iScience, Volume *23*

Supplemental Information

Investigating Diadromy in Fishes and Its Loss in an -Omics Era

M. Lisette Delgado and Daniel E. Ruzzante

Table S1. List of known diadromous species. Related to Table 1.

Species	Family	Category	Little information available (e.g. no microchemistry analysis)	References	Resident populations
Acipenser baerii	Acipenseridae	anadromous		(Rodríguez et al., 2002)	yes
Acipenser brevirostrum	Acipenseridae	anadromous		(Kynard, 1997)	
Acipenser dabryanus	Acipenseridae	anadromous		(Kynard et al., 2003)	
Acipenser gueldenstaedtii	Acipenseridae	semi-anadromous		(Arai and Miyazaki, 2001)	yes
Acipenser medirostris	Acipenseridae	anadromous		(Allen et al., 2009)	
Acipenser mikadoi	Acipenseridae	anadromous		(Koshelev et al., 2012)	
Acipenser naccarii	Acipenseridae	semi-anadromous		(Martínez-Álvarez et al., 2005)	
Acipenser nudiventris	Acipenseridae	anadromous		(Acolas and Lambert, 2016)	
Acipenser oxyrinchus	Acipenseridae	anadromous		(Allen et al., 2014)	
Acipenser persicus	Acipenseridae	anadromous		(Acolas and Lambert, 2016)	
Acipenser schrenckii	Acipenseridae	anadromous		(Koshelev et al., 2014)	
Acipenser sinensis	Acipenseridae	anadromous		(Zhuang et al., 2002)	
Acipenser stellatus	Acipenseridae	anadromous		(Honţ et al., 2019)	
Acipenser sturio	Acipenseridae	anadromous		(Acolas et al., 2012)	
Acipenser transmontanus	Acipenseridae	anadromous		(McEnroe and Cech, 1985)	
Huso dauricus	Acipenseridae	anadromous		(Koshelev et al., 2014)	
Huso huso	Acipenseridae	anadromous		(Honţ et al., 2019)	
Scaphirhynchus suttkusi	Acipenseridae	anadromous		(Acolas and Lambert, 2016)	
Arius madagascariensis	Ariidae	anadromous	X	(Acolas and Lambert, 2016; Milton, 2009)	
Genidens barbus	Ariidae	anadromous		(Avigliano et al., 2017)	yes
Neoarius graeffei	Ariidae	anadromous	X	(Milton, 2009)	
Atherinella chagresi	Atherinopsidae	anadromous	X	(Milton, 2009)	
Atherinella guatemalensis	Atherinopsidae	anadromous	X	(Milton, 2009)	
Mystus gulio	Bagridae	anadromous	X	(Acolas and Lambert, 2016; Bijoy Nandan et al., 2012)	
Citharinus citharus	Citharinidae	anadromous	X	(Riede, 2004)	
Citharinus eburneensis	Citharinidae	anadromous	X	(Acolas and Lambert, 2016)	
Clarotes laticeps	Claroteidae	anadromous	X	(Acolas and Lambert, 2016)	
Alosa aestivalis	Clupeidae	anadromous		(Limburg, 2001)	yes
Alosa alabamae	Clupeidae	anadromous		(Schaffler et al., 2015)	
Alosa alosa	Clupeidae	anadromous		(Baglinière et al., 2003)	yes

Alosa fallax	Clupeidae	anadromous		(Aprahamian et al., 2003)	
Alosa immaculata	Clupeidae	anadromous		(Acolas and Lambert, 2016)	
Alosa kessleri	Clupeidae	anadromous		(Kuzishchin et al., 2020)	
Alosa mediocris	Clupeidae	anadromous		(McBride and Holder, 2008)	
Alosa pseudoharengus	Clupeidae	anadromous		(Walters et al., 2009)	
Alosa sapidissima	Clupeidae	anadromous		(McBride and Holder, 2008)	
Alosa tanaica	Clupeidae	anadromous		(Acolas and Lambert, 2016)	
Alosa volgensis	Clupeidae	anadromous		(Acolas and Lambert, 2016)	
Anodontostoma chacunda	Clupeidae	anadromous	X	(Milton, 2009)	
Anodontostoma thailandiae	Clupeidae	anadromous	X	(Acolas and Lambert, 2016; Milton, 2009)	
Clupanodon thrissa	Clupeidae	anadromous	X	(Riede, 2004)	
Clupeonella cultriventris	Clupeidae	anadromous		(Bloom and Lovejoy, 2014)	
Dorosoma cepedianum	Clupeidae	anadromous	X	(Acolas and Lambert, 2016)	
Dorosoma petenense	Clupeidae	anadromous	X	(Acolas and Lambert, 2016)	
Herklotsichthys gotoi	Clupeidae	anadromous	X	(Milton, 2009)	
Hilsa kelee	Clupeidae	anadromous	X	(Milton, 2009)	
Nematalosa galatheae	Clupeidae	anadromous	X	(Acolas and Lambert, 2016; Milton, 2009)	
Nematalosa nasus	Clupeidae	anadromous	X	(Acolas and Lambert, 2016; Milton, 2009)	
Pellonula leonensis	Clupeidae	anadromous	X	(Milton, 2009)	
Pellonula vorax	Clupeidae	anadromous	X	(Acolas and Lambert, 2016; Milton, 2009)	
Tenualosa ilisha	Clupeidae	anadromous		(Arai et al., 2019)	yes
Tenualosa reevesii	Clupeidae	anadromous		(Blaber et al., 2003)	
Tenualosa toli	Clupeidae	anadromous		(Milton et al., 1997)	
Leuciscus idus	Cyprinidae	semi-anadromous		(Skovrind et al., 2016)	yes
Pelecus cultratus	Cyprinidae	anadromous		(Acolas and Lambert, 2016)	
Rutilus frisii	Cyprinidae	anadromous		(Kohestan-Eskandari et al., 2014)	
Tribolodon brandtii	Cyprinidae	anadromous		(Sakai and Imai, 2005)	
Tribolodon hakonensis	Cyprinidae	anadromous		(Sakai et al., 2002)	yes
Vimba vimba	Cyprinidae	anadromous		(Łuszczek-Trojnar et al., 2008)	
Elops hawaiensis	Elopidae	anadromous	X	(Milton, 2009)	
Anchoviella lepidentostole	Engraulidae	anadromous		(Milton, 2009)	
Colia ectenes	Engraulidae	anadromous		(Duan et al., 2012)	
Coilia nasus	Engraulidae	anadromous		(Dou et al., 2012)	yes
Lycengraulis grossidens	Engraulidae	anadromous		(Mai and Vieira, 2013)	
Stolephorus commersonnii	Engraulidae	anadromous	X	(Bijoy Nandan et al., 2012)	

Microgadus tomcod	Gadidae	anadromous		(Couillard et al., 2011)	
Lovettia sealii	Galaxiidae	semi-anadromous		(Schmidt et al., 2014)	
Gasterosteus aculeatus	Gasterosteidae	anadromous		(Arai et al., 2003)	yes
Pungitius pungitius	Gasterosteidae	anadromous		(Arai and Goto, 2008)	yes
Geotria australis	Geotriidae	anadromous		(Miles et al., 2014)	
Leucopsarion petersii	Gobiidae	anadromous		(Kokita and Nohara, 2011)	
Luciogobius guttatus	Gobiidae	anadromous		(Miyazaki and Terui, 2016; Riede, 2004)	
Lota lota	Lotidae	anadromous	X	(Rohtla et al., 2014)	yes
Mordacia lapicida	Mordaciidae	anadromous	X	(McDowall, 1999)	
Mordacia mordax	Mordaciidae	anadromous		(Miles et al., 2014)	
Morone americana	Moronidae	anadromous		(Acolas and Lambert, 2016)	
Morone saxatilis	Moronidae	anadromous		(Secor et al., 1995)	yes
Rhinomugil corsula	Mugilidae	anadromous	X	(Acolas and Lambert, 2016)	
Pisodonophis boro	Ophichthidae	anadromous	X	(Acolas and Lambert, 2016)	
Hypomesus japonicus	Osmeridae	anadromous		(Dodson et al., 2009)	
Hypomesus nipponensis	Osmeridae	anadromous		(Katayama et al., 2000)	yes
Hypomesus olidus	Osmeridae	anadromous		(Acolas and Lambert, 2016)	yes
Hypomesus transpacificus	Osmeridae	anadromous		(Acolas and Lambert, 2016)	
Osmerus dentex	Osmeridae	anadromous		(Dodson et al., 2009)	
Osmerus eperlanus	Osmeridae	anadromous		(Lyle and Maitland, 1997)	
Osmerus mordax	Osmeridae	anadromous		(Bradbury et al., 2008)	yes
Spirinchus lanceolatus	Osmeridae	anadromous		(Yatsuyanagi et al., 2020)	
Spirinchus thaleichthys	Osmeridae	anadromous		(Acolas and Lambert, 2016)	yes
Thaleichthys pacificus	Osmeridae	anadromous		(Clarke et al., 2007)	
Pangasius krempfi	Pangasiidae	anadromous		(Hogan et al., 2007)	
Perca fluviatilis	Percidae	semi-anadromous		(Nesbø et al., 1998)	yes
Caspiomyzon wagneri	Petromyzontidae	anadromous		(Mark Shrimpton, 2012)	
Entosphenus tridentatus	Petromyzontidae	anadromous		(Clemens et al., 2013)	
Lampetra ayresii	Petromyzontidae	anadromous		(Acolas and Lambert, 2016)	
Lampetra fluviatilis	Petromyzontidae	anadromous		(Morris and Pickering, 1976)	
Lampetra tridentata	Petromyzontidae	anadromous		(Beamish and Levings, 1991)	
Lethenteron camtschaticum	Petromyzontidae	anadromous		(Acolas and Lambert, 2016)	yes
Lethenteron reissneri	Petromyzontidae	anadromous		(Acolas and Lambert, 2016)	
Petromyzon marinus	Petromyzontidae	anadromous		(Waldman et al., 2008)	
Ilisha filigera	Pristigasteridae	anadromous	X	(Milton, 2009)	

Ilisha megaloptera	Pristigasteridae	anadromous	X	(Milton, 2009)	
Ilisha sirishai	Pristigasteridae	anadromous	X	(Milton, 2009)	
Pellona ditchela	Pristigasteridae	anadromous	X	(Milton, 2009)	
Retropinna tasmanica	Retropinnidae	anadromous	X	(Miles et al., 2014)	
Hemisalanx prognathus	Salangidae	anadromous		(Zhang et al., 2007)	
Neosalanx jordani	Salangidae	anadromous		(Dodson et al., 2009)	
Neosalanx reganius	Salangidae	anadromous		(Acolas and Lambert, 2016)	
Salangichthys microdon	Salangidae	anadromous		(Yamaguchi et al., 2004)	yes
Salanx ariakensis	Salangidae	anadromous		(Shiao et al., 2016)	yes
Salanx cuvieri	Salangidae	anadromous		(Dodson et al., 2009; Riede, 2004)	
Brachymystax lenok	Salmonidae	anadromous	X	(Riede, 2004)	
Coregonus albula	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus artedii	Salmonidae	anadromous		(Morin et al., 1982)	
Coregonus autumnalis	Salmonidae	anadromous		(Wilson, 1984)	
Coregonus clupeaformis	Salmonidae	anadromous		(Morin et al., 1982)	
Coregonus huntsmani	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus laurettae	Salmonidae	anadromous		(Brown et al., 2008)	
Coregonus lavaretus	Salmonidae	anadromous		(Lehtonen et al., 1992)	
Coregonus muksun	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus nasus	Salmonidae	anadromous		(Brown et al., 2008)	yes
Coregonus oxyrinchus	Salmonidae	anadromous		(Borcherding et al., 2014)	
Coregonus pallasii	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus peled	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus pidschian	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Coregonus sardinella	Salmonidae	anadromous		(Brown et al., 2008)	
Hucho perryi	Salmonidae	anadromous		(Edo et al., 2005)	
Oncorhynchus clarkii	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Oncorhynchus gorbuscha	Salmonidae	anadromous		(Gallagher et al., 2013)	
Oncorhynchus keta	Salmonidae	anadromous		(Wood and Foote, 1996)	yes
Oncorhynchus kisutch	Salmonidae	anadromous		(Dodson et al., 2013)	
Oncorhynchus masou	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Oncorhynchus mykiss	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Oncorhynchus nerka	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Oncorhynchus tshawytscha	Salmonidae	anadromous		(Dodson et al., 2013)	
Salmo labrax	Salmonidae	anadromous		(Acolas and Lambert, 2016)	

Salmo marmoratus	Salmonidae	anadromous		(Acolas and Lambert, 2016)	
Salmo salar	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Salmo trutta	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Salvelinus alpinus	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Salvelinus confluentus	Salmonidae	anadromous		(Austin et al., 2019; Dodson et al., 2013)	yes
Salvelinus fontinalis	Salmonidae	anadromous		(Dodson et al., 2013)	yes
Salvelinus leucomaenis	Salmonidae	anadromous		(Dodson et al., 2013)	
Salvelinus malma	Salmonidae	anadromous		(Dodson et al., 2013)	
Salvelinus namaycush	Salmonidae	semi-anadromous		(Kissinger et al., 2016)	yes
Stenodus leucichthys	Salmonidae	anadromous		(Brown et al., 2008)	
Takifugu obscurus	Tetraodontidae	anadromous		(Jeong et al., 2014)	yes
Takifugu ocellatus	Tetraodontidae	anadromous		(Yang and Chen, 2008)	
Ambassis interrupta	Ambassidae	catadromous	X	(Milton, 2009)	
Anguilla anguilla	Anguillidae	catadromous		(Arai et al., 2006)	yes
Anguilla australis	Anguillidae	catadromous		(Miles et al., 2014)	
Anguilla bengalensis	Anguillidae	catadromous		(Bijoy Nandan et al., 2012; Milton, 2009)	
Anguilla bicolor	Anguillidae	catadromous		(Arai and Chino, 2019)	yes
Anguilla celebesensis	Anguillidae	catadromous		(Milton, 2009)	
Anguilla dieffenbachii	Anguillidae	catadromous		(Arai et al., 2003)	
Anguilla interioris	Anguillidae	catadromous		(Arai and Chino, 2012)	
Anguilla japonica	Anguillidae	catadromous		(Tsukamoto and Arai, 2001)	yes
Anguilla malgumora	Anguillidae	catadromous		(Arai and Chino, 2012)	
Anguilla marmorata	Anguillidae	catadromous		(Arai et al., 2013)	yes
Anguilla megastoma	Anguillidae	catadromous		(Arai and Chino, 2012)	
Anguilla mossambica	Anguillidae	catadromous		(Whitfield, 2005)	
Anguilla nebulosa	Anguillidae	catadromous		(Arai and Chino, 2012)	
Anguilla obscura	Anguillidae	catadromous		(Miles et al., 2014)	
Anguilla rheinhardtii	Anguillidae	catadromous		(Miles et al., 2014)	
Anguilla rostrata	Anguillidae	catadromous		(Jessop et al., 2007)	yes
Centropomus undecimalis	Centropomidae	catadromous		(Lowerre-Barbieri et al., 2014)	
Centropomus pectinatus	Centropomidae	catadromous	X	(Milton, 2009)	
Ethmalosa fimbriata	Clupeidae	catadromous		(Bloom and Lovejoy, 2014)	
Potamalosa richmondia	Clupeidae	catadromous		(Miles et al., 2014)	
Cottus kazika	Cottidae	catadromous		(Augspurger et al., 2017)	
Trachidermus fasciatus	Cottidae	catadromous	X	(Milton, 2009)	

Eleotris annobonensis	Eleotridae	catadromous	X	(Milton, 2009)	
Eleotris balia	Eleotridae	catadromous	X	(Milton, 2009)	
Eleotris pisonis	Eleotridae	catadromous	X	(Milton, 2009)	
Eleotris senegalensis	Eleotridae	catadromous	X	(Milton, 2009)	
Eleotris vittata	Eleotridae	catadromous	X	(Milton, 2009)	
Thryssa scratchleyi	Engraulidae	catadromous		(Miles et al., 2014)	
Kuhlia marginata	Kuhliidae	catadromous		(Feutry et al., 2013)	
Kuhlia malo	Kuhliidae	catadromous		(Feutry et al., 2013)	
Kuhlia rupestris	Kuhliidae	catadromous		(Augspurger et al., 2017)	
Khulia salelea	Kuhliidae	catadromous		(Feutry et al., 2013)	
Khulia sauvagii	Kuhliidae	catadromous		(Feutry et al., 2013)	
Lateolabrax japonicus	Lateolabracidae	catadromous		(Fuji et al., 2018)	
Lates calcarifer	Latidae	catadromous		(Miles et al., 2014)	yes
Lutjanus goldiei	Lutjanidae	catadromous	X	(Milton, 2009)	
Lutjanus maxweberi	Lutjanidae	catadromous	X	(Milton, 2009)	
Megalops cyprinoides	Megalopidae	catadromous	X	(Miles et al., 2014)	
Agonostomus monticola	Mugilidae	catadromous	X	(Tulkani, 2017)	
Agonostomus telfairii	Mugilidae	catadromous	X	(Milton, 2009)	
Aldrichetta forsteri	Mugilidae	catadromous		(Chang and Iizuka, 2012)	
Chelon labrosus	Mugilidae	catadromous		(Gordoa, 2009)	
Crenimugil heterocheilos	Mugilidae	catadromous	X	(Milton, 2009)	
Ellochelon vaigiensis	Mugilidae	catadromous	X	(Milton, 2009)	
Joturus pichardi	Mugilidae	catadromous	X	(Tulkani, 2017)	
Liza alata	Mugilidae	catadromous		(Villamarín et al., 2016)	
Liza aurata	Mugilidae	catadromous		(Como et al., 2018)	
Liza falcipinnis	Mugilidae	catadromous		(Milton, 2009)	
Liza grandisquamis	Mugilidae	catadromous		(Milton, 2009)	
Liza haematocheila	Mugilidae	catadromous		(Chang and Iizuka, 2012)	
Liza macrolepsis	Mugilidae	semi-catadromous		(Bijoy Nandan et al., 2012; Chang and Iizuka, 2012)	
Liza parsia	Mugilidae	catadromous		(Bijoy Nandan et al., 2012)	
Liza ramada	Mugilidae	catadromous		(Filipe et al., 2009)	
Liza richardsonii	Mugilidae	catadromous		(Chang and Iizuka, 2012)	
Liza rumadu	Mugilidae	catadromous		(Almeida, 1996)	
Liza subviridis	Mugilidae	catadromous		(Chang and Iizuka, 2012)	

Mugil cephalus	Mugilidae	catadromous		(Bijoy Nandan et al., 2012)	yes
Mugil curema	Mugilidae	catadromous		(Albieri et al., 2010)	
Mugil liza	Mugilidae	catadromous		(Garbin et al., 2014)	
Mugil soiuy	Mugilidae	catadromous		(McDowall, 1997)	
Mugil trichodon	Mugilidae	catadromous		(Mai et al., 2018)	
Myxus capensis	Mugilidae	catadromous		(Strydom, 2003)	
Trachystoma petardi	Mugilidae	catadromous		(Miles et al., 2018)	yes
Valamugil cunnesius	Mugilidae	catadromous		(Bijoy Nandan et al., 2012)	
Valamugil speigleri	Mugilidae	catadromous		(Bijoy Nandan et al., 2012)	
Gymnothorax polyuranodon	Muraenidae	catadromous		(Tsukamoto et al., 2014)	
Macquaria novemaculeata	Percichthyidae	catadromous		(Chenoweth and Hughes, 1997)	
Platichthys flesus	Pleuronectidae	catadromous		(Trancart et al., 2012)	
Rhombosolea retiaria	Pleuronectidae	catadromous		(McDowall, 2000)	
Pseudaphritis urvillii	Pseudaphritidae	catadromous - female		(Crook et al., 2010)	
Terapon jarbua	Terapontidae	catadromous	X	(Musarrat-ul-Ain et al., 2015; Riede, 2004)	
Notesthes robusta	Tetrarogidae	catadromous		(Milton, 2009)	
Ambassis miops	Ambassidae	amphidromous	X	(Miles et al., 2014; Milton, 2009)	
Ambassis gymnocephalus	Ambassidae	amphidromous	X	(Milton, 2009)	
Ambassis kopsii	Ambassidae	amphidromous	X	(Milton, 2009)	
Ameiurus melas	Ariidae	amphidromous	X	(Milton, 2009)	
Arius jella	Ariidae	amphidromous	X	(Milton, 2009)	
Cephalocassia jatia	Ariidae	amphidromous	X	(Milton, 2009)	
Cochlefelis burmanica	Ariidae	amphidromous	X	(Milton, 2009)	
Hemiarius sona	Ariidae	amphidromous	X	(Milton, 2009)	
Hexanematichthys sagor	Ariidae	amphidromous	X	(Milton, 2009)	
Nemapteryx caelata	Ariidae	amphidromous	X	(Milton, 2009)	
Netuma thalassina	Ariidae	amphidromous	X	(Milton, 2009)	
Plicofollis platystomus	Ariidae	amphidromous	X	(Milton, 2009)	
Plicofollis tenuispinis	Ariidae	amphidromous		(Hashemi et al., 2013; Milton, 2009)	
Atherina boyeri	Atherinidae	amphidromous	X	(Filipe et al., 2009)	
Carangaoides malabaricus	Carangidae	amphidromous	X	(Bijoy Nandan et al., 2012)	
Caranx sexfasciatus	Carangidae	amphidromous	X	(Bijoy Nandan et al., 2012)	
Centropomus ensiferus	Centropomidae	amphidromous		(McBride and Matheson, 2011; Milton, 2009)	
Centropomus medius	Centropomidae	amphidromous	X	(Milton, 2009)	
Centropomus nigrescens	Centropomidae	amphidromous	X	(Milton, 2009)	

Centropomus parallelus	Centropomidae	amphidromous		(McBride and Matheson, 2011; Milton, 2009)	
Centropomus pectinatus	Centropomidae	amphidromous		(McBride and Matheson, 2011)	
Centropomus robalito	Centropomidae	amphidromous	X	(Milton, 2009)	
Centropomus undecimalis	Centropomidae	amphidromous	X	(Milton, 2009)	
Cheimarrichthys fosteri	Cheimarrichthyidae	amphidromous		(Augspurger et al., 2017; McDowall, 2000)	
Clupea harangus	Clupeidae	amphidromous		(Augspurger et al., 2017)	
Sardinella melanura	Clupeidae	amphidromous		(Elahi et al., 2017; Milton, 2009)	
Sprattus sprattus	Clupeidae	amphidromous		(Augspurger et al., 2017)	
Cottus aleuticus	Cottidae	amphidromous		(Augspurger et al., 2017)	
Cottus amblystomopsis	Cottidae	amphidromous		(Augspurger et al., 2017)	
Cottus asper	Cottidae	amphidromous		(Augspurger et al., 2017)	
Cottus hangiongensis	Cottidae	amphidromous		(Augspurger et al., 2017; Miyazaki and Terui, 2016)	
Cottus pollux	Cottidae	amphidromous		(Augspurger et al., 2017; Goto and Arai, 2003)	yes
Leptocottus armatus	Cottidae	amphidromous		(McDowall, 1997)	
Bostrychus africanus	Eleotridae	amphidromous	X	(Milton, 2009)	
Bostrychus sinensis	Eleotridae	amphidromous	X	(Milton, 2009)	
Bunaka gyrinoides	Eleotridae	amphidromous	X	(Miles et al., 2014; Milton, 2009)	
Bunaka pinguis	Eleotridae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Butis amboinensis	Eleotridae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Butis butis	Eleotridae	amphidromous		(Bijoy Nandan et al., 2012; Milton, 2009)	
Butis humeralis	Eleotridae	amphidromous	X	(Milton, 2009)	
Butis koilomatodon	Eleotridae	amphidromous	X	(Milton, 2009)	
Butis melanostigma	Eleotridae	amphidromous	X	(Milton, 2009)	
Dormitator latifrons	Eleotridae	amphidromous		(Augspurger et al., 2017; McDowall, 2009)	
Dormitator maculatus	Eleotridae	amphidromous		(Augspurger et al., 2017; Milton, 2009)	
Eleotris acanthopoma	Eleotridae	amphidromous		(Milton, 2009; Shen et al., 1998)	
Eleotris amblyopsis	Eleotridae	amphidromous		(Augspurger et al., 2017; Nordlie, 2012)	
Eleotris fusca	Eleotridae	amphidromous		(Bijoy Nandan et al., 2012; Mennesson et al., 2015)	
Eleotris melanosoma	Eleotridae	amphidromous		(Maeda and Tachihara, 2005)	
Eleotris oxycephala	Eleotridae	amphidromous	X	(Xia et al., 2015)	
Eleotris perniger	Eleotridae	amphidromous		(Frotté et al., 2019)	
Eleotris picta	Eleotridae	amphidromous		(Augspurger et al., 2017)	
Eleotris sandwicensis	Eleotridae	amphidromous		(Heim-Ballew et al., 2020)	yes
Giuris margaritacea	Eleotridae	amphidromous	X	(Miles et al., 2014)	

Gobiomorphus australis	Eleotridae	amphidromous	X	(Miles et al., 2014)	
Gobiomorphus cotidianus	Eleotridae	amphidromous		(Augspurger et al., 2017)	yes
Gobiomorphus gobioides	Eleotridae	amphidromous		(Augspurger et al., 2017)	
Gobiomorphus hubbsi	Eleotridae	amphidromous		(Augspurger et al., 2017; Jarvis et al., 2018)	
Gobiomorphus huttoni	Eleotridae	amphidromous		(Augspurger et al., 2017)	
Gobiomorus dormitor	Eleotridae	amphidromous		(Augspurger et al., 2017; Smith and Kwak, 2014)	
Gobiomorus maculatus	Eleotridae	amphidromous		(Augspurger et al., 2017)	
Guavina guavina	Eleotridae	amphidromous		(Augspurger et al., 2017; Milton, 2009)	
Hypseleotris cyprinoides	Eleotridae	amphidromous		(Donaldson and Myers, 2002)	
Hypseleotris guentheri	Eleotridae	amphidromous		(Donaldson and Myers, 2002)	
Ophieleotris aporos	Eleotridae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Ophiocara porocephala	Eleotridae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Thryssa dussumieri	Engraulidae	amphidromous	X	(Bijoy Nandan et al., 2012; Milton, 2009)	
Thryssa gautamiensis	Engraulidae	amphidromous	X	(Milton, 2009)	
Thryssa hamaltonii	Engraulidae	amphidromous	X	(Milton, 2009)	
Thryssa kammalensoides	Engraulidae	amphidromous	X	(Milton, 2009)	
Thryssa malabarica	Engraulidae	amphidromous	X	(Bijoy Nandan et al., 2012)	
Aplochiton taeniatus	Galaxiidae	amphidromous		(Alò et al., 2019; Augspurger et al., 2017)	
Aplochiton marinus	Galaxiidae	amphidromous		(Alò et al., 2019)	
Aplochiton zebra	Galaxiidae	amphidromous		(Augspurger et al., 2017)	
Galaxias argenteus	Galaxiidae	amphidromous		(Augspurger et al., 2017)	
Galaxias brevipinnis	Galaxiidae	amphidromous		(Augspurger et al., 2017)	
Galaxias fasciatus	Galaxiidae	amphidromous		(Augspurger et al., 2017)	
Galaxias maculatus	Galaxiidae	amphidromous		(Augspurger et al., 2017; Hickford and Schiel, 2016)	yes
Galaxias postvectis	Galaxiidae	amphidromous		(Franklin and Gee, 2019)	
Galaxias truttaceus	Galaxiidae	amphidromous		(Augspurger et al., 2017)	yes
Neochanna cleaveri	Galaxiidae	amphidromous		(McDowall, 2004; Miles et al., 2014)	
Eucinostomus melanopterus	Gerreidae	amphidromous	X	(Milton, 2009)	
Gerres cinereus	Gerreidae	amphidromous	X	(Milton, 2009)	
Gerres erythrourus	Gerreidae	amphidromous	X	(Bijoy Nandan et al., 2012)	
Gerres filamentosus	Gerreidae	amphidromous	X	(Milton, 2009)	
Gerres limbatus	Gerreidae	amphidromous	X	(Milton, 2009)	
Gerres longirostris	Gerreidae	amphidromous	X	(Milton, 2009)	
Gerres seifer	Gerreidae	amphidromous	X	(Bijoy Nandan et al., 2012; Milton, 2009)	

Gobiesox cephalus	Gobiesocidae	semi-amphidromous		(Frotté et al., 2019)	yes
Acantrogobius caninus	Gobiidae	amphidromous		(Palavai, 2009)	
Acanthogobius lactipes	Gobiidae	amphidromous		(Miyazaki and Terui, 2016)	
Awaous acritosus	Gobiidae	amphidromous		(Augspurger et al., 2017)	yes
Awaous banana	Gobiidae	amphidromous		(Augspurger et al., 2017; Smith and Kwak, 2014)	yes
Awaous bustamantei	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Awaous grammepomus	Gobiidae	amphidromous	X	(Milton, 2009)	
Awaous guamensis	Gobiidae	amphidromous		(Augspurger et al., 2017)	
Awaous lateristriga	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Awaous melanocephalus	Gobiidae	amphidromous		(Shen et al., 1998; Shiao et al., 2015)	
Awaous ocellaris	Gobiidae	amphidromous	X	(Milton, 2009)	
Awaous stamineus	Gobiidae	amphidromous		(Augspurger et al., 2017; Hogan et al., 2017)	yes
Awaous tajasica	Gobiidae	amphidromous		(Trevisan dos Santos, 2016)	
Awaous transandeanus	Gobiidae	amphidromous	X	(Lyons and Schneider, 1990)	
Cotylopus acutipinnis	Gobiidae	amphidromous		(Milton, 2009; Teichert et al., 2014)	
Glossogobius aureus	Gobiidae	amphidromous		(Miles et al., 2014; Shiao et al., 2015)	
Glossogobius celebius	Gobiidae	amphidromous		(Milton, 2009; Shen et al., 1998)	
Glossogobius giuris	Gobiidae	amphidromous		(Miles et al., 2014; Milton, 2009)	
Gobioides broussonnetii	Gobiidae	amphidromous	X	(Milton, 2009)	
Gobioides sagitta	Gobiidae	amphidromous	X	(Milton, 2009)	
Gobionellus occidentalis	Gobiidae	amphidromous	X	(Milton, 2009)	
Gobionellus oceanicus	Gobiidae	amphidromous	X	(Milton, 2009)	
Gobionellus thoropsis	Gobiidae	amphidromous	X	(Milton, 2009)	
Gymnogobius petschiliensis	Gobiidae	amphidromous		(Oto, 2019)	
Gymnogobius opperiens	Gobiidae	amphidromous		(Miyazaki and Terui, 2016)	
Gymnogobius urotaenia	Gobiidae	amphidromous		(Miyazaki and Terui, 2016)	
Lentipes armatus	Gobiidae	amphidromous	X	(Milton, 2009)	
Lentipes concolor	Gobiidae	amphidromous		(Augspurger et al., 2017; Heim-Ballew et al., 2020)	yes
Lentipes whittenorum	Gobiidae	amphidromous	X	(Milton, 2009)	
Oligolepis acutipennis	Gobiidae	amphidromous		(Shen et al., 1998)	
Parasicydium bandama	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Periophthalmus argentilineatus	Gobiidae	amphidromous	X	(Milton, 2009)	
Periophthalmus barbarus	Gobiidae	amphidromous	X	(Milton, 2009)	
Periophthalmus malaccensis	Gobiidae	amphidromous	X	(Milton, 2009)	

Periophthalmus modestus	Gobiidae	amphidromous	X	(Milton, 2009)	
Periophthalmus novemradiatus	Gobiidae	amphidromous		(Milton, 2009; Rahman et al., 2015)	
Periophthalmus weberi	Gobiidae	amphidromous	X	(Milton, 2009)	
Periophthalmodon schlosseri	Gobiidae	amphidromous	X	(Milton, 2009)	
Periophthalmodon septemradiatus	Gobiidae	amphidromous	X	(Milton, 2009)	
Porogobius schlegelii	Gobiidae	amphidromous	X	(Milton, 2009)	
Pseudapocryptes elongatus	Gobiidae	amphidromous	X	(Milton, 2009)	
Pseudogobius javanicus	Gobiidae	amphidromous	X	(Milton, 2009)	
Pseudogobius melanostictus	Gobiidae	amphidromous	X	(Milton, 2009)	
Pseudogobius poicilosoma	Gobiidae	amphidromous	X	(Milton, 2009)	
Redigobius balteatus	Gobiidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Redigobius bikolanus	Gobiidae	amphidromous		(Shen et al., 1998)	
Redigobius dispar	Gobiidae	amphidromous	X	(Milton, 2009)	
Redigobius horiae	Gobiidae	amphidromous		(Donaldson and Myers, 2002)	
Redigobius macrostoma	Gobiidae	amphidromous	X	(Milton, 2009)	
Redigobius roemeri	Gobiidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Redigobius sapangus	Gobiidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)	
Rhinogobius brunneus	Gobiidae	amphidromous		(Augspurger et al., 2017; Iguchi and Mizuno, 1999)	
Rhinogobius giurinus	Gobiidae	amphidromous		(Shiao et al., 2015)	
Rhinogobius similis	Gobiidae	amphidromous		(Iida et al., 2017)	
Rhinogobius sp.	Gobiidae	amphidromous		(Augspurger et al., 2017; Tsunagawa and Arai, 2008)	yes
Schismatogobius sp.	Gobiidae	amphidromous		(Keith, 2003)	
Schismatogobius roxasi	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicydium brevifile	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Sicydium bustamantei	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Sicydium crenilabrum	Gobiidae	amphidromous	X	(Schliewen, 2012)	
Sicydium multipunctatum	Gobiidae	amphidromous	X	(González-Murcia and Álvarez, 2018)	
Sicydium plumieri	Gobiidae	amphidromous		(Frotté et al., 2019; Milton, 2009)	
Sicydium punctatum	Gobiidae	amphidromous		(Augspurger et al., 2017; Bell et al., 1995)	
Sicydium salvini	Gobiidae	amphidromous		(Lyons and Schneider, 1990)	
Sicyopterus aiensis	Gobiidae	amphidromous		(Augspurger et al., 2017)	
Sicyopterus cynocephalus	Gobiidae	amphidromous	X	(Ebner et al., 2017)	
Sicyopterus fuliag	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopterus griseus	Gobiidae	amphidromous	X	(Milton, 2009)	

Sicyopterus japonicus	Gobiidae	amphidromous		(Augspurger et al., 2017; Shen et al., 1998)	
Sicyopterus lacrymosus	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopterus lagocephalus	Gobiidae	amphidromous		(Augspurger et al., 2017)	
Sicyopterus macrostetholepis	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopterus micrurus	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopterus rapa	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopterus sarasini	Gobiidae	amphidromous		(Augspurger et al., 2017)	
Sicyopterus stimpsoni	Gobiidae	amphidromous		(Heim-Ballew et al., 2020)	
Sicyopus auxilimentus	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopus jonklaasi	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopus leprurus	Gobiidae	amphidromous	X	(Milton, 2009)	
Sicyopus zosterophorum	Gobiidae	amphidromous		(Augspurger et al., 2017; Taillebois et al., 2015)	
Smilosicyopus chloe	Gobiidae	amphidromous		(Taillebois et al., 2015)	
Stenogobius blokzeyli	Gobiidae	amphidromous	X	(Milton, 2009)	
Stenogobius fasciatus	Gobiidae	amphidromous	X	(McBride and Matheson, 2011)	
Stenogobius fehlmanni	Gobiidae	amphidromous		(Donaldson and Myers, 2002)	
Stenogobius genivittatus	Gobiidae	amphidromous		(Shen et al., 1998; Shiao et al., 2015)	
Stenogobius gramnepomus	Gobiidae	amphidromous		(Palavai, 2009)	
Stenogobius hawaiiensis	Gobiidae	amphidromous		(Heim-Ballew et al., 2020)	yes
Stiphodon alcedo	Gobiidae	amphidromous		(Maeda et al., 2011)	
Stiphodon aureorostrum	Gobiidae	amphidromous	X	(Milton, 2009)	
Stiphodon caeruleus	Gobiidae	amphidromous		(Chabarria et al., 2014)	
Stiphodon elegans	Gobiidae	amphidromous		(Milton, 2009; Shiao et al., 2015)	
Stiphodon larson	Gobiidae	amphidromous		(McDowall, 2010)	
Stiphodon niraikanaiensis	Gobiidae	amphidromous		(Maeda, 2014)	
Stiphodon percnopterygionus	Gobiidae	amphidromous		(Iida et al., 2017; McDowall, 2009)	
Stiphodon rutilaureus	Gobiidae	amphidromous	X	(Ebner and Thuesen, 2011)	
Stiphodon semoni	Gobiidae	amphidromous		(Keith, 2003)	
Stiphodon surrufus	Gobiidae	amphidromous	X	(Milton, 2009)	
Taenoides cirratus	Gobiidae	amphidromous		(Bijoy Nandan et al., 2012)	
Taenoides buchanani	Gobiidae	amphidromous		(Bijoy Nandan et al., 2012)	
Tridentiger brevispinis	Gobiidae	amphidromous		(Miyazaki and Terui, 2016)M	
Tridentiger kuroiwae	Gobiidae	amphidromous		(Iida et al., 2017)	
Zappa confluentus	Gobiidae	amphidromous	X	(Milton, 2009)	
Pomadasys maculatus	Haemulidae	amphidromous	X	(Ahmed and Bat, 2016; Riede, 2004)	

Kuhlia caudavittata	Kuhliidae	amphidromous		(Augspurger et al., 2017)
Kuhlia mugil	Kuhliidae	amphidromous		(Augspurger et al., 2017)
Kuhlia petiti	Kuhliidae	amphidromous		(Augspurger et al., 2017)
Kuhlia sandvicensis	Kuhliidae	amphidromous		(Benson and Michael Fitzsimons, 2002; Milton, 2009)
Kuhlia xenura	Kuhliidae	amphidromous		(Augspurger et al., 2017)
Agonostomus monticola	Mugilidae	amphidromous		(Frotté et al., 2019)
Liza macrolepis	Mugilidae	amphidromous	X	(Milton, 2009)
Liza melinoptera	Mugilidae	amphidromous	X	(Milton, 2009)
Liza subviridis	Mugilidae	amphidromous	X	(Milton, 2009)
Liza vaigiensis	Mugilidae	amphidromous	X	(Milton, 2009)
Valamugil buchanani	Mugilidae	amphidromous	X	(Milton, 2009)
Plecoglossus altivelis	Plecoglossidae	amphidromous		(Arai, 2006; Murase and Iguchi, 2019)
Plotosus canius	Plotosidae	amphidromous	X	(Samani et al., 2016)
Ilisha kampeni	Pristigasteridae	amphidromous	X	(Milton, 2009)
Ilisha melastoma	Pristigasteridae	amphidromous	X	(Milton, 2009)
Ilisha novacula	Pristigasteridae	amphidromous	X	(Milton, 2009)
Prototroctes maraena	Retropinnidae	amphidromous		(Augspurger et al., 2017)
Prototroctes oxyrhynchus	Retropinnidae	amphidromous		(Augspurger et al., 2017)
Retropinna retropinna	Retropinnidae	amphidromous		(Augspurger et al., 2017)
Retropinna semoni	Retropinnidae	amphidromous		(Augspurger et al., 2017)
Rhyacichthys aspro	Rhyacichthyidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)
Rhyacichthys guilberti	Rhyacichthyidae	amphidromous		(Milton, 2009; Tabouret et al., 2014)
Johnius belangerii	Sciaenidae	amphidromous	X	(Bijoy Nandan et al., 2012)
Johnius coitor	Sciaenidae	amphidromous	X	(Sakar et al., 2018)
Otolithoides biauritus	Sciaenidae	amphidromous	X	(Bijoy Nandan et al., 2012)
Silonia silondia	Schilbeidae	amphidromous		(Flura et al., 2018)
Hippichthys cyanospilus	Syngnathidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)
Hippichthys spicifer	Syngnathidae	amphidromous		(Donaldson and Myers, 2002; Milton, 2009)
Microphis brachyurus	Syngnathidae	amphidromous		(McBride and Matheson, 2011)
Microphis leiaspis	Syngnathidae	amphidromous		(Ishihara and Tachihara, 2008; Milton, 2009)
Syngnathus abaster	Syngnathidae	amphidromous		(Filipe et al., 2009)
Toxotes blythii	Toxotidae	amphidromous	X	(Milton, 2009)
Toxotes chatareus	Toxotidae	amphidromous	X	(Milton, 2009)
Toxotes jaculatrix	Toxotidae	amphidromous	X	(Milton, 2009)

Table S2. References of diadromous taxa's ancestral environment from Figure 1.

Taxa	Origin	Reference
Acipenseriformes	Fresh water	Sulak & Randall 2002
Ambassidae	Marine	Martin 1990
Anguilliformes	Marine	Corush 2019
Atheriniformes	Marine	Campanella *et al.* 2015
Characiformes	Marine	Chen *et al.* 2013
Clupeiformes	Marine	Bloom & Lovejoy 2014
Cypriniformes	Fresh water	Imoto *et al.* 2013
Elopiformes	Unknown	
Gadiformes	Unknown	
Galaxiiformes	Unknown	Vega & Wiens 2012
Gobiesoformes	Unknown	
Gobiiformes	Fresh water	Thacker 2009
Lutjanidae	Unknown	
Moroniformes	Unknown	
Mugiliformes	Unknown	
Osmeriformes	Unknown	Vega & Wiens 2012
Perciformes	Marine/Catadromous	Cottidae (Dickman, 1995), Terapontidae (Davis *et al*., 2012)/Kuhliidae (Feutry et al., 2013)
Petromyzontiformes	Fresh water	Bartels *et al.* 2017
Pleuronectiformes	Marine	Azevedo *et al.* 2008
Salmoniformes	Fresh water	Wang *et al.* 2011
Siluriformes	Marine	Betancur-R 2010
Syngnathiformes	Unknown	
Tetraodontiformes	Marine	Yamanoue *et al.* 2011

Table S3. A representation of putative genes that differentiate migratory vs. non-migratory populations reported by different studies.

Function	Example of putative genes	Reference
Cell junction/adhesion	Tight junction protein ZO-3, Occludin, Protocadherin-18, Cadherin-8	Hale *et al.* 2013; Kozak *et al.* 2014
Cell proliferation	Epidermal growth factor receptor kinase	Kozak *et al.* 2014
Cytoskeletal connections	Obscurin-like 1	Morris *et al.* 2014
Reproduction	Zonadhesin-like, Estrogen receptor, MORC family CW-type zinc finger, Round spermatid basic protein 1-like, RING finger protein 114, life history divergence [9], Gonadotropin-releasing hormone (GnRH), Sperm-associated antigen 16, Gonadotropin subunit beta-2	Mavarez *et al.* 2009; Hale *et al.* 2013; Mateus *et al.* 2013; Kozak *et al.* 2014
Growth/differentiation factor, hormone, FSH inhibitor	Inhibin, alpha, growth hormone 2 (GH2)	Hale *et al.* 2013; Morris *et al.* 2014
Involved in immunity	NOD-like receptor family CARD domain containing 5, Immunoglobulin heavy chain (IgD-A) gene, MHC class I a region	Hale *et al.* 2013; Morris *et al.* 2014
Ion transport	ATPase, Na+/K+ transporting alpha 1, Solute carrier family 9, 10, 12 (Na+/H+ exchanger), ATPase, H+ transporting, Sodium/potassium/calcium exchanger, Potassium voltage-gated channel subfamily H, Na+/Cl- cotransporter	Mavarez *et al.* 2009; Hale *et al.* 2013; Dennenmoser *et al.* 2017; Velotta *et al.* 2017; Brennan *et al.* 2018; Willoughby *et al.* 2018; Delgado *et al.* 2019
Microtubule attachment to the centromere	Bardet-Biedl syndrome 4 protein	Kozak *et al.* 2014
Enzymes	Glutamate dehydrogenase (GDH), d1-pyrroline-5-carboxylase synthase (P5CS), Carbonic anhydrase, Malate dehydrogenase, FMS-related tyrosine kinase 4, Alkaline ceramidase 1, Protein kinase D3	Hale *et al.* 2013; Dennenmoser *et al.* 2017; Debiasse *et al.* 2018; Willoughby *et al.* 2018
Myocyte cytoskeletal development	SPEG, Myosin regulatory light chain 2, Myostatin 2b (MSTN2)	Hale *et al.* 2013; Morris *et al.* 2014
Negative regulator of cell proliferation	Insulin-like growth factor-binding protein 1, 2a, 5	Morris *et al.* 2014; Kusakabe *et al.* 2017; Velotta *et al.* 2017
Osmosensing	Interleukin receptor 17c, 22a, Mitogen-activated protein kinase 1, 8, 13	Velotta *et al.* 2017
Osmotic/salinity stress	Glucocorticoid receptor, Aldehyde dehydrogenase 7, 9, Vasotocin	Mavarez *et al.* 2009; Mateus *et al.* 2013; Kozak *et al.* 2014
Regulation of immune cell proliferation	SAM and SH3 domain-containing protein	Kozak *et al.* 2014; Guo *et al.* 2015
Regulator of fatty acid uptake, intracellular binding	Peroxisome proliferator-activated receptor alpha a, Fatty acid-binding protein, adipocyte (AFABP)	Mavarez *et al.* 2009; Morris *et al.* 2014
Tight junction	Claudin 1, 3, 4, 7, 8, 10, 15	Kozak *et al.* 2014; Dennenmoser *et al.* 2017; Kusakabe *et al.* 2017; Velotta *et al.* 2017
Water transport	Aquaporin 3	Velotta *et al.* 2017

References

Acolas, M.L., Lambert, P., 2016. Life histories of anadromous fihes, in: Morais, P., Daverat, F. (Eds.), An Introduction to Fish Migration. pp. 66–67.

Acolas, M.L., Rochard, E., Le Pichon, C., Rouleau, E., 2012. Downstream migration patterns of one-year-old hatchery-reared European sturgeon (Acipenser sturio). J. Exp. Mar. Bio. Ecol. 430–431, 68–77. https://doi.org/10.1016/j.jembe.2012.06.026

Ahmed, Q., Bat, L., 2016. Levels and Health Risk Assessments of Cd and Pb in Pomadasys maculatus Marketed by Karachi Fish Harbor, Pakistan. ILMU Kelaut. Indones. J. Mar. Sci. 21, 53. https://doi.org/10.14710/ik.ijms.21.2.53-58

Albieri, R.J., Araújo, F.G., Ribeiro, T.P., 2010. Gonadal development and spawning season of white mullet Mugil curema (Mugilidae) in a tropical bay: Short communication. J. Appl. Ichthyol. 26, 105–109. https://doi.org/10.1111/j.1439-0426.2009.01369.x

Allen, P.J., Cech, J.J., Kültz, D., 2009. Mechanisms of seawater acclimation in a primitive, anadromous fish, the green sturgeon. J. Comp. Physiol. B Biochem. Syst. Environ. Physiol. 179, 903–920. https://doi.org/10.1007/s00360-009-0372-2

Allen, P.J., Mitchell, Z.A., Devries, R.J., Aboagye, D.L., Ciaramella, M.A., Ramee, S.W., Stewart, H.A., Shartau, R.B., 2014. Salinity effects on Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus Mitchill, 1815) growth and osmoregulation. J. Appl. Ichthyol. 30, 1229–1236. https://doi.org/10.1111/jai.12542

Almeida, P.R., 1996. Estuarine movement patterns of adult thin-lipped grey mullet, Liza ramada (Risso) (Pisces, Mugilidae), observed by ultrasonic tracking. J. Exp. Mar. Bio. Ecol. 202, 137–150.

Alò, D., Correa, C., Samaniego, H., Krabbenhoft, C.A., Turner, T.F., 2019. Otolith microchemistry and diadromy in Patagonian river fishes. PeerJ 2019, 1–25. https://doi.org/10.7717/peerj.6149

Aprahamian, M.W., Baglinière, J.L., Sabatié, M.R., Alexandrino, P., Thiel, R., Aprahamian, C.D., 2003. Biology, status, and conservation of the anadromous Atlantic twaite shad Alosa fallax fallax. Am. Fish. Soc. Symp. 2003, 103–124.

Arai, T., 2006. Comparison of habitat use during early life stage between ayu Plecoglossus altivelis and ice goby Leucopsarion petersi along the Sanriku Coast of Japan, as determined from otolith microchemistry. Fish. Sci. 72, 382–387. https://doi.org/10.1111/j.1444-2906.2006.01160.x

Arai, T., Chino, N., 2019. Variations in the migratory history of the tropical catadromous eels Anguilla bicolor bicolor and A. bicolor pacifica in south-east Asian waters. J. Fish Biol. 94, 752–758. https://doi.org/10.1111/jfb.13952

Arai, T., Chino, N., 2012. Diverse migration strategy between freshwater and seawater habitats in the freshwater eel genus Anguilla. J. Fish Biol. 81, 442–455. https://doi.org/10.1111/j.1095-8649.2012.03353.x

Arai, T., Chino, N., Le, D.Q., 2013. Migration and habitat use of the tropical eels Anguilla marmorata and A. bicolor pacifica in Vietnam. Aquat. Ecol. 47, 57–65. https://doi.org/10.1007/s10452-012-9424-x

Arai, T., Goto, A., 2008. Diverse migratory histories in a brackish water type of the ninespine stickleback, Pungitius pungitius. Environ. Biol. Fishes 83, 349–353. https://doi.org/10.1007/s10641-008-9349-3

Arai, T., Goto, A., Miyazaki, N., 2003. Use of otolith microchemistry to estimate the migratory history of the threespine stickleback, Gasterosteus aculeatus. J. Mar. Biol. Assoc. United Kingdom 83, 223–230. https://doi.org/10.1017/s0025315403007008h

Arai, T., Kotake, A., McCarthy, T.K., 2006. Habitat use by the European eel Anguilla anguilla in Irish waters. Estuar. Coast. Shelf Sci. 67, 569–578. https://doi.org/10.1016/j.ecss.2006.01.001

Arai, T., Miyazaki, N., 2001. Use of otolith microchemistry to estimate the migratory history of the Russian sturgeon, Acipenser guldenstadti. J. Mar. Biol. Assoc. United Kingdom 81, 709–710. https://doi.org/10.1017/S0025315401004465

Arai, T., Taha, H., Amalina, R., Iizuka, Y., Chang, C.W., 2019. Anadromy and heterogenous population of a tropical shad Tenualosa ilisha in Malaysia, as revealed by otolith microchemistry and molecular evidence. J. Fish Biol. 95, 1506–1511. https://doi.org/10.1111/jfb.14154

Augspurger, J.M., Warburton, M., Closs, G.P., 2017. Life-history plasticity in amphidromous and catadromous fishes: a continuum of strategies. Rev. Fish Biol. Fish. 27, 177–192. https://doi.org/10.1007/s11160-016-9463-9

Austin, C.S., Bond, M.H., Smith, J.M., Lowery, E.D., Quinn, T.P., 2019. Otolith microchemistry reveals partial migration and life history variation in a facultatively anadromous, iteroparous salmonid, bull trout (Salvelinus confluentus). Environ. Biol. Fishes 102, 95–104. https://doi.org/10.1007/s10641-019-0848-1

Avigliano, E., Carvalho, B., Velasco, G., Tripodi, P., Vianna, M., Volpedo, A.V., 2017. Nursery areas and connectivity of the adults anadromous catfish (Genidens barbus) revealed by otolith-core microchemistry in the south-western Atlantic Ocean. Mar. Freshw. Res. 68, 931–940. https://doi.org/10.1071/MF16058

Azevedo, M.F.C., Oliveira, C., Pardo, B.G., Martínez, P., Foresti, F., 2008. Phylogenetic analysis of the order Pleuronectiformes (Teleostei) based on sequences of 12S and 16S mitochondrial genes. Genet. Mol. Biol. 31, 284–292. https://doi.org/10.1590/s1415-47572008000200023

Baglinière, J.L., Sabatié, M.R., Rochard, E., Alexandrino, P., Aprahamian, M.W., 2003. The allis shad Alosa alosa: Biology, ecology, range, and status of populations. Am. Fish. Soc. Symp. 2003, 85–102.

Bartels, H., Wrede, C., Przybylski, M., Potter, I.C., Docker, M.F., 2017. Implications of absence of seawater-type mitochondria-rich cells and results of molecular analyses for derivation of the non-parasitic Ukrainian brook lamprey Eudontomyzon mariae. Environ. Biol. Fishes 100, 509–518. https://doi.org/10.1007/s10641-017-0581-6

Beamish, R.J., Levings, C.D., 1991. Abundance and freshwater migrations of the anadromous parasitic lamprey, Lampetra tridentata, in a tributary of the Fraser River, British Columbia. Can. J. Fish. Aquat. Sci. 48, 1250–1263. https://doi.org/10.1139/f91-151

Bell, K.N.I., Pepin, P., Brown, J.A., 1995. Seasonal, inverse cycling of length- and age-at-recruitment in the diadromous gobies Sicydium punctatum and Sicydium antillarum in Dominica, West Indies. Can. J. Fish. Aquat. Sci. 52, 1535–1545. https://doi.org/10.1139/f95-147

Benson, L.K., Michael Fitzsimons, J., 2002. Life history of the Hawaiian fish Kuhlia sandvicensis as inferred from daily growth rings of otoliths. Environ. Biol. Fishes 65, 131–137. https://doi.org/10.1023/A:1020045525086

Betancur-R, R., 2010. Molecular phylogenetics supports multiple evolutionary transitions from marine to freshwater habitats in ariid catfishes. Mol. Phylogenet. Evol. 55, 249–258. https://doi.org/10.1016/j.ympev.2009.12.018

Bijoy Nandan, S., Jayachandran, P.R., Sreedevi, O.K., 2012. Temporal pattern of fish production in a microtidal tropical estuary in the south-west coast of India. Indian J. Fish. 59, 17–26.

Blaber, S.J.M., Milton, D.A., Brewer, D.T., Salini, J.P., 2003. Biology, fisheries, and status of tropical shads Tenualosa spp. in south and southeast Asia. Am. Fish. Soc. Symp. 2003, 49–58.

Bloom, D.D., Lovejoy, N.R., 2014. The evolutionary origins of diadromy inferred from a time-calibrated phylogeny for Clupeiformes (herring and allies). Proc. R. Soc. B Biol. Sci. 281, 20132081. https://doi.org/10.1098/rspb.2013.2081

Borcherding, J., Breukelaar, A.W., Winter, H. V., König, U., 2014. Spawning migration and larval drift of anadromous North Sea houting (Coregonus oxyrinchus) in the River IJssel, the Netherlands. Ecol. Freshw. Fish 23, 161–170. https://doi.org/10.1111/eff.12058

Bradbury, I.R., Campana, S.E., Bentzen, P., 2008. Otolith elemental composition and adult tagging reveal spawning site fidelity and estuarine dependency in rainbow smelt. Mar. Ecol. Prog. Ser. 368, 255–268. https://doi.org/10.3354/meps07583

Brennan, R.S., Healy, T.M., Bryant, H.J., La, M. Van, Schulte, P.M., Whitehead, A., 2018. Integrative Population and Physiological Genomics Reveals Mechanisms of Adaptation in Killifish. Mol. Biol. Evol. 35, 2639–2653. https://doi.org/10.1093/molbev/msy154

Brown, R.J., Daum, D.W., Zuray, S.J., Carter, W.K., 2008. Documentation of annual spawning migrations of anadromous coregonid fishes in a large river using maturity indices, length and age analyses, and CPUE. Adv. Limnol. 63, 101–116. https://doi.org/10.1127/advlim/63/2012/101

Campanella, D., Hughes, L.C., Unmack, P.J., Bloom, D.D., Piller, K.R., Ortí, G., 2015. Multi-locus fossil-calibrated phylogeny of Atheriniformes (Teleostei, Ovalentaria). Mol. Phylogenet. Evol. 86, 8–23. https://doi.org/10.1016/j.ympev.2015.03.001

Chabarria, R., Furiness, S., Patterson, L., Hall, J., Chen, Y., Lynch, B., Pezold, F., 2014. Genetic Structure and Demographic History of Endemic Micronesian Blue Riffle Goby, Stiphodon caeruleus (Gobiidae) Inferred from Mitochondrial DNA Sequence Analysis. Copeia 2014, 23–37. https://doi.org/10.1643/ci-12-150

Chang, C.W., Iizuka, Y., 2012. Estuarine use and movement patterns of seven sympatric Mugilidae fishes: The Tatu Creek estuary, central western Taiwan. Estuar. Coast. Shelf Sci. 106, 121–126. https://doi.org/10.1016/j.ecss.2012.04.023

Chen, W.J., Lavoué, S., Mayden, R.L., 2013. Evolutionary Origin And Early Biogeography Of Otophysan Fishes (Ostariophysi: Teleostei). Evolution (N. Y). 67, 2218–2239. https://doi.org/10.1111/evo.12104

Chenoweth, S.F., Hughes, J.M., 1997. Genetic population structure of the catadromous perciform: Macquaria novemaculeata (Percichthyidae). J. Fish Biol. 50, 721–733. https://doi.org/10.1006/jfbi.1996.0336

Clarke, A.D., Lewis, A., Telmer, K.H., Shrimpton, J.M., 2007. Life history and age at maturity of an anadromous smelt, the eulachon Thaleichthys pacificus (Richardson). J. Fish Biol. 71, 1479–1493. https://doi.org/10.1111/j.1095-8649.2007.01618.x

Clemens, B.J., van de Wetering, S., Sower, S.A., Schreck, C.B., 2013. Maturation characteristics and life-history strategies of the Pacific lamprey, Entosphenus tridentatus. Can. J. Zool. 91, 775–778. https://doi.org/10.1139/cjz-2013-0114

Como, S., Carpentier, A., Rossi, F., Dupuy, C., Richard, P., Feunteun, E., Lefrançois, C., 2018. Stable isotopes as tracers can reveal resource allocation in juvenile golden gray mullets (Liza aurata, Risso, 1810). J. Exp. Mar. Bio. Ecol. 503, 72–79. https://doi.org/10.1016/j.jembe.2018.01.009

Corush, J.B., 2019. Evolutionary patterns of diadromy in fishes: more than a transitional state between marine and freshwater. BMC Evol. Biol. 19, 168. https://doi.org/10.1186/s12862-019-1492-2

Couillard, M.A., Cabana, G., Dery, J.F., Daigle, G., Dodson, J.J., 2011. Ontogenetic Habitat Shifts of the Atlantic Tomcod (Microgadus tomcod) Across an Estuarine Transition Zone. Estuaries and Coasts 34, 1234–1245. https://doi.org/10.1007/s12237-011-9428-0

Crook, D.A., Koster, W.M., Macdonald, J.I., Nicol, S.J., Belcher, C.A., Dawson, D.R., O'mahony, D.J., Lovett, D., Walker, A., Bannam, L., 2010. Catadromous migrations by female tupong (Pseudaphritis urvillii) in coastal streams in VICtoria, Australia. Mar. Freshw. Res. 61, 474–483. https://doi.org/10.1071/MF09170

Davis, A.M., Unmack, P.J., Pusey, B.J., Johnson, J.B., Pearson, R.G., 2012. Marine-freshwater transitions are associated with the evolution of dietary diversification in terapontid grunters (Teleostei: Terapontidae). J. Evol. Biol. 25, 1163–1179. https://doi.org/10.1111/j.1420-9101.2012.02504.x

Debiasse, M.B., Kawji, Y., Kelly, M.W., 2018. Phenotypic and transcriptomic responses to salinity stress across genetically and geographically divergent Tigriopus californicus populations. Mol. Ecol. 27, 1621–1632. https://doi.org/10.1111/mec.14547

Delgado, M.L., Górski, K., Habit, E., Ruzzante, D.E., 2019. The effects of diadromy and its loss on genomic divergence: The case of amphidromous Galaxias maculatus populations. Mol. Ecol. 28, 5217–5231. https://doi.org/10.1111/mec.15290

Dennenmoser, S., Vamosi, S.M., Nolte, A.W., Rogers, S.M., 2017. Adaptive genomic divergence under high gene flow between freshwater and brackish-water ecotypes of prickly sculpin (Cottus asper) revealed by Pool-Seq. Mol. Ecol. 26, 25–42. https://doi.org/10.1111/mec.13805

Dickman, M., 1995. An isolated population of fourhorn sculpins (Myoxocephalus quadricornis, family Cottidae) in a hypersaline high arctic Canadian lake. Hydrobiologia 312, 27–35. https://doi.org/10.1007/BF00018884

Dodson, J.J., Aubin-Horth, N., Thériault, V., Páez, D.J., 2013. The evolutionary ecology of alternative migratory tactics in salmonid fishes. Biol. Rev. 88, 602–625. https://doi.org/10.1111/brv.12019

Dodson, J.J., Laroche, J., Lecomte, F., 2009. Contrasting evolutionary pathways of anadromy in euteleostean fishes. Am. Fish. Soc. Symp. 69, 63–77.

Donaldson, T.J., Myers, R.F., 2002. Insular freshwater fish faunas of Micronesia: Patterns of species richness and similarity. Environ. Biol. Fishes 65, 139–149. https://doi.org/10.1023/A:1020050931158

Dou, S.Z., Yokouchi, K., Yu, X., Cao, L., Kuroki, M., Otake, T., Tsukamoto, K., 2012. The migratory history of anadromous and non-anadromous tapertail anchovy Coilia nasus in the Yangtze River Estuary revealed by the otolith Sr:Ca ratio. Environ. Biol. Fishes 95, 481–490. https://doi.org/10.1007/s10641-012-0042-1

Duan, J., Zhang, H., Liu, K., Xu, D., Zhang, M., Shi, W., 2012. An overview of Coilia ectenes in Jiangsu Section of the Yangtze River. Agric. Sci. Technol. 13, 1950–1954.

Ebner, B.C., Donaldson, J.A., Allen, G.R., Keith, P., 2017. Visual census, photographic records and the trial of a video network provide first evidence of the elusive Sicyopterus cynocephalus in Australia. Cybium 41, 117–125.

Ebner, B.C., Thuesen, P., 2011. Discovery of stream-cling-goby assemblages (Stiphodon species) in the Australian Wet Tropics. Aust. J. Zool. 58, 331–340.

Edo, K., Kawaguchi, Y., Nunokawa, M., Kawamula, H., Higashi, S., 2005. Morphology, stomach contents and growth of the endangered salmonid, Sakhalin taimen Hucho perryi, captured in the Sea of Okhotsk, northern Japan: Evidence of an anadromous form. Environ. Biol. Fishes 74, 1–7. https://doi.org/10.1007/s10641-004-6115-z

Elahi, N., Yousuf, F., Tabassum, S., Hossain, M., Hossen, M., Nawer, F., Bahkali, A., El-Shikh, M., Elgorban, A., Rahman, M., 2017. Life-history Traits of the Blacktrip sardinella, Sardinella melanura (Clupeidae) in the Gwadar, Balochistan Coast, Pakistan. Indian J. Geo-Marine Sci. 46, 397–404.

Feutry, P., Castelin, M., Ovenden, J.R., Dettaï, A., Robinet, T., Cruaud, C., Keith, P., 2013. Evolution of

diadromy in fish: insights from a tropical genus (Kuhlia species). Am. Nat. 181, 52–63. https://doi.org/10.1086/668593

Filipe, A.F., Araújo, M.B., Doadrio, I., Angermeier, P.L., Collares-Pereira, M.J., 2009. Biogeography of Iberian freshwater fishes revisited: The roles of historical versus contemporary constraints. J. Biogeogr. 36, 2096–2110. https://doi.org/10.1111/j.1365-2699.2009.02154.x

Flura, -, Alam, M.A., Hossain, M.R.A., 2018. A review on Silonia silondia (Hamilton, 1822) threatened fish of the world: (Siluriformes: Schilbeidae). Res. Agric. Livest. Fish. 5, 235–240. https://doi.org/10.3329/ralf.v5i2.38113

Franklin, P., Gee, E., 2019. Living in an amphidromous world: Perspectives on the management of fish passage from an island nation. Aquat. Conserv. Mar. Freshw. Ecosyst. 29, 1424–1437. https://doi.org/10.1002/aqc.3049

Frotté, L., Ringelstein, J., Monti, D., Robert, M., Pécheyran, C., Améziane, N., Tabouret, H., 2019. Detection of full and limited amphidromous migratory dynamics of fish in Caribbean rivers. Ecol. Freshw. Fish eff.12501. https://doi.org/10.1111/eff.12501

Fuji, T., Kasai, A., Yamashita, Y., 2018. Upstream migration mechanisms of juvenile temperate sea bass Lateolabrax japonicus in the stratified Yura River estuary. Fish. Sci. 84, 163–172. https://doi.org/10.1007/s12562-017-1167-0

Gallagher, Z.S., Bystriansky, J.S., Farrell, A.P., Brauner, C.J., 2013. A novel pattern of smoltification in the most anadromous salmonid: Pink salmon (Oncorhynchus gorbuscha). Can. J. Fish. Aquat. Sci. 70, 349–357. https://doi.org/10.1139/cjfas-2012-0390

Garbin, T., Castello, J.P., Kinas, P.G., 2014. Age, growth, and mortality of the mullet Mugil liza in Brazil's southern and southeastern coastal regions. Fish. Res. 149, 61–68. https://doi.org/10.1016/j.fishres.2013.09.008

González-Murcia, S., Álvarez, F.S., 2018. Your place, my place…, distribution of Agonostomus monticola and Sicydium multipunctatum in the Acahuapa Watershed. Rev. Mex. Biodivers. 89, 854–864. https://doi.org/10.22201/ib.20078706e.2018.3.2244

Gordoa, A., 2009. Characterization of the infralittoral system along the north-east Spanish coast based on sport shore-based fishing tournament catches. Estuar. Coast. Shelf Sci. 82, 41–49. https://doi.org/10.1016/j.ecss.2008.11.024

Goto, A., Arai, T., 2003. Migratory histories of three types of Cottus pollux (small-egg, middle-egg, and large-egg types) as revealed by otolith microchemistry. Ichthyol. Res. 50, 67–72. https://doi.org/10.1007/s102280300009

Guo, B., DeFaveri, J., Sotelo, G., Nair, A., Merilä, J., 2015. Population genomic evidence for adaptive differentiation in Baltic Sea three-spined sticklebacks. BMC Biol. 13, 19. https://doi.org/10.1186/s12915-015-0130-8

Hale, M.C., Thrower, F.P., Berntson, E.A., Miller, M.R., Nichols, K.M., 2013. Evaluating adaptive divergence between migratory and nonmigratory ecotypes of a salmonid fish, Oncorhynchus mykiss. G3 Genes, Genomes, Genet. 3, 1273–1285. https://doi.org/10.1534/g3.113.006817

Hashemi, S.A., Taghavimotlagh, S.A., Hedayati, A., Ghorbani, R., 2013. Original article Some biological aspect of thinspine seacatfish (plicofollis tenuispinis) in northwest of persian gulf (Khuzestan coastal waters , Iran) 2, 176–183. https://doi.org/10.14196/sjbs.v2i8.857

Heim-Ballew, H., Moody, K.N., Blum, M.J., McIntyre, P.B., Hogan, J.D., 2020. Migratory flexibility in native Hawai'ian amphidromous fishes. J. Fish Biol. 96, 456–468. https://doi.org/10.1111/jfb.14224

Hickford, M.J.H., Schiel, D.R., 2016. Otolith microchemistry of the amphidromous Galaxias maculatus shows recruitment to coastal rivers from unstructured larval pools. Mar. Ecol. Prog. Ser. 548, 197–207. https://doi.org/10.3354/meps11701

Hogan, J.D., Kozdon, R., Blum, M.J., Gilliam, J.F., Valley, J.W., McIntyre, P.B., 2017. Reconstructing larval growth and habitat use in an amphidromous goby using otolith increments and microchemistry. J. Fish Biol. 90, 1338–1355. https://doi.org/10.1111/jfb.13240

Hogan, Z., Baird, I.G., Radtke, R., Vander Zanden, M.J., 2007. Long distance migration and marine habitation in the tropical Asian catfish, Pangasius krempfi. J. Fish Biol. 71, 818–832. https://doi.org/10.1111/j.1095-8649.2007.01549.x

Honț, Ștefan, Paraschiv, M., Ion Iani, M., Taflan, E., Holostenco, D.N., Oprea, D., Oprea, L., 2019. Detailed analysis of beluga sturgeon (Huso huso) and stellate sturgeon (Acipenser stellatus) migration in the Lower Danube River. Turkish J. Zool. 43, 457–464. https://doi.org/10.3906/zoo-1902-32

Iguchi, K., Mizuno, N., 1999. Early starvation limits survival in amphidromous fishes. J. Fish Biol. 54, 705–712. https://doi.org/10.1006/jfbi.1998.0909

Iida, M., Kondo, M., Tabouret, H., Maeda, K., Pécheyran, C., Hagiwara, A., Keith, P., Tachihara, K., 2017. Specific gravity and migratory patterns of amphidromous gobioid fish from Okinawa Island, Japan. J. Exp. Mar. Bio. Ecol. 486, 160–169. https://doi.org/10.1016/j.jembe.2016.09.011

Imoto, J.M., Saitoh, K., Sasaki, T., Yonezawa, T., Adachi, J., Kartavtsev, Y.P., Miya, M., Nishida, M., Hanzawa, N., 2013. Phylogeny and biogeography of highly diverged freshwater fish species (Leuciscinae, Cyprinidae, Teleostei) inferred from mitochondrial genome analysis. Gene 514, 112–124. https://doi.org/10.1016/j.gene.2012.10.019

Ishihara, T., Tachihara, K., 2008. Reproduction and early development of a freshwater pipefish Microphis leiaspis in Okinawa-jima Island, Japan. Ichthyol. Res. 55, 349–355. https://doi.org/10.1007/s10228-008-0049-y

Jarvis, M.G., Harland, H.A., Warburton, M.L., Closs, G.P., 2018. The spawning and early life-history of a New Zealand endemic amphidromous eleotrid, bluegill bully (Gobiomorphus hubbsi). New Zeal. J. Mar. Freshw. Res. 52, 55–68. https://doi.org/10.1080/00288330.2017.1330760

Jeong, S.Y., Kim, J.H., Lee, W.O., Dahms, H.U., Han, K.N., 2014. Salinity changes in the anadromous river pufferfish, Takifugu obscurus, mediate gene regulation. Fish Physiol. Biochem. 40, 205–219. https://doi.org/10.1007/s10695-013-9837-z

Jessop, B.M., Cairns, D.K., Thibault, I., Tzeng, W.N., 2007. Life history of American eel Anguilla rostrata: New insights from otolith microchemistry. Aquat. Biol. 1, 205–216. https://doi.org/10.3354/ab00018

Katayama, S., Radtke, R.L., Omori, M., Shafer, D.J., 2000. Coexistence of anadromous and resident life history styles of pond smelt, Hypomesus nipponensis, in Lake Ogawara, Japan, as determined by analyses of otolith structure and strontium: Calcium ratios. Environ. Biol. Fishes 58, 195–201. https://doi.org/10.1023/A:1007682729460

Keith, P., 2003. Biology and ecology of amphidromous Gobiidae of the Indo-Pacific and the Caribbean regions. J. Fish Biol. 63, 831–847. https://doi.org/10.1046/j.1095-8649.2003.00197.x

Kissinger, B.C., Gantner, N., Anderson, W.G., Gillis, D.M., Halden, N.M., Harwood, L.A., Reist, J.D., 2016. Brackish-water residency and semi-anadromy in Arctic lake trout (Salvelinus namaycush) inferred from otolith microchemistry. J. Great Lakes Res. 42, 267–275. https://doi.org/10.1016/j.jglr.2015.05.016

Kohestan-Eskandari, S., Anvarifar, H., Mousavi-Sabet, H., Yousefi, M., Khanzade, M., 2014. A morphology-based hypothesis for homeward migration success and population differentiation in the anadromous kutum

Rutilus kutum (Pisces: Cyprinidae) along the southern Caspian Sea, Iran. Folia Zool. 63, 151–160. https://doi.org/10.25225/fozo.v63.i3.a2.2014

Kokita, T., Nohara, K., 2011. Phylogeography and historical demography of the anadromous fish Leucopsarion petersii in relation to geological history and oceanography around the Japanese Archipelago. Mol. Ecol. 20, 143–164. https://doi.org/10.1111/j.1365-294X.2010.04920.x

Koshelev, V.N., Mikodina, E. V., Mironova, T.N., Presnyakov, A. V., Novosadov, A.G., 2012. New data on biology and distribution of Sakhalin sturgeon Acipenser mikadoi. J. Ichthyol. 52, 619–627. https://doi.org/10.1134/S0032945212050025

Koshelev, V.N., Ruban, G., Shmigirilov, A., 2014. Spawning migrations and reproductive parameters of the kaluga sturgeon, Huso dauricus (Georgi, 1775), and Amur sturgeon, Acipenser schrenckii (Brandt, 1869). J. Appl. Ichthyol. 30, 1125–1132. https://doi.org/10.1111/jai.12549

Kozak, G.M., Brennan, R.S., Berdan, E.L., Fuller, R.C., Whitehead, A., 2014. Functional and population genomic divergence within and between two species of killifish adapted to different osmotic niches. Evolution (N. Y). 68, 63–80. https://doi.org/10.1111/evo.12265

Kusakabe, M., Ishikawa, A., Ravinet, M., Yoshida, K., Makino, T., Toyoda, A., Fujiyama, A., Kitano, J., 2017. Genetic basis for variation in salinity tolerance between stickleback ecotypes. Mol. Ecol. 26, 304–319. https://doi.org/10.1111/mec.13875

Kuzishchin, K. V., Gruzdeva, M.A., Filenko, V.A., Pavlov, D.S., 2020. Caspian Anadromous Shad Alosa kessleri kessleri (Grimm, 1887) from the Akhtuba River, Lower Volga River Basin: Biological and Morphological Features. Inl. Water Biol. 13, 79–87. https://doi.org/10.1134/S1995082920010125

Kynard, B., 1997. Life history, latitudinal patterns, and status of the shortnose sturgeon, Acipenser brevirostrum. Environ. Biol. Fishes 48, 319–334. https://doi.org/10.1023/a:1007372913578

Kynard, B., Zhuang, P., Zhang, T., Zhang, L., 2003. Ontogenetic behavior and migration of Dabry's sturgeon, Acipenser dabryanus, from the Yangtze River, with notes on body color and development rate. Environ. Biol. Fishes 66, 27–36. https://doi.org/10.1023/A:1023238117045

Lehtonen, H., Nyberg, K., Vuoronen, P.J., Leskelä, A., 1992. Radioactive strontium (85Sr) in marking whitefish [Coregonus lavaretus (L.)] larvae and the dispersal of larvae from river to sea. J. Fish Biol. 41, 417–423. https://doi.org/10.1111/j.1095-8649.1992.tb02670.x

Limburg, K.E., 2001. Otolith microchemistry indicates unexpected patterns of residency and anadromy in blueback herring, alosa aestivalis, in the hudson and mohawk rivers. BFPP - Bull. Fr. la Pech. la Prot. des Milieux Aquat. 931–938. https://doi.org/10.1051/kmae:2001028

Lowerre-Barbieri, S., Villegas-Rís, D., Walters, S., Bickford, J., Cooper, W., Muller, R., Trotter, A., 2014. Spawning site selection and contingent behavior in common snook, Centropomus undecimalis. PLoS One 9. https://doi.org/10.1371/journal.pone.0101809

Łuszczek-Trojnar, E., Drąg-Kozak, E., Kleszcz, M., Popek, W., Epler, P., 2008. Gonadal maturity in vimba (Vimba vimba L.) raised in carp ponds. J. Appl. Ichthyol. 24, 316–320. https://doi.org/10.1111/j.1439-0426.2008.01057.x

Lyle, A.A., Maitland, P.S., 1997. The spawning migration and conservation of smelt Osmerus eperlanus in the River Cree, Southwest Scotland. Biol. Conserv. 80, 303–311. https://doi.org/10.1016/S0006-3207(96)00039-0

Lyons, J., Schneider, D.W., 1990. Factors influencing fish distribution and community structure in a small coastal river in southwestern Costa Rica. Hydrobiologia 203, 1–14. https://doi.org/10.1007/BF00005608

Maeda, K., 2014. Stiphodon niraikanaiensis, a new species of sicydiine goby from Okinawa Island (Gobiidae: Sicydiinae). Ichthyol. Res. 61, 99–107. https://doi.org/10.1007/s10228-013-0379-2

Maeda, K., Mukai, T., Tachihara, K., 2011. A new species of amphidromous goby, Stiphodon alcedo, from the ryukyu archipelago (Gobiidae: Sicydiinae). Cybium 35, 285–298.

Maeda, K., Tachihara, K., 2005. Recruitment of amphidromous sleepers Eleotris acanthopoma, Eleotris melanosoma, and Eleotris fusca into the Teima River, Okinawa Island. Ichthyol. Res. 52, 325–335. https://doi.org/10.1007/s10228-005-0289-z

Mai, A.C.G., dos Santos, M.L., Lemos, V.M., Vieira, J.P., 2018. Discrimination of habitat use between two sympatric species of mullets, Mugil curema and Mugil liza (Mugiliformes: Mugilidae) in the rio Tramandaí Estuary, determined by otolith chemistry. Neotrop. Ichthyol. 16, 1–8. https://doi.org/10.1590/1982-0224-20170045

Mai, A.C.G., Vieira, J.P., 2013. Revisão e considerações sobre o uso do habitat, distribuição e história de vida de Lycengraulis grossidens (Agassiz, 1829) (Actinopterygii, Clupeiformes, Engraulididae). Biota Neotrop. 13, 121–130. https://doi.org/10.1590/S1676-06032013000300015

Mark Shrimpton, J., 2012. Seawater to Freshwater Transitions in Diadromous Fishes, Fish Physiology. Elsevier Inc. https://doi.org/10.1016/B978-0-12-396951-4.00007-4

Martin, T.J., 1990. Osmoregulation in three species of Ambassidae (Osteichthyes: Perciformes) from estuaries in Natal. South African J. Zool. 25, 229–234. https://doi.org/10.1080/02541858.1990.11448217

Martínez-Álvarez, R.M., Sanz, A., García-Gallego, M., Domezain, A., Domezain, J., Carmona, R., Del Valle Ostos-Garrido, M., Morales, A.E., 2005. Adaptive branchial mechanisms in the sturgeon Acipenser naccarii during acclimation to saltwater. Comp. Biochem. Physiol. - A Mol. Integr. Physiol. 141, 183–190. https://doi.org/10.1016/j.cbpb.2005.05.003

Mateus, C.S., Stange, M., Berner, D., Roesti, M., Quintella, B.R., Alves, M.J., Almeida, P.R., Salzburger, W., 2013. Strong genome-wide divergence between sympatric European river and brook lampreys. Curr. Biol. 23, R649–R650. https://doi.org/10.1016/j.cub.2013.06.026

Mavarez, J., Audet, C., Bernatchez, L., 2009. Major disruption of gene expression in hybrids between young sympatric anadromous and resident populations of brook charr (Salvelinus fontinalis Mitchill). J. Evol. Biol. 22, 1708–1720. https://doi.org/10.1111/j.1420-9101.2009.01785.x

McBride, R.S., Holder, J.C., 2008. A Review and Updated Assessment of Florida's Anadromous Shads: American Shad and Hickory Shad. North Am. J. Fish. Manag. 28, 1668–1686. https://doi.org/10.1577/m07-066.1

McBride, R.S., Matheson, R.E., 2011. FLORIDA ' S DIADROMOUS FISHES : BIOLOGY , ECOLOGY , CONSERVATION , AND MANAGEMENT. Florida Sci. 74, 187–213.

McDowall, R., 2010. Why be amphidromous : expatrial dispersal and the place of source and sink population dynamics ? Rev. Fish Biol. Fish. 20, 87–100. https://doi.org/10.1007/s11160-009-9125-2

McDowall, R., 2004. Ancestry and amphidromy in island freshwater fish faunas. Fish Fish. 5, 75–85. https://doi.org/10.1111/j.1467-2960.2004.00138.x

McDowall, R., 1999. Different kinds of diadromy: Different kinds of conservation problems. ICES J. Mar. Sci. 56, 410–413. https://doi.org/10.1006/jmsc.1999.0450

McDowall, R., 1997. The evolution of diadromy in fishes (revisited) and its place in phylogenetic analysis. Rev. Fish Biol. Fish. 7, 443–462. https://doi.org/10.1023/A:1018404331601

McDowall, R.M., 2009. Early hatch: A strategy for safe downstream larval transport in amphidromous gobies. Rev. Fish Biol. Fish. 19, 1–8. https://doi.org/10.1007/s11160-008-9085-y

McDowall, R.M., 2000. Biogeography of the New Zealand torrentfish, Cheimarrichthys fosteri (Teleostei: Pinguipedidae): A distribution driven mostly by ecology and behaviour. Environ. Biol. Fishes 58, 119–131. https://doi.org/10.1023/A:1007666014842

McEnroe, M., Cech, J.J., 1985. Osmoregulation in juvenile and adult white sturgeon, Acipenser transmontanus. Environ. Biol. Fishes 14, 23–30. https://doi.org/10.1007/BF00001573

Mennesson, M.I., Tabouret, H., Pécheyran, C., Feunteun, E., Keith, P., 2015. Amphidromous life cycle of Eleotris fusca (Gobioidei: Eleotridae), a widespread species from the Indo-Pacific studied by otolith analyses. Cybium 39, 249–260.

Miles, N.G., Butler, G.L., Diamond, S.L., Bishop, D.P., van der Meulen, D.E., Reinfelds, I., Walsh, C.T., 2018. Combining otolith chemistry and telemetry to assess diadromous migration in pinkeye mullet, Trachystoma petardi (Actinopterygii, Mugiliformes). Hydrobiologia 808, 265–281. https://doi.org/10.1007/s10750-017-3430-x

Miles, N.G., Walsh, C.T., Butler, G., Ueda, H., West, R.J., 2014. Australian diadromous fishes - Challenges and solutions for understanding migrations in the 21st century. Mar. Freshw. Res. https://doi.org/10.1071/MF12340

Milton, D., 2009. Living in Two Worlds: Diadromous Fishes, and Factors Affecting Populaiton Connectivity Between Tropical Rivers and Coasts, Ecological Connectivity among Tropical Coastal Ecosystems.

Milton, D.A., Chenery, S.R., Farmer, M.J., Blaber, S.J.M., 1997. Identifying the spawning estuaries of the tropical shad, terubok Tenualosa toli, using otolith microchemistry. Mar. Ecol. Prog. Ser. 153, 283–291. https://doi.org/10.3354/meps153283

Miyazaki, Y., Terui, A., 2016. Temporal dynamics of fluvial fish community caused by marine amphidromous species in the Shubuto River, southwestern Hokkaido, Japan. Ichthyol. Res. 63, 173–179. https://doi.org/10.1007/s10228-015-0474-7

Morin, R., Dodson, J.J., Power, G., 1982. Life history of anadromous cisco (Coregonus artedii), lake whitefish (Coregonus clupeaformis), and round whitefish (Prosopium cylindraceum) populations of eastern James-Hudson bay. Can. J. Aquat. Sci. 39, 958–967.

Morris, M.R.J., Richard, R., Leder, E.H., Barrett, R.D.H., Aubin-Horth, N., Rogers, S.M., 2014. Gene expression plasticity evolves in response to colonization of freshwater lakes in threespine stickleback. Mol. Ecol. 23, 3226–3240. https://doi.org/10.1111/mec.12820

Morris, R., Pickering, A.D., 1976. Changes in the ultrastructure of the gills of the river lamprey, Lampetra fluviatilis (L.), during the anadromous spawning migration. Cell Tissue Res. 173, 271–277. https://doi.org/10.1007/BF00221380

Murase, I., Iguchi, K., 2019. Facultative amphidromy involving estuaries in an annual amphidromous fish from a subtropical marginal range. J. Fish Biol. 95, 1391–1398. https://doi.org/10.1111/jfb.14147

Musarrat-ul-Ain, Farooq, R.Y., Masood, Z., 2015. Gonadosomatic Index of Terapontid species. Int. J. Biol. Biotechnol. 12, 575–578.

Nesbø, C.L., Magnhagen, C., Jakobsen, K.S., 1998. Genetic differentiation among stationary and anadromous perch (Perca fluviatilis) in the Baltic Sea. Hereditas 129, 241–249. https://doi.org/10.1111/j.1601-5223.1998.00241.x

Nordlie, F.G., 2012. Life-history characteristics of eleotrid fishes of the western hemisphere, and perils of life in

a vanishing environment. Rev. Fish Biol. Fish. 22, 189–224. https://doi.org/10.1007/s11160-011-9229-3

Oto, Y., 2019. Upstream migration without complete osmoregulatory switching in an amphidromous goby: Estimated by body condition changes in different salinity environment. J. Exp. Mar. Bio. Ecol. 514–515, 67–75. https://doi.org/10.1016/j.jembe.2019.03.014

Palavai, V., 2009. Diversity and Distribution of Freshwater Fishes of the Andaman.

Rahman, M.M., Rahman, M., Parvez, S., Mallik, N., Nabi, M.R., 2015. Population dynamics of mudskipper *Periophthalmus novemradiatus* from Bakkhali river estuary , Cox ' s Bazar, Bangladesh. Agric. Sci. Res. J. 5, 118–123.

Riede, K., 2004. Global register of migratory species - from global to regional scales. Final Rep. R&D-Projekt 808 05 081. Fed. Agency Nat. Conserv. 329 pp.

Rodríguez, A., Gallardo, M.A., Gisbert, E., Santilari, S., Ibarz, A., Sánchez, J., Castelló-Orvay, F., 2002. Osmoregulation in juvenile Siberian sturgeon (Acipenser baerrii). Fish Physiol. Biochem. 26, 345–354. https://doi.org/10.1023/B:FISH.0000009263.83075.68

Rohtla, M., Vetemaa, M., Taal, I., Svirgsden, R., Urtson, K., Saks, L., Verliin, A., Kesler, M., Saat, T., 2014. Life history of anadromous burbot (Lota lota, Linneaus) in the brackish Baltic Sea inferred from otolith microchemistry. Ecol. Freshw. Fish 23, 141–148. https://doi.org/10.1111/eff.12057

Sakai, H., Goto, A., Jeon, S.-R., 2002. Speciation and Dispersal of Tribolodon Species (Pisces, Cyprinidae) around the Sea of Japan. Zoolog. Sci. 19, 1291–1303. https://doi.org/10.2108/zsj.19.1291

Sakai, H., Imai, C., 2005. Otolith Sr:Ca ratios of the freshwater and anadromous cyprinid genus Tribolodon. Ichthyol. Res. 52, 182–184. https://doi.org/10.1007/s10228-004-0264-0

Sakar, U.K., Naskar, M., Roy, K., Sudheesan, D., Gupta, S., Bose, A.K., Srivastava, P.K., Nandy, S.K., Verma, V.K., Sarkar, S.D., Karnatak, G., 2018. Baseline information of reproduction parameters of an amphidromous croaker Johnius coitor (Hamilton, 1822) from Ganga river basin, India with special reference to potential influence of climatic variability. Aquat. Living Resour. 31.

Samani, N.K., Esa, Y., Amin, S.M.N., Ikhsan, N.F.M., 2016. Phylogenetics and population genetics of Plotosus canius (Siluriformes: Plotosidae) from Malaysian coastal waters. PeerJ 2016. https://doi.org/10.7717/peerj.1930

Schaffler, J.J., Young, S.P., Herrington, S., Ingram, T., Tannehill, J., 2015. Otolith Chemistry to Determine Within-River Origins of Alabama Shad in the Apalachicola–Chattahoochee–Flint River Basin. Trans. Am. Fish. Soc. 144, 1–10. https://doi.org/10.1080/00028487.2014.954056

Schliewen, U.K., 2012. Diversity and Distribution of Marine, Euryhaline and Amphidromous Gobies from Western, Central and Southern Africa, in: Patzner, R.A., Van Tassell, J.L., Kovacic, M., Kapoor, B. (Eds.), The Biology of Gobies. pp. 207–229.

Schmidt, D.J., Crook, D.A., Macdonald, J.I., Huey, J.A., Zampatti, B.P., Chilcott, S., Raadik, T.A., Hughes, J.M., 2014. Migration history and stock structure of two putatively diadromous teleost fishes, as determined by genetic and otolith chemistry analyses. Freshw. Sci. 33.

Secor, D.H., Henderson-Arzapalo, A., Piccoli, P.M., 1995. Can otolith microchemistry chart patterns of migration and habitat utilization in anadromous fishes? J. Exp. Mar. Bio. Ecol. 192, 15–33. https://doi.org/10.1016/0022-0981(95)00054-U

Shen, K.N., Lee, Y.C., Tzeng, W.N., 1998. Use of otolith microchemistry to investigate the life history pattern of gobies in a Taiwanese stream. Zool. Stud. 37, 322–329.

Shiao, J.C., Chen, C.Y., Zhang, J., Iizuka, Y., 2016. Habitat use and migratory life history of Salangid icefish (salangidae) revealed by otolith Sr/Ca ratios. Zool. Stud. 55, 1–10. https://doi.org/10.6620/ZS.2016.55-03

Shiao, J.C., Tzeng, C.S., Li, P.C., Bell, K.N.I., 2015. Upstream migration and marine early life history of amphidromous gobies inferred from otolith increments and microchemistry. Environ. Biol. Fishes 98, 933–950. https://doi.org/10.1007/s10641-014-0329-5

Skovrind, M., Olsen, M.T., Vieira, F.G., Pacheco, G., Carl, H., Gilbert, M.T.P., Møller, P.R., 2016. Genomic population structure of freshwater-resident and anadromous ide (Leuciscus idus) in north-western Europe. Ecol. Evol. 6, 1064–1074. https://doi.org/10.1002/ece3.1909

Smith, W.E., Kwak, T.J., 2014. Otolith microchemistry of tropical diadromous fishes: Spatial and migratory dynamics. J. Fish Biol. 84, 913–928. https://doi.org/10.1111/jfb.12317

Strydom, N.A., 2003. Occurrence of larval and early juvenile fishes in the surf zone adjacent to two intermittently open estuaries, South Africa. Environ. Biol. Fishes 66, 349–359. https://doi.org/10.1023/A:1023949607821

Sulak, K.J., Randall, M., 2002. Understanding sturgeon life history: Enigmas, myths, and insights from scientific studies. J. Appl. Ichthyol. 18, 519–528. https://doi.org/10.1046/j.1439-0426.2002.00413.x

Tabouret, H., Tomadin, M., Taillebois, L., Iida, M., Lord, C., Pécheyran, C., Keith, P., 2014. Amphidromy and marine larval phase of ancestral gobioids Rhyacichthys guilberti and Protogobius attiti (Teleostei: Rhyacichthyidae). Mar. Freshw. Res. 65, 776–783. https://doi.org/10.1071/MF13146

Taillebois, L., Tabouret, H., Pecheyran, C., Keith, P., 2015. Inputs from microchemistry to the understanding of three Sicydiinae species' life cycle. Vie Milieu 65, 73–84.

Teichert, N., Valade, P., Lim, P., Dauba, F., Labonne, J., Richarson, M., Bosc, P., Gaudin, P., 2014. Habitat selection in amphidromous Gobiidae of Reunion Island: Sicyopterus lagocephalus (Pallas, 1770) and Cotylopus acutipinnis (Guichenot, 1863). Environ. Biol. Fishes 97, 255–266. https://doi.org/10.1007/s10641-013-0148-0

Thacker, C., 2009. Phylogeny of Gobioidei and Placement within Acanthomorpha, with a New Classification and Investigation of Diversification and Character Evolution. Copeia 2009, 93–104. https://doi.org/10.1643/ci-08-004

Trancart, T., Lambert, P., Rochard, E., Daverat, F., Coustillas, J., Roqueplo, C., 2012. Alternative flood tide transport tactics in catadromous species: Anguilla anguilla, Liza ramada and Platichthys flesus. Estuar. Coast. Shelf Sci. 99, 191–198. https://doi.org/10.1016/j.ecss.2011.12.032

Trevisan dos Santos, J.., 2016. Revisão taxonômica e anatomia de Awaous tajasica (Lichtenstein, 1822) (Gobiiformes: Gobiidae).

Tsukamoto, K., Arai, T., 2001. Facultative catadromy of the eel Anguilla japonica between freshwater and seawater habitats. Mar. Ecol. Prog. Ser. 220, 265–276. https://doi.org/10.3354/meps220265

Tsukamoto, K., Watanabe, S., Kuroki, M., Aoyama, J., Miller, M.J., 2014. Freshwater habitat use by a moray eel species, Gymnothorax polyuranodon, in Fiji shown by otolith microchemistry. Environ. Biol. Fishes 97, 1377–1385. https://doi.org/10.1007/s10641-014-0228-9

Tsunagawa, T., Arai, T., 2008. Flexible migration of Japanese freshwater gobies Rhinogobius spp. as revealed by otolith Sr:Ca ratios. J. Fish Biol. 73, 2421–2433. https://doi.org/10.1111/j.1095-8649.2008.02089.x

Tulkani, R., 2017. Population Biology of Two Species of Grey Mullet, Liza abu in Central Iraq (Heckel, 1843) and Chelon labrosus (Risso, 1827) in North West Wales.

Vega, G.C., Wiens, J.J., 2012. Why are there so few fish in the sea? Proc. R. Soc. B Biol. Sci. 279, 2323–2329. https://doi.org/10.1098/rspb.2012.0075

Velotta, J.P., Wegrzyn, J.L., Ginzburg, S., Kang, L., Czesny, S., Neill, R.J.O.', Mccormick, S.D., Michalak, P., Schultz, E.T., 2017. Transcriptomic imprints of adaptation to fresh water: parallel evolution of osmoregulatory gene expression in the Alewife. Mol. Ecol. 26, 831–848. https://doi.org/10.1111/mec.13983

Villamarín, F., Magnusson, W.E., Jardine, T.D., Valdez, D., Woods, R., Bunn, S.E., 2016. Temporal uncoupling between energy acquisition and allocation to reproduction in a herbivorous-detritivorous fish. PLoS One 11, 1–17. https://doi.org/10.1371/journal.pone.0150082

Waldman, J., Grunwald, C., Wirgin, I., 2008. Sea lamprey Petromyzon marinus: An exception to the rule of homing in anadromous fishes. Biol. Lett. 4, 659–662. https://doi.org/10.1098/rsbl.2008.0341

Walters, A.W., Barnes, R.T., Post, D.M., 2009. Anadromous alewives (Alosa pseudoharengus) contribute marine-derived nutrients to coastal stream food webs. Can. J. Fish. Aquat. Sci. 66, 439–448. https://doi.org/10.1139/F09-008

Wang, Y., Guo, R., Li, H., Zhang, X., Du, J., Song, Z., 2011. The complete mitochondrial genome of the Sichuan taimen (Hucho bleekeri): Repetitive sequences in the control region and phylogenetic implications for Salmonidae. Mar. Genomics 4, 221–228. https://doi.org/10.1016/j.margen.2011.06.003

Whitfield, A.K., 2005. Preliminary documentation and assessment of fish diversity in sub-Saharan African estuaries. African J. Mar. Sci. 27, 307–324. https://doi.org/10.2989/18142320509504089

Willoughby, J.R., Harder, A.M., Tennessen, J.A., Scribner, K.T., Christie, M.R., 2018. Rapid genetic adaptation to a novel environment despite a genome-wide reduction in genetic diversity. Mol. Ecol. 27, 4041–4051. https://doi.org/10.1111/mec.14726

Wilson, J.P.F., 1984. A Review of the Biology of the Pollan Coregonus autumnalis pollan Thompson : An Endemic Irish Salmonid Subspecies. Proc. R. Irish Acad. Sect. B Biol. Geol. Chem. Sci. 84B, 123–127.

Wood, C.C., Foote, C.J., 1996. Evidence for sympatric genetic divergence of anadromous and nonanadromous morphs of sockeye salmon (Oncorhynchus nerka). Evolution (N. Y). 50, 1265–1279. https://doi.org/10.1111/j.1558-5646.1996.tb02367.x

Xia, A., Zhong, L., Chen, X., Bian, W., Zhang, T., Shi, Y., 2015. Complete mitochondrial genome of spined sleeper Eleotris oxycephala (Perciformes, Eleotridae) and phylogenetic consideration. Biochem. Syst. Ecol. 62, 11–19. https://doi.org/10.1016/j.bse.2015.07.030

Yamaguchi, M., Katayama, S., Omori, M., 2004. Migration pattern of shirauo Salangichthys microdon Bleeker, in the Ishikari River system and adjacent nearshore sea area, Japan, as estimated by otolith microchemistry analysis. Fish. Sci. 70, 546–552. https://doi.org/10.1111/j.1444-2906.2004.00839.x

Yamanoue, Y., Miya, M., Doi, H., Mabuchi, K., Sakai, H., Nishida, M., 2011. Multiple invasions into freshwater by pufferfishes (Teleostei: Tetraodontidae): A mitogenomic perspective. PLoS One 6, e17410. https://doi.org/10.1371/journal.pone.0017410

Yang, Z., Chen, Y.F., 2008. Differences in reproductive strategies between obscure puffer Takifugu obscurus and ocellated puffer Takifugu ocellatus during their spawning migration. J. Appl. Ichthyol. 24, 569–573. https://doi.org/10.1111/j.1439-0426.2008.01071.x

Yatsuyanagi, T., Ishida, R., Sakata, M.K., Kanbe, T., Mizumoto, H., Kobayashi, Y., Kamada, S., Namba, S., Nii, H., Minamoto, T., Araki, H., 2020. Environmental DNA monitoring for short-term reproductive migration of endemic anadromous species, Shishamo smelt (Spirinchus lanceolatus) . Environ. DNA 2, 130–139. https://doi.org/10.1002/edn3.50

Zhang, J., Wei, F., Li, M., Xu, M., 2007. Threatened fishes of the world: Hemisalanx prognathus (Regan 1908) (Salangidae). Environ. Biol. Fishes 78, 209–210. https://doi.org/10.1007/s10641-006-0011-7

Zhuang, P., Kynard, B., Zhang, L., Zhang, T., Cao, W., 2002. Ontogenetic behavior and migration of Chinese sturgeon, Acipenser sinensis. Environ. Biol. Fishes 65, 83–97. https://doi.org/10.1023/A:1019621501672