rhodeus* Acheilognathidae Duyvené de Wit 1964, Schwartz 1972 (ref. 375, 672, 679), Schwartz 1981 (ref. 750)
Paracheilognathus° (= *Tanakia* p. p.) × *Tanakia* 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 × *Richardsonius* Leuciscidae (nat. hyb.) Calhoun 1940, Meisel 1955, Hubbs 1955, Schwartz 1972 (ref. 127a, 274, 278, 785 etc.), Schwartz 1981 (ref. 1042)

Rhinichthys × *Semotilus* Leuciscidae (nat. hyb.) Schwartz 1972 (ref. 1548, 1549), Ross & Cavender 1981, Schwartz 1981 (ref. 1042, 1352)

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

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

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

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

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

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

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

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

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

Schizothorax × *"Varicorhinus"* Cyprinidae (nat. hyb.) Schwartz 1972 (ref. 1548, 1549, 1551a)

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

Intersubordinal hybrids within Cypriniformes:

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 × Cyprinidae Schwartz 1972 (ref. 991 = Leonhardt 1903)

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

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

Barbatula (= *Nemacheilus*°) *barbatula* × *Phoxinus* **ISO** Nemacheilidae × Cyprinidae 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** Cyprinidae × Cobitidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

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

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

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

Cobitis biwae × *Pseudorasbora parva* **ISO** Cobitidae × Cyprinidae 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 × Cyprinidae Schwartz 1972 (ref. 1621 = Suzuki 1959; ref. 1636 = Suzuki 1968)

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

Gnathopogon elongatus × *Misgurnus anguillicaudatus* **ISO** Cyprinidae × 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 × Cyprinidae Schwartz 1972 (ref. 1621 = Suzuki 1959, 1636 = Suzuki 1968)

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

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

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

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

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

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

Misgurnus anguillicaudatus × *Zacco platipus, temmincki* **ISO** Cobitidae × Cyprinidae 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 × *Rasbora heteromorpha* **ISO** Cobitidae × Cyprinidae

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

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

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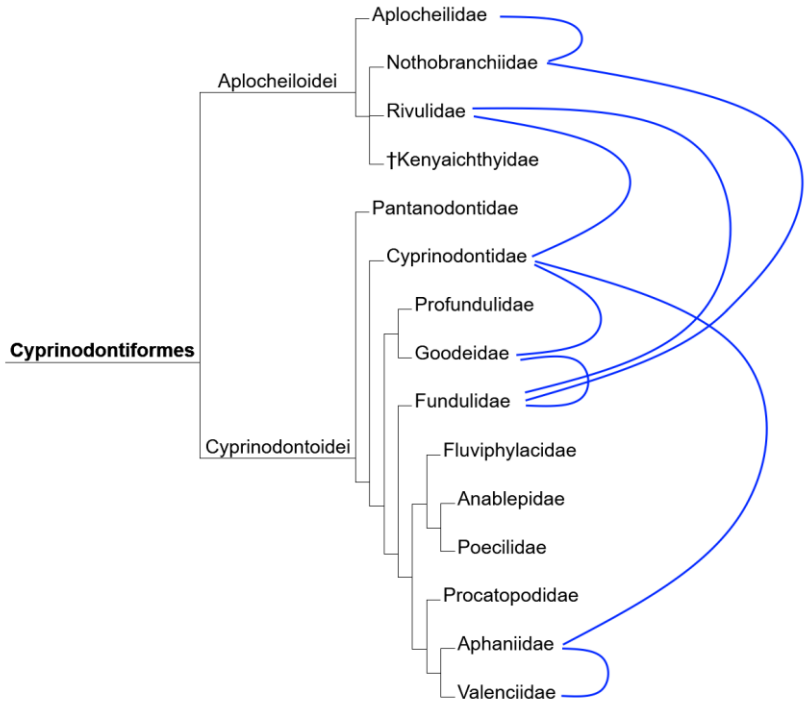
Cyprinodontiformes 2 suborders, 14 families, 150: 1500

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 distinct taxa (see the figure below).



Cyprinodontiformes: Hybridization within the phylogeny according to en.wikipedia (2025, CC BY 4.0; cf. Bragança PHN et al. (2018), doi:10.3897/zse.94.22173; Altner M & Reichenbacher B (2015). doi:10.1371/journal.pone.0123056)

For supposed interordinal hybrids see the appendix at the end of this file and Hubbs 1971a, p. 325.

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

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

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

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

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

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

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

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

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

Crenichthys × *Fundulus* **IF** Goodeidae × Fundulidae (Hubbs 1971a: mature), Schwartz

1972 (ref. 451, 740a, 745 = Hubbs & Drewry 1962)

Cynolebias bellottii × *Cyprinodon dispar* **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)

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

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 (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.

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

Cyprinodontiformes: Cyprinodontidae 8: 100 (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 (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.*
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 (suborder Cyprinodontoidei)

splitfins or goodeids = Hochlandkärpflinge

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

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 (suborder Aplocheiloidei)

African killifishes

Schwartz 1972: p. 272 sub Cyprinodontidae.

Aphyosemion (incl. *Panchax° bualanus, calliurus, cameronensis, ...*), *Callopanchax*, *Epiplatys* (e. g. *fasciolatus, sexfasciatus, spilargyreius*), *Fenerbahce*, *Fundulopanchax*, *Nimbapanchax*, *Nothobranchius 54*, *Scriptaphyosemion*, ….

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

Attention: The generic names have changed for some part!
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*) 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 (suborder Cyprinodontoidei)

livebearers = Lebendgebärende Zahnkarpfen

en.wikipedia 2025 3 subfamilies:
Poeciliinae 28: 198, Tomeurinae 1: 1, Xenodexiinae 1: 1

Poeciliinae 8 tribes:
Alfarini 1
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

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.

Probably all members of **family Poeciliidae** (37: 200) belong to the same basic type. All known hybrids are within subfamily Poeciliinae (28: 198), linking 5 of the 8 tribes. More importantly, the family is part of the basic type order Cyprinodontiformes. No confirmed connections exist yet of Poeciliidae with other families of the order, but from a molecular view the family seems 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* p. p.) × *Girardinus* **IS** *Girardini* (nat. hyb.) Hubbs 1955
Gambusia × *Girardinus* 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 (suborder Aplocheiloidei)

rivulids = New World killifishes

Formerly subfamily Rivulinae of Aplocheilidae s. l.

de.wikipedia 2025 3 subfamilies:

Cynolebiinae

Kryptolebiatinae 1 *Kryptolebias*

Rivulinae *Austrofundulus, Pterolebias, Rivulus, Rachovia, …*

Austrofundulus × *Pterolebias* **IT** Rivulinae Rivulini × Rivulinae Neofundulini Schwartz 1972 (ref. 1344)

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

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.

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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.*

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Kosswig C (1928) Über Kreuzungen zwischen den Teleostiern *Xiphophorus helleri* × *Platypoecilus maculatus.* Z. Ind. Abst. Vererb.lehre 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.

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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.

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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.
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Esociformes → Salmoniformes

Gadiformes 18 families

Gadiformes: Gadidae 11: 21

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 (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 hybrids show their close connection.

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 88: 600 (suborder Gobioidei)

mudskipper etc.

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)

References on Gobiiformes:
Weber M & DeBeaufort LF (1953) The fishes of the Indo-Australian Archipelago. X. Gobioidea. Leiden: E. J. Brill. 423 p. = ref. 1741 of Schwartz 1972.

Labriformes 2 suborders, 8 families

formerly part of Perciformes
2 suborders: Labroidei, Uranoscopoidei.

Labriformes: Labridae 82: 600 (suborder Labroidei)

wrasses and parrotfishes = Lippfische und Papageifische

en.wikipedia 2025: 9 tribes/subfamilies, incl. the former family Scaridae.

Centrolabrus exoletus × *Crenilabrus*° (= *Symphodus*) *melops* Labrini Schwartz 1972 (ref. 608 = Hagstrom & Wennesberg 1964)
Centrolabrus × *Labrus* Labrini Schwartz 1972 (ref. 608)
Gomphosus × *Thalassoma* Julidini Randall & Gerald 2004
Symphodus (= *Crenilabrus*°) *quinquemaculatus* × *Thalassoma pavo* **IT** Labrini × Julidini Schwartz 1972 (ref. 1013)
Tautoga onitis × *Tautogolabrus adspersus* Labrini Schwartz 1972 (ref. 1154 = Moenkhaus 1911), Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

References on Labridae:
Hagstrom BE & Wennesberg C (1964) Hybridization experiments with wrasses (Labridae). Sarsia 17, 47–54. = ref. 608 of Schwartz 1972.

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

Lepisosteiformes 1 family

Lepisosteiformes: Lepisosteidae 2: 7

gars = Knochenhechte

Basic type order Lepisosteiformes Borger & Scholl 2024, 2025; Kutzelnigg unpubl. 2014 Fachtagung Biologie W&W.

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

References on Lepisosteiformes:

Borger P & Scholl B (2024) Evolutionärer Stillstand bei „lebenden Fossilien“ auch auf molekularer Ebene. Genesisnet News of 28.05.2024. https://www.genesisnet.info/index.php?News=340
Borger P & Scholl B (2025) Evolutionärer Stillstand auf molekularer Ebene bei Knochenhechten als „Lebenden Fossilien“. Stud. Integrale J. 32, 50–51.
Herrington SJ, Hettiger KN, Heist EJ & Keeney DB (2008) Hybridization between longnose and alligator gars in captivity, with comments on possible gar hybridization in nature. Trans. Amer. Fisheries Soc. 137, 158–164. http://www.zoology.siu.edu/heist/Publications/Gar%20Hybridization.pdf pdf

Mugiliformes 2 families

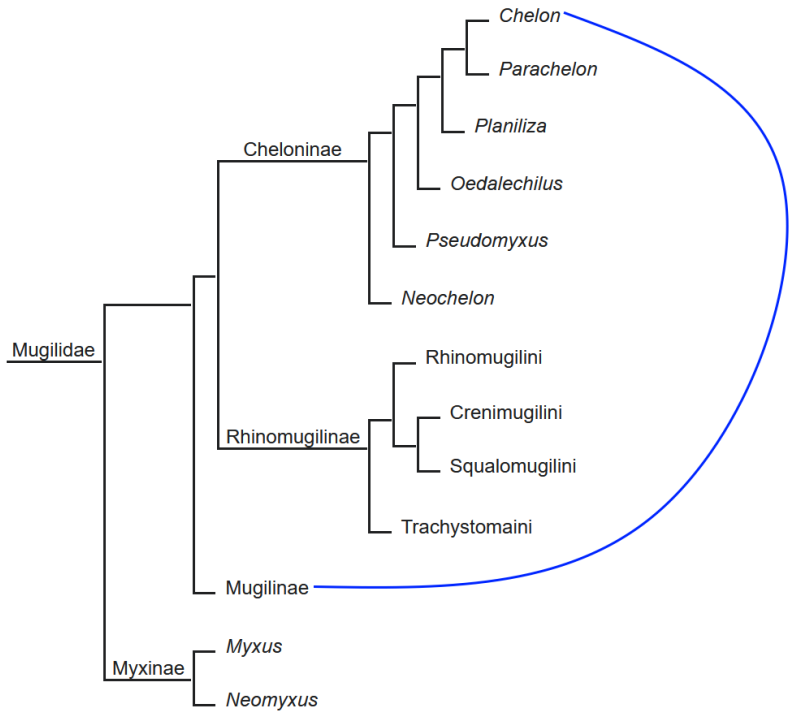
en.wikpiepdia 2025 2 families: Ambassidae: 8: 75, Mugilidae 26: 80.

Mugiliformes: Mugilidae 26: 80

mullets = Meeräschen

The subdivision is matter of debate.

Possibly **basic type family Mugilidae**. There is only one known intergeneric hybrid, but it links two distant taxa in a cladogram of Xia et al. 2016.



Mugilidae: Hybridization within the phylogeny according to de.wikipedia (2025, CC BY 4.0; cf. Xia R, Durand JD, Cuizhang Fu C (2016). doi:10.1016/j.ympev.2015.12.010).

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.

Perciformes 6 suborders, 56 families

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

The taxonomy of this order has been revised and is still under discussion.
We follow Eschmeyers's Catalog of fishes from en.wikipedia 2025
6 suborders:
Cottoidei 11 families: Cottidae, Jordaniidae, Liparidae, …

Gasterosteoidei 3 families: Aulorhynchidae, Gasterosteideae, …
Notothenioidei 8 families: Channichthyidae, …
Percoidei 9 families: Epinephelidae, Percidae, Serranidae, …
Scorpaenoidei 11 families: Normanichthyidae, Scorpaenidae, Triglidae, …
Zoarcoidei 14 families: Eulophiidae, Zoarcidae,

Perciformes: Channichthyidae 11: 20 (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 16 (suborder Percoidei)

groupers = Zackenbarsche

Also considered as a subfamily of family Serranidae.

Cephalopholis, *Chromileptes* (or *Cromileptes*, now often part of *Epinephelus*), *Dermatolepis*, *Epinephelus*, *Paranthias*, …

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

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

Cromileptes altivelis × *Epinephelus lanceolatus* **(IS)** Gong et al. 2025

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.

https://www.sciencedirect.com/science/article/abs/pii/S0044848624009542
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 (suborder Gasterosteoidei)

sticklebacks = Stichlinge

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

Schwartz 1982: *Gasterosteus* ca. 4 IS.

Probably **basic type family Gasterosteidae** (5: 18): 4 of the 5 genera are connected by hybridization.

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)

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

Perciformes: Percidae 10: 200 (suborder Percoidei)

true perches = Echte Barsche

en.wikipedia 2025: 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*°)

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

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

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

Perciformes: Serranidae 64: 450 (suborder Percoidei)

sea basses = Sägebarsche

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

Petromyzontiformes 3 families 10: 48 + extinct taxa

superclass Agnatha, class Cyclostomata
fishbase 2025 3 families: Geotriidae 1: 2, Mordaciidae 1: 3, Petromyzontidae 8: 43

Petromyzontiformes: Petromyzontidae 8: 43

lampreys = Neunaugen

2 subfamilies:
Lampetrinae 6: *Caspiomyzon 3, Entosphenus 7, Eudontomyzon 7, Lampetra 10, Lethenteron 8, Tetrapleurodon 2.*
Petromyzontinae 2: *Ichthyomyzon 6, Petromyzon 1* (*marinus*).

Schwartz 1981: *Ichthyomyzon ca. 7 IS*

Probably **basic type family Petromyzontidae** (8: 43). The two subfamilies are linked by hybridization.

Eudontomyzon × *Lampetra* Lampetrinae Schwartz 1972 (ref. 667a)
Ichthyomyzon × *Lampetra* **ISF** Petromyzontnae × Lampetrinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971)
Ichthyomyzon × *Petromyzon* Petromyzontinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971)

Lampetra × *Petromyzon* **ISF** Lampetrinae × Petromyzontinae Schwartz 1972 (ref. 1337), Schwartz 1981 (ref. 1270 = Piavis 1971)

References:

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.

Pleuronectiformes → Acanthuriformes

Salmoniformes 2 suborders, 2 families + extinct taxa

en.wikipedia 2025: 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

Schwartz 1981: *Esox ca. 11 IS.*

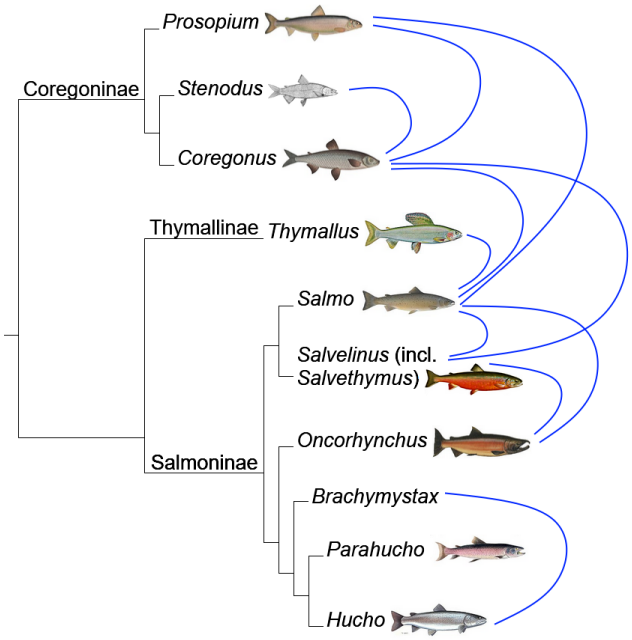
Salmoniformes: Salmonidae 10: 190 (suborder Salmonoidei)

trout = Forellen

en.wikipedia 2025 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.*

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

Basic type family Salmonidae (10: 190): The three subfamilies and nearly all genera are linked by hybridization.



Salmonidae: Hybridization within 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)

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, Balakirev et al. 2013 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3741329/

Coregonus × *Leucichthys°* (= *Coregonus* p. p.) **IS** Coregoninae (nat. hyb.) Schwartz 1972 (ref. 478, 1548, 1549), Schwartz 1981 (ref. 491 = Dangel et al. 1973); 1213)

Coregonus × *Prosopium* Coregoninae Schwartz 1972 (ref. 1101), Schwartz 1981 (ref. 608, 1213)

Coregonus × *Salmo* **ISF** Coregoninae × Salmoninae Schwartz 1972 (ref. 356, 1426; 1433 = Rubaschev 1935), Schwartz 1981 (ref. 491 = Dangel et al. 1973 (with many citations), 1346, 1543)

Coregonus × *Salvelinus fontinalis* **ISF** Coregoninae × Salmoninae Schwartz 1972 (ref. 1359, 1433), Schwartz 1981 (ref. 1004, 1005, 1029, 1433, 1543)

Coregonus × *Stenodus leucichthys* Coregoninae (nat. hyb.) Schwartz 1972 (ref. 15a, 780 etc.), Schwartz 1981 (ref. 272, 797)

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

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

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

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

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

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

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

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

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.

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, Cataudella S & Gentile de Fronza T (1973) Some remarks on the karyotype of an intergeneric hybrid, *Salmo trutta* × *Salvelinus fontinalis* (Pisces: Salmoniformes). Genetica 44, 194–206. = ref. 385.

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. http://archive.org/stream/annotatedbibliog00dang/annotatedbibliog00dang_djvu.txt 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, Kobayasi H, Maekawa K, Azuma N & Nagase T (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 *Oncorrhynus/Dalmo/Salvelnus*

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.

Rubaschev 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) Genetics 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. http://www.fishscichina.com/English/Magazine/Show.aspx?Id=4852

Scombriformes 2 suborders, 16 families

formerly part of Perciformes

Scombriformes: Scombridae 15: 51 (suborder Scombroidei)

mackerel, tuna and bonito family = Makrelen und Thunfische

2 subfamilies: Gasterochismatinae 1: 1, Scombrinae 14: 50.

Euthynnus × *Katsuwonus* Scombrinae Thunnini Silas et al. 1976

References:

Matsui Y & Ojima Y (1956) Some cytological observations on male sterility in the carp-funa hybrids. Jap. J. Ichth. 5 (1/2), 52–58. **= ref. 1083 of Schwartz 1972.**

Silas EG, Pillai PP & Muthiah C (1976) *Euthynnus* sp. nov. or an inter-generic hybrid of Tuna: an enigma. J. Marine Biol. Ass. India 18 (3), 411–420. http://eprints.cmfri.org.in/1469/1/Silas_411-420.pdf

Scorpaeniformes 30 families

Siluriformes 4 suborders, ca. 36 families, 480: 4000 + extinct taxa

4 suborders:

Cetopsoidei 1 family Cetopsidae

Diplomystoidei 1 family Diplomystidae

Loricarioidae 6 families Astroblepidae, Callichthyidae, Loricariidae, Nematogenyiidae, Scoloplacidae, Trichomycteridae

Siluroidei ca. 28 families (335: 3400) Ailiidae, Akysidae, Amblycipitidae, Amphiliidae, Anchariidae, Ariidae, Aspredinidae, Auchenipteridae, Auchenoglaniidae, Austroglanididae, Bagridae, Chacidae, Clariidae, Claroteidae, Cranoglanididae, Doradidae, Heptapteridae, Heteropneustidae, Horabagridae, Ictaluridae, Kryptoglanidae, Lacantuniidae, Malapteruridae, Mochokidae, , Pangasiidae, Phreatobilidae, Pimelodidae, Plotosidae, Pseudopimelodidae, Ritidae, Schilbeidae, Siluridae, Sisoridae.

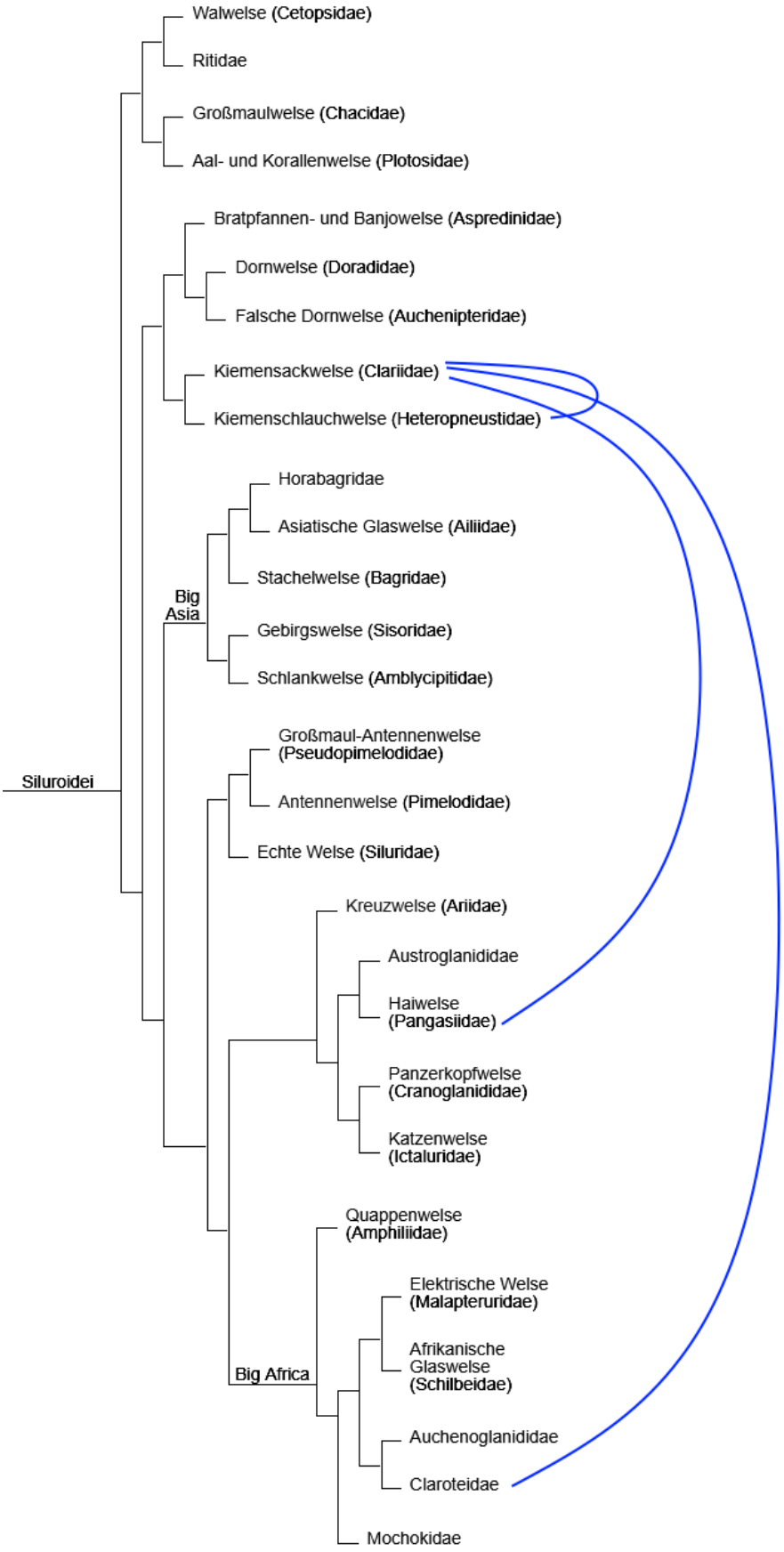
Basic type Siluriformes suborder Siluroidei (355: 3400), acccording to the hybrids below. This includes 28 families (Ryoce 1996) or alternatively 36 families (de.wikipedia 2025) with at least 2203 species (https://fishtreeoflife.org/taxonomy/suborder/Siluroidei/); if we compile the data of en.wikipedia 2025 and Schedel et al. 2022 (https://doi.org/10.1111/jfb.15014) there are only 145 genera and 624 species in Siluriformes which do not belong to Siluroidei:

Chrysichthys × *Heterobranchus* **IF** Claroteidae Claroteinae × 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



Siluroidei: Hybridization within the phylogeny according to en.wikipedia (2025, CC BY 4.0; cf. Schedel FDB et al. (2022). https://doi.org/10.1111/jfb.15014).

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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.

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

Tarnchalanukit W (1986) Experimental hybridization between catfishes of the family Clariidae and Pangasiidae in Thailand. Environ. Biol. Fishes 16, 317–320.

Siluriformes: Clariidae 14: 100 (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

References on Clariidae:

Akinwande AA, Fagbenro OA & Adebayo OT (2013) Phenotypic characterisation in interspecific and intergeneric hybrids of the clariid catfishes *Heterobranchus 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.

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.

Teugels GG (2003) *Clarias lamottei* (Siluriformes, Clariidae), a natural intergeneric hybrid from West Africa. Cybium 27 (1), 11–15. http://www.mnhn.fr/sfi/cybium/numeros/pdf/271pdf/04-Teugels147.pdf

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

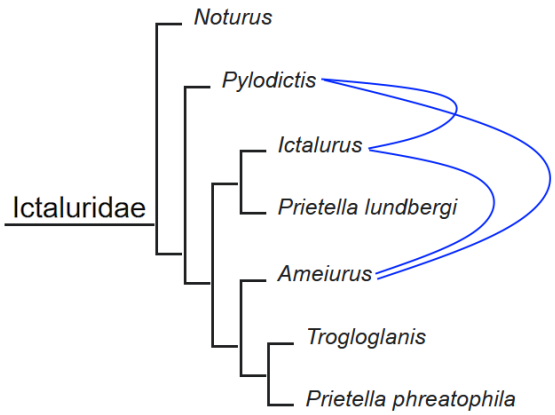
ictalurids = Katzen- und Zwergwelse

en.wikipedia 2025: no subdivision, monophyletic.

Ameiurus 7, Ictalurus 9, Noturus 29, Prietella 2, Pylodictis 1, Satan 1, Trogloglanis 1.

Schwartz 1981: *Ictalurus ca. 10 IS.*

The **family Ictaluridae** (7: 50) is probably **part** of the **basic type suborder Siluroidei**.



Ictaluridae: Hybridization within the phylogeny according to en.wikipedia (2025, CC BY 4.0; cf. Schedel FDB et al. (2022). https://doi.org/10.1111/jfb.15014). The family is obviously part of basic type suborder Siluroidei.

Ameiurus catus, melas, natalis × *Ictalurus furcatus, punctatus* Sneed 1971, Schwartz 1981 (ref. 1424), Goudie et al. 1993, Zhang & Tiersch 1997 („equal contribution to the genomes of F-1 hybrids")

Ameiurus (= *Ictalurus*°) *catus* × *Pylodictis olivaris* (nat. hyb.) Schwartz 1972 (ref. 65, 1548, 1549, 1568), Zhang & Tiersch 1997

Ictalurus punctatus × *Pylodictis olivaris* (nat. hyb.) Sneed 1971, Schwartz 1972 (ref. 65, 1276, 1548, 1549, 1568, 1680), Zhang & Tiersch 1997 („equal contribution to the genomes of F-1 hybrids")

Noturus gyrinus × *Schilbeodes*° (= *Noturus*) *miurus* **IS** Schwartz 1981 (ref. 1976)

References on Ictaluridae:

Goudie CA et al. (1993) Early growth and morphology among hybrids of ictalurid catfishes. J. Applied Aquaculture 3, 235–256.

Lutz CG (1997) What do you get when you cross. Aquaculture Magazine 23 (3) March/April, 84–90.

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Sneed KE (1971) Some current North American work in hybridization and selection of cultured fishes. http://www.fao.org/docrep/005/B3310E/B3310E00.htm#TOC 2.1 Rainbow trout breeding (Salmonidae). 3.1 Catfish hybridization (Ictaluridae).
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.

Siluriformes: Pimelodidae 30: 90 (suborder Siluroideae)

long-whiskered catfishes = Antennenwelse

Leiarius marmoratus × *Pseudoplatystoma reticulatum* Coelho et al. 2021

References on Pimeloideae:

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.

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Appendix: Reported interordinal fish hybrids (132 intergeneric combinations)

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

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 Malacanthidae × Gobiiformes Oxudercidae Schwartz 1972 (ref. 739 = Hubbs 1967)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Stenotomus × *Tautogolabrus* **IO** Acanthuriformes Sparidae × Labriformes Labridae Schwartz 1972 (ref. 744, 1203 = Newman 1915 (None of the ... embryos ... had successfully closed the blastopore although considerable embryonic development had taken place.))

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

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

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

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

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

Acerina: see *Gymnocephalus*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Ctenolabrus × *Fundulus* **IO** Labriformes Labridae × Cyprinodontiformes Fundulidae

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Fundulus × *Morone americana* **IO** Cyprinodontiformes Fundulidae × Perciformes

Moronidae Schwartz 1972 (ref. 1203 = Newman 1915)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Gasterosteus aculeatus × *Menidia* **IO** Perciformes Gasterosteidae × Atheriniformes Atherinopsidae Schwartz 1972 (ref. 740a = Hubbs 1970; 1154 = Moenkhaus 1911 („The eggs of this stickleback are practically all impregnated when placed with *Menidia* sperm. In the two experiments tried, 100 per cent, and 70 per cent, were fertilized. A small per cent, of these are polyspermic. The development keeps well apace with the normals until toward the closure of the blastopore. The embryo is laid down, the eyes are formed, but the anterior region of body is quite heavy. Pigment forms and the heart is developed. I have never seen fins form in these hybrids. The embryos soon die, owing possibly to the fact that the eggs even normally do not do well in a fingerbowl of water."); ref. 1203 = Newman 1915)

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

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

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

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

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

Gobio × *Thallassoma pavo* **IO** Cypriniformes Cyprinidae × 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)

Menidia audens × *Notemigonus chrysoleucas* **IO** Atheriniformes Atherinopsidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Menidia audens × *Notropis cornutus* **IO** Atheriniformes Atherinopsidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 740a)

Menidia notata × *Opsanus tau* **IO** Atheriniformes Atherinidae × Batrachoidiformes Batrachoididae Schwartz 1972 (ref. 1154 = Moenkhaus 1911)

Menidia menidia × *Peprilus* (= *Poronotus*°) *triacanthus* **IO** Atheriniformes Atherinopsidae × Scombriformes Stromateidae Schwartz 1972 (ref. 1203 = Newman 1915)

Menidia audens × *Percina caprodes* **IO** Atheriniformes Atherinopsidae × Perciformes Percidae Schwartz 1972 (ref. 740a = Hubbs 1970)

Menidia × *Prionotus* Atheriniformes Atherinopsidae × Scorpaeniformes Triglidae **IO** Schwartz 1981 (ref. 691 = Hubbs 1936; 1347 = Pinney 1928 (mitosis abnormal, no embryos); ref. 1514)

Menidia menidia × *Scomber scombrus* **IO** Atheriniformes Atherinopsidae × Scombriformes Scombridae Schwartz 1972 (ref. 1203 = Newman 1915 = Newman 1915)

Menidia menidia × *Tautoga onitis* **IO** Atheriniformes Atherinopsidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911; 1203 = Newman 1915)

Menidia menidia × *Tautogalabrus adspersus* **IO** Atheriniformes Atherinopsidae × Labriformes Labridae Schwartz 1972 (ref. 1154 = Moenkhaus 1911, ref. 1203 = Newman 1915), Schwartz 1981 (ref. 1431 = Serchuk & Frame 1973)

Menidia menidia × *Stenotomus chrysops* **IO** Atheriniformes Atherinopsidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Misgurnus anguillicaudatus × *Oryzias latipes* **IO** Cypriniformes Cobitidae × Beloniformes Adrianichthyidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

Oncorhynchus gorbuscha × *Pterolamiops*° (= *Carcharhinus*) *longimanus* **IO/IC** Salmoniformes Salmonidae × Carcharhiniformes Carcharhinidae Schwartz 1981 (ref. 1064 = DNA-hybridization)

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

Peprilus (*Poronotus*°) *triacanthus* × *Stenotomus chrysops* **IO** Scombriformes Stromateidae × Acanthuriformes Sparidae Schwartz 1972 (ref. 1203 = Newman 1915)

Perca fluviatilis × *Rutilus rutilus* **IO** Perciformes Percidae × Cypriniformes Cyprinidae Schwartz 1972 (ref. 946, 950 = Kryzanovski 1968)

Perca flavescens × *Salmo gairdneri* **IO** Perciformes Percidae × Salmoniformes Salmonidae Schwartz 1981 (ref. 1065 = Meehan 1898)

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

Sander (= *Stizostedion*°) *vitreus* × *Xiphophorus* (= *Platypoecilus*°) *helleri* **IO** Perciformes Percidae × Cyprinodontiformes Poeciliidae Schwartz 1981 (ref. 767 = Hubbs 1971b)

Tribolodon hakonensis × *Salmo gairdneri* **IO** Cypriniformes Cyprinidae × Salmoniformes Salmonidae Schwartz 1972 (ref. 1636 = Suzuki 1968)

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