

SUPPLEMENTARY MATERIAL

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The status of COI and 12S rRNA DNA barcode reference libraries for freshwater fish in South Africa: Implications for future eDNA projects

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Supplementary Table S1: List of the 106 native South African freshwater fish species used in this study (Sources: Skelton et al. (2001), Chakona et al. (2022), and FishBase (Froese and Pauly 2023))

Family	Genus	Species	Common name
Alestidae	<i>Brycinus</i>	<i>imberi</i> ^{ab}	Imberi
	<i>Brycinus</i>	<i>lateralis</i> ^a	Striped Robber
	<i>Hydrocynus</i>	<i>vittatus</i> ^{ab}	Tigerfish
	<i>Micralestes</i>	<i>acutidens</i> ^{ab}	Silver Robber
Amphiliidae	<i>Amphilius</i>	<i>engelbrechti</i> ^a	Inkomati Mountain Catfish
	<i>Amphilius</i>	<i>natalensis</i> s.s. ^{ab}	Natal Mountain Catfish
	<i>Amphilius</i>	<i>zuluorum</i> ^a	Mkhomazi Mountain Catfish
	<i>Amphilius</i>	<i>uranoscopus</i> ^a	Stargazer Mountain Catfish
Anabantidae	<i>Ctenopoma</i>	<i>multispine</i> *	Manyspined Climbing Perch
	<i>Microctenopoma</i>	<i>intermedium</i> *	Swartkol-Kurper
	<i>Sandelia</i>	<i>bainsii</i> *	Eastern Cape Rocky
	<i>Sandelia</i>	<i>capensis</i> ^{ab}	Cape Kurper
Austroglanididae	<i>Austroglanis</i>	<i>barnardi</i> ^{ab}	Barnard's Rock Catfish
	<i>Austroglanis</i>	<i>gilli</i> ^{ab}	Clanwilliam Rock-Catfish
	<i>Austroglanis</i>	<i>sclateri</i> ^b	Rock-Catfish
Cichlidae	<i>Chetia</i>	<i>brevis</i> *	Orange-Fringed Largemouth
	<i>Chetia</i>	<i>flaviventris</i> ^a	Canary Kurper
	<i>Coptodon</i>	<i>rendalli</i> ^{ab}	Redbreast Tilapia
	<i>Oreochromis</i>	<i>mossambicus</i> ^{ab}	Mozambique Tilapia
	<i>Oreochromis</i>	<i>placidus</i> ^a	Black Tilapia
	<i>Pseudocrenilabrus</i>	<i>philander</i> ^{ab}	Southern Mouthbrooder
	<i>Serranochromis</i>	<i>meridianus</i> *	Lowveld Largemouth
	<i>Tilapia</i>	<i>sparrmanii</i> ^{ab}	Banded Tilapia
Clariidae	<i>Clarias</i>	<i>garipepinus</i> ^{ab}	Sharptooth Catfish
	<i>Clarias</i>	<i>ngamensis</i> ^a	Blunttooth Catfish
	<i>Clarias</i>	<i>theodora</i> ^{ab}	Snake Catfish
Cyprinidae	<i>Amatolacypris</i>	<i>trevelyani</i> *	Border Barb
	<i>Cheilobarbus</i>	<i>capensis</i> *	Cape Whitefish
	<i>Cheilobarbus</i>	<i>serra</i> ^a	Sawfin
	<i>Enteromius</i>	<i>afrohamiltoni</i> ^a	Hamilton's Barb
	<i>Enteromius</i>	<i>amatolicus</i> *	Amatola Barb

	<i>Enteromius</i>	<i>annectens</i> *	Broadstriped Barb
	<i>Enteromius</i>	<i>anoplus</i> s.s. ^a	Chubbyhead Barb
	<i>Enteromius</i>	<i>argenteus</i> ^a	Rosefin Barb
	<i>Enteromius</i>	<i>bifrenatus</i> ^a	Hyphen Barb
	<i>Enteromius</i>	<i>brevipinnis</i> ^a	Shortfin Barb
	<i>Enteromius</i>	<i>cernuus</i> *	
	<i>Enteromius</i>	<i>eutaenia</i> ^{ab}	Orangefin Barb
	<i>Enteromius</i>	<i>gurneyi</i> *	Redtail Barb
	<i>Enteromius</i>	<i>lineomaculatus</i> ^a	Line-Spotted Barb
	<i>Enteromius</i>	<i>mandelai</i> *	Eastern Chubbyhead Barb
	<i>Enteromius</i>	<i>mattozi</i> ^a	Papermouth
	<i>Enteromius</i>	<i>motebensis</i> ^a	Marico Barb
	<i>Enteromius</i>	<i>oraniensis</i> *	Gariep Chubbyhead Barb
	<i>Enteromius</i>	<i>pallidus</i> ss ^a	Goldie Barb
	<i>Enteromius</i>	<i>paludinosus</i> ^a	Straightfin Barb
	<i>Enteromius</i>	<i>radiatus</i> ^a	Beira Barb
	<i>Enteromius</i>	<i>toppini</i> *	East Coast Barb
	<i>Enteromius</i>	<i>treurensis</i> ^a	Treur River Barb
	<i>Enteromius</i>	<i>trimaculatus</i> ^{ab}	Threespot Barb
	<i>Enteromius</i>	<i>unitaeniatus</i> ^a	Longbeard Barb
	<i>Enteromius</i>	<i>viviparus</i> ^a	Bowstripe Barb
	<i>Labeo</i>	<i>capensis</i> ^a	Orange River Labeo
	<i>Labeo</i>	<i>congoro</i> ^b	Purple Labeo
	<i>Labeo</i>	<i>cylindricus</i> ^{ab}	Redeye Labeo
	<i>Labeo</i>	<i>molybdinus</i> ^a	Leaden Labeo
	<i>Labeo</i>	<i>rosae</i> *	Rednose Labeo
	<i>Labeo</i>	<i>rubromaculatus</i> *	Tugela Labeo
	<i>Labeo</i>	<i>ruddi</i> ^a	Silver Labeo
	<i>Labeo</i>	<i>seeberi</i> *	Clanwilliam Sandfish
	<i>Labeo</i>	<i>umbratus</i> *	Moggel
	<i>Labeobarbus</i>	<i>aeneus</i> *	Smallmouth Yellowfish
	<i>Labeobarbus</i>	<i>kimberleyensis</i> *	Largemouth Yellowfish
	<i>Labeobarbus</i>	<i>marequensis</i> ^a	Largescale Yellowfish
	<i>Labeobarbus</i>	<i>natalensis</i> ^a	Scaly
	<i>Labeobarbus</i>	<i>nelspruitensis</i> ^a	Incomati Chiselmouth
	<i>Labeobarbus</i>	<i>polylepis</i> ^a	Smallscale Yellowfish
	<i>Labeobarbus</i>	<i>seeberi</i> ^a	Clanwilliam Yellowfish
	<i>Namaquacypris</i>	<i>hospes</i> *	Namaqua Barb
	<i>Pseudobarbus</i>	<i>afer</i> *	Eastern Cape Redfin
	<i>Pseudobarbus</i>	<i>asper</i> *	Smallscale Redfin
	<i>Pseudobarbus</i>	<i>burchelli</i> ^a	Burchell's Redfin
	<i>Pseudobarbus</i>	<i>burgi</i> ^a	Berg River Redfin
	<i>Pseudobarbus</i>	<i>phlegethon</i> *	Fiery Redfin
	<i>Pseudobarbus</i>	<i>quathlambae</i> *	Drakensberg Minnow
	<i>Pseudobarbus</i>	<i>senticeps</i> *	
	<i>Pseudobarbus</i>	<i>skeltoni</i> *	Giant Redfin
	<i>Pseudobarbus</i>	<i>swartzi</i> ^a	Gamtoos Redfin
	<i>Pseudobarbus</i>	<i>tenuis</i> *	Slender Redfin
	<i>Pseudobarbus</i>	<i>verloreni</i> *	Verlorenvlei Redfin
	<i>Sedercypris</i>	<i>calidus</i> ^a	Clanwilliam Redfin
	<i>Sedercypris</i>	<i>erubescens</i> ^a	Twee River Redfin
	<i>Engraulicypris</i>	<i>brevianalis</i> ^a	River Sardine

	<i>Engraulicypris</i>	<i>gariepinus</i> *	
	<i>Opsaridium</i>	<i>peringueyi</i> ^a	Southern Barred Minnow
Galaxiidae	<i>Galaxias</i>	<i>zebratus</i> ^a	Cape Galaxias
Gobiidae	<i>Glossogobius</i>	<i>callidus</i> ^a	River Goby
	<i>Silhouettea</i>	<i>sibayi</i> *	Sibayi Goby
Kneriidae	<i>Kneria</i>	<i>auriculata</i> ^a	Southern Kneria
Mochokidae	<i>Chiloglanis</i>	<i>anoterus</i> ^a	Pennant Tail Suckermouth
	<i>Chiloglanis</i>	<i>bifurcus</i> ^a	Incomati Suckermouth
	<i>Chiloglanis</i>	<i>emarginatus</i> ^a	Pongolo Suckermouth
	<i>Chiloglanis</i>	<i>paratus</i> *	Sawfin Suckermouth
	<i>Chiloglanis</i>	<i>pretoriae</i> ^a	Shortspine Suckermouth
	<i>Chiloglanis</i>	<i>swierstrai</i> ^a	Lowveld Suckermouth
	<i>Synodontis</i>	<i>zambezensis</i> ^a	Brown Squeaker
Mormyridae	<i>Marcusenius</i>	<i>caudisquamatus</i> ^a	Mhlatuze Mormyrid
	<i>Marcusenius</i>	<i>krameri</i> ^a	Kramer's Mormyrid
	<i>Marcusenius</i>	<i>pongolensis</i> ^a	Southern Bulldog
	<i>Petrocephalus</i>	<i>wesselsi</i> ^a	Southern Churchill
Nothobranchiidae	<i>Nothobranchius</i>	<i>orthonotus</i> ^a	Spotted Killifish
Procatopodidae	<i>Lacustricola</i>	<i>johnstoni</i> ^a	Johnston's Topminnow
	<i>Lacustricola</i>	<i>katangae</i> ^a	Striped Topminnow
	<i>Lacustricola</i>	<i>myaposaе</i> ^a	Natal Topminnow
Protopteridae	<i>Protopterus</i>	<i>annectens brieni</i> ^{ab}	Lungfish
Schilbeidae	<i>Schilbe</i>	<i>depressirostris</i> ^{ab}	Silver Catfish

^{ab}Native South African freshwater fish with COI and 12S rRNA records

^aNative South African freshwater fish with only COI records

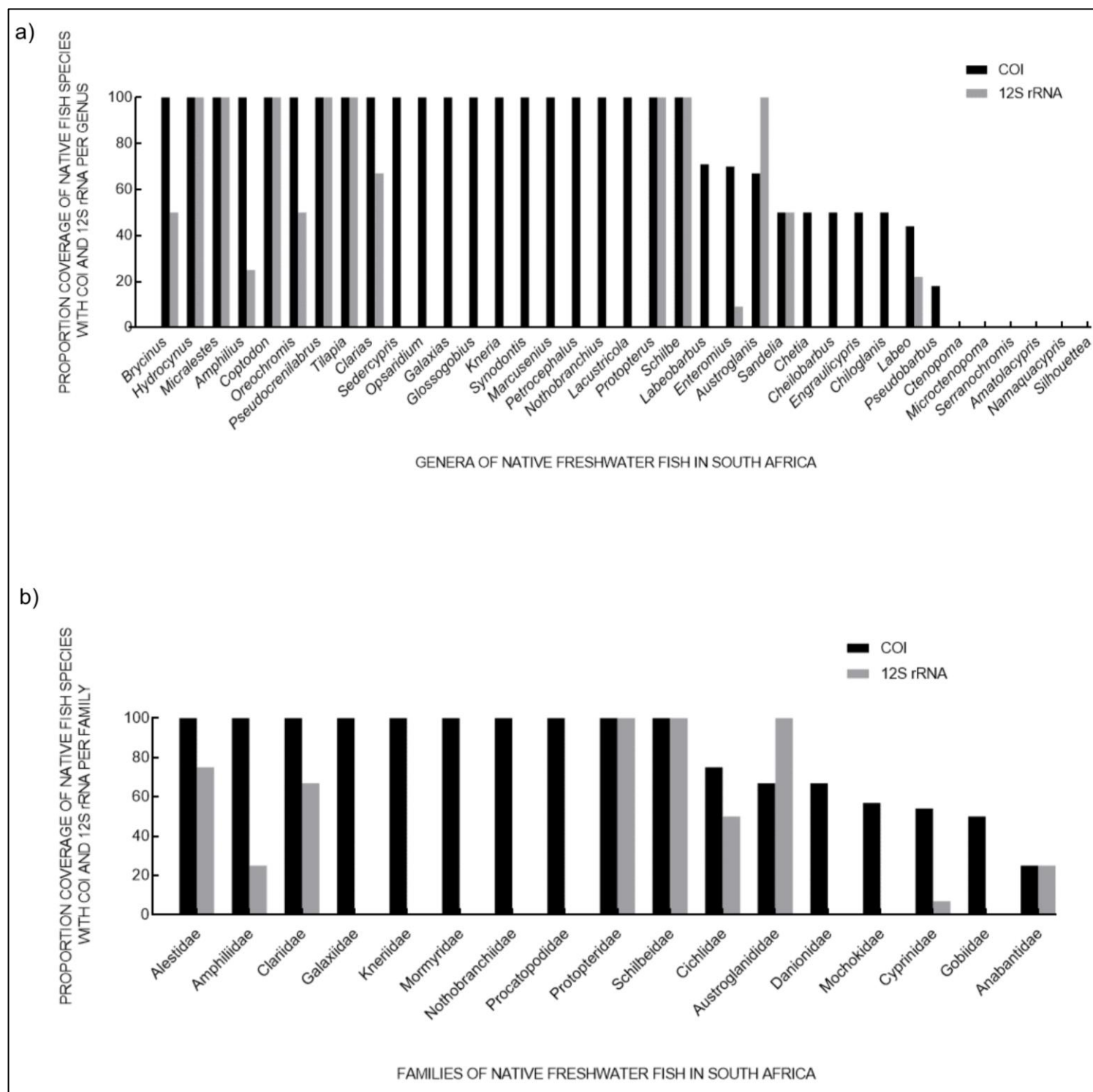
^bNative South African freshwater fish with only 12S rRNA records

*Native South African freshwater fish without COI or 12S rRNA records

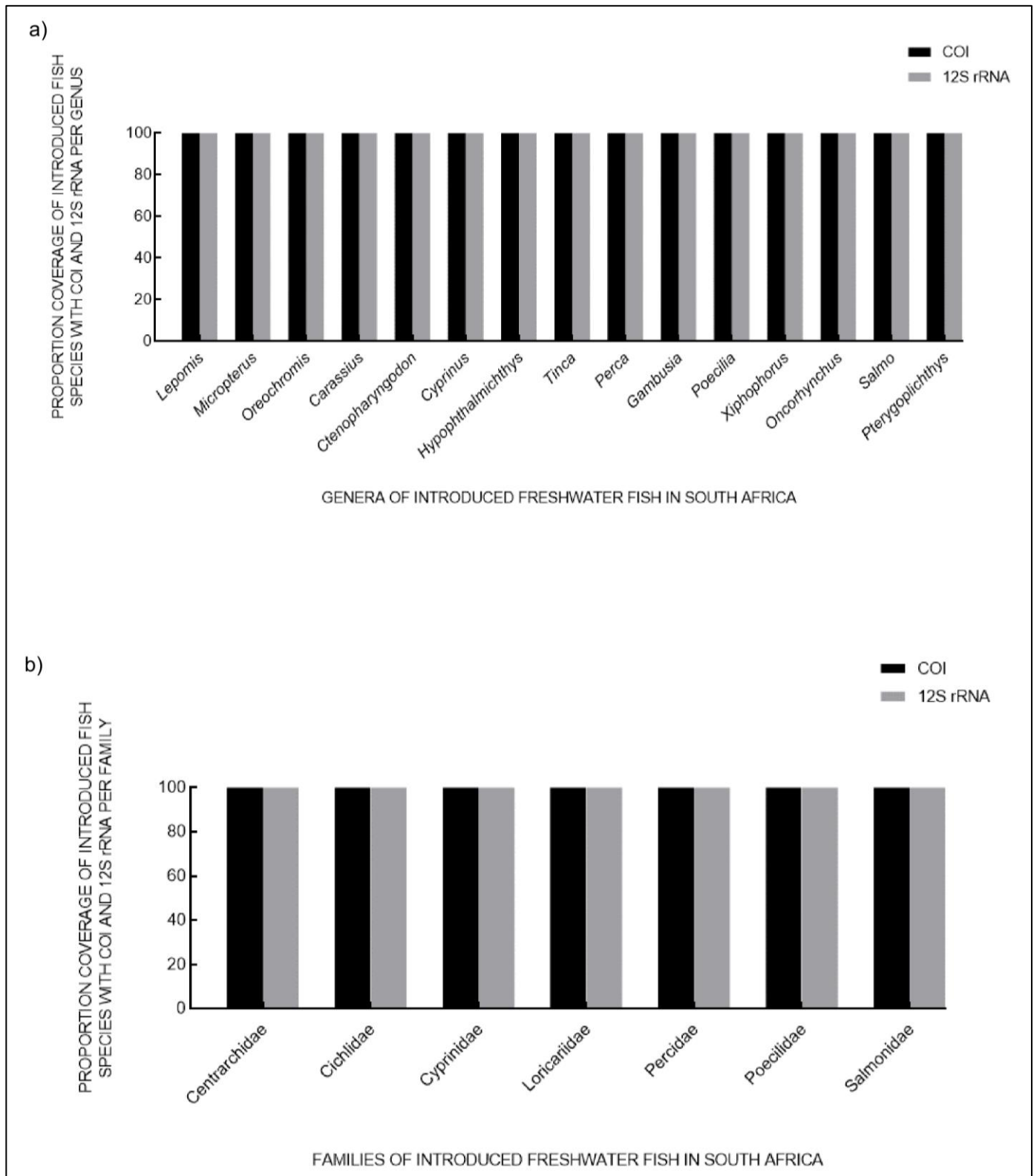
Supplementary Table S2: List of 20 introduced freshwater fish species found in South Africa (Sources: Weyl et al. 2020 and FishBase (Froese and Pauly 2023))

Family	Genus	Species	Common name
Centrarchidae	<i>Lepomis</i>	<i>macrochirus</i> ^{ab}	Bluegill
	<i>Micropterus</i>	<i>dolomieu</i> ^{ab}	Smallmouth Bass
	<i>Micropterus</i>	<i>floridanus</i> ^{ab}	Florida Bass
	<i>Micropterus</i>	<i>punctulatus</i> ^{ab}	Spotted Bass
	<i>Micropterus</i>	<i>salmoides</i> ^{ab}	Largemouth Bass
Cichlidae	<i>Oreochromis</i>	<i>aureus</i> ^{ab}	Blue Tilapia
	<i>Oreochromis</i>	<i>niloticus</i> ^{ab}	Nile Tilapia
Cyprinidae	<i>Carassius</i>	<i>auratus</i> ^{ab}	Goldfish
	<i>Ctenopharyngodon</i>	<i>idella</i> ^{ab}	GrassCarp
	<i>Cyprinus</i>	<i>carpio</i> ^{ab}	Common Carp
	<i>Hypophthalmichthys</i>	<i>molitrix</i> ^{ab}	Silver Carp
	<i>Tinca</i>	<i>tinca</i> ^{ab}	Tench
Loricariidae	<i>Pterygoplichthys</i>	<i>disjunctivus</i> ^{ab}	Vermiculated Sailfin Catfish
Percidae	<i>Perca</i>	<i>fluviatilis</i> ^{ab}	European Perch
Poeciliidae	<i>Gambusia</i>	<i>affinis</i> ^{ab}	Western Mosquitofish
	<i>Poecilia</i>	<i>reticulata</i> ^{ab}	Guppy
	<i>Xiphophorus</i>	<i>hellerii</i> ^{ab}	Green Swordtail
	<i>Xiphophorus</i>	<i>maculatus</i> ^{ab}	Southern Platyfish
Salmonidae	<i>Oncorhynchus</i>	<i>mykiss</i> ^{ab}	Rainbow Trout
	<i>Salmo</i>	<i>trutta</i> ^{ab}	Brown Trout

^{ab}Introduced freshwater fish in South Africa with both COI and 12S rRNA records



Supplementary Figure S1: Proportion coverage of South African native fish with a) COI and 12S rRNA records per genus and b) COI and 12S rRNA records per family. Percentage coverage was calculated as the percentage of species per genus or family with records. This considers the size of each genus or family



Supplementary Figure S2: Proportion coverage of introduced fish with a) COI and 12S rRNA records per genus and b) COI and 12S rRNA records per family. Percentage coverage was calculated as the percentage of species per genus or family with records. This considers the size of each genus or family