

Table S1. Traits of considered alien (A), cryptogenic (C), range-expanding (RE) and vagrant (V) Mediterranean fish species of Atlantic origin.

Generally, Golani et al. (2013), Froese & Pauly (2018) and Louisy (2015) were used as sources to determine the trait values of all species. Additional sources are listed in the last column of the table.

Column headings refer to the following traits:

Body size [numeric value]	
L_c (cm)	Common length as defined by Froese & Pauly (2018)
Depth range [numeric values]	
D_{min} (m)	Shallowest depth at which recorded
D_{max} (m)	Deepest depth at which recorded
Habitat type [nominal variable; 5 categories]	
HT_pelagic	Pelagic habitat type [0 = absent; 1 = present]
HT_hard bottom	Hard bottom habitat type [0 = absent; 1 = present]
HT_soft bottom	Soft bottom habitat type [0 = absent; 1 = present]
HT_vegetated bottom	Vegetated habitat type [0 = absent; 1 = present]
HT_multi-habitat use	Multi-habitat use habitat type [0 = absent; 1 = present]
Feeding type [nominal variable; 4 categories]	
FT_planktivorous	Planktivorous feeding type [0 = absent; 1 = present]
FT_herbivorous	Herbivorous feeding type [0 = absent; 1 = present]
FT_carnivorous	Carnivorous feeding type [0 = absent; 1 = present]
FT_omnivorous	Omnivorous feeding type [0 = absent; 1 = present]
Schooling behaviour [ordinal variable; 4 categories]	
[1 = solitary; 2 = mostly in pairs; 3 = mostly in small groups or shoals; 4 = large schools]	
Latitudinal range (°) [numeric value]	
Range between the northernmost and southernmost latitudes of distribution in the Atlantic Ocean	
Temperature range [numeric values]	
T_{min} (°C)	Lowest temperature at which recorded
T_{max} (°C)	Highest temperature at which recorded
T_{range} (°C)	Range between lowest and highest temperature values at which recorded
Migratory type [nominal variable; 2 categories]	
MT_oceanodromous	[0 = non-migratory; 1 = oceanodromous or amphidromous]

Species	Category	Body size (L _c : cm)	D _{min} (m)	D _{max} (m)	HT_pelagic	HT_hard bottom	HT_soft bottom	HT_vegetated bottom	HT_multi-habitat use	FT_planktivorous	FT_herbivorous	FT_carnivorous	FT_omnivorous	Schooling behaviour	Latitudinal range (°)	T _{min} (°C)	T _{max} (°C)	T _{range} (°C)	MT_oceanodromous	Remarks and additional references
<i>Abudefduf hoefleri</i> (Steindachner 1881)	C	15	1	15	0	1	0	0	0	0	0	0	1	3	44	19	28	9	0	Temperature values estimated based on <i>Cephalopholis nigri</i> with similar distribution
<i>Abudefduf saxatilis</i> Linnaeus, 1758	RE	15	1	15	0	1	0	0	0	0	0	0	1	3	78	20	28	8	0	
<i>Acanthocybium solandri</i> (Cuvier, 1832)	V	170	0	12	1	0	0	0	0	0	0	1	0	3	107	18	28	10	1	Riede 2004
<i>Acanthurus chirurgus</i> (Bloch, 1787)	A	35	2	25	0	1	0	0	0	0	1	0	0	3	65	22	28	6	0	Luiz-Júnior et al. 2004; Rocha et al. 2012
<i>Acanthurus coeruleus</i> Bloch & Schneider, 1801	A	25	2	40	0	1	0	0	0	0	1	0	0	3	57	23	28	5	0	
<i>Acanthurus monroviae</i> Steindachner, 1876	RE	38	5	40	0	1	0	0	0	1	0	0	0	3	45	22	28	6	0	Luiz-Júnior et al. 2004; Abesamis et al. 2012
<i>Aluterus monoceros</i> (Linnaeus, 1758)	V	40	1	80	0	1	0	0	0	0	0	1	0	2	82	20	29	9	0	
<i>Anarhichas lupus</i> (Linnaeus, 1758)	V	50	18	110	0	1	0	0	0	0	0	1	0	1	42	1	12	11	1	Riede 2004
<i>Beryx splendens</i> Lowe, 1934	RE	40	400	600	0	1	0	0	0	0	0	1	0	4	88	7	13	6	0	Kells & Carpenter 2011
<i>Carcharhinus altimus</i> (Springer, 1950)	V	250	25	800	0	0	0	0	1	0	0	1	0	1	71	14	26	12	0	
<i>Carcharhinus falciformis</i> (Müller & Henle, 1839)	V	250	0	300	0	0	0	0	1	0	0	1	0	1	85	12	29	17	1	Riede 2004
<i>Carlarius parkii</i> (Günther, 1864)	C	40	50	80	0	0	1	0	0	0	0	1	0	3	52	18	20	3	0	Conand et al. 1995
<i>Centrolabrus exoletus</i> (Linnaeus, 1758)	C	12	2	15	0	0	0	1	0	0	0	1	0	1	25	9	13	4	0	
<i>Cephalopholis nigri</i> (Günther, 1859)	C	20	5	50	0	1	1	0	0	0	0	1	0	1	44	19	28	9	0	

<i>Cephalopholis taeniops</i> (Valenciennes, 1828)	RE	40	20	200	0	1	1	0	0	0	0	1	0	1	46	16	21	5	0	
<i>Chaunax suttkusi</i> Caruso, 1989	V	18	220	1000	0	1	1	0	0	0	0	1	0	1	50	6	17	11	0	
<i>Cheilopogon furcatus</i> (Mitchill, 1815)	C	25	0	20	1	0	0	0	0	1	0	1	0	3	88	20	28	8	1	Riede 2004
<i>Chilomycterus reticulatus</i> (Linnaeus, 1758)	C	25	20	100	0	0	0	0	1	0	0	1	0	1	64	18	28	10	0	Leis 2016; Seret & 1990
<i>Chilomycterus spinosus mauretanicus</i> (Le Danois, 1954)	C	20	10	100	0	0	1	0	0	0	0	1	0	1	38	19	28	9	0	Jing et al. 2015; Leis 2016; Seret & 1990. Temperature values estimated based on <i>Cephalopholis nigri</i> with similar distribution
<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	C	25	0	55	1	0	0	0	0	1	0	1	0	4	83	23	28	5	0	Smith-Vaniz 2016
<i>Cyclopterus lumpus</i> Linnaeus, 1758	V	43	0	150	0	1	0	0	0	0	0	1	0	1	48	1	11	10	1	
<i>Dentex canariensis</i> Steindachner, 1881	C	33	2	150	0	0	0	0	1	0	0	1	0	3	54	13	16	3	0	
<i>Diaphus dumerilii</i> (Bleeker, 1856)	C	8	0	800	1	0	0	0	0	0	0	1	0	4	91	6	14	8	1	Riede 2004; Hulley & Paxton 2016
<i>Dicologlossa hexophthalma</i> (Bennett, 1831)	RE	18	10	150	0	0	1	0	0	0	0	1	0	1	51	18	28	10	0	Louisy 2015
<i>Diodon hystrix</i> Linnaeus, 1758	C	40	2	50	0	1	0	0	0	0	0	1	0	1	66	23	29	6	0	
<i>Diplodus bellottii</i> (Steindachner, 1882)	RE	15	30	50	0	0	0	0	1	0	0	1	0	3	22	18	22	4	0	
<i>Enchelycore anatina</i> (Lowe, 1838)	RE	100	3	60	0	1	0	0	0	0	0	1	0	1	57	18	20	2	0	
<i>Fistularia petimba</i> Lacepède, 1803	C	80	10	200	0	0	1	0	0	0	0	1	0	3	83	23	29	6	0	Randall 1995
<i>Gadus morhua</i> Linnaeus, 1758	V	100	30	200	0	0	0	0	1	0	0	1	0	3	38	1	10	9	1	Riede 2004
<i>Galeocerdo cuvier</i> (Péron & LeSueur, 1822)	V	500	0	370	0	0	0	0	1	0	0	1	0	1	106	16	29	13	1	Riede 2004
<i>Gephyroberyx darwini</i> (Johnson, 1866)	RE	45	200	500	0	1	0	0	0	0	0	1	0	4	78	8	19	11	0	Iwamoto 2015; Fernández-Perlata & Puerto 2017; Radtke 2009
<i>Gymnammodytes semisquamatus</i> (Jourdain, 1879)	RE	15	10	50	0	0	1	0	0	1	0	0	0	4	25	8	12	5	0	

<i>Halosaurus ovenii</i> Johnson, 1863	C	60	440	1700	0	1	1	0	0	0	0	1	0	3	73	4	11	7	0	
<i>Holacanthus africanus</i> Cadenat, 1951	C	30	1	14	0	1	0	0	0	0	1	0	0	1	21	24	28	4	0	Bailly 2016; Seret & Opic 1990
<i>Holacanthus ciliaris</i> (Linnaeus, 1758)	C	30	1	70	0	1	0	0	0	0	1	0	0	1	24	24	28	4	0	
<i>Holocentrus adscensionis</i> (Osbeck, 1765)	C	25	8	30	0	1	0	0	0	0	0	1	0	3	62	23	28	5	0	
<i>Istiompax indica</i> (Cuvier, 1832)	V	380	0	200	1	0	0	0	0	0	0	1	0	1	91	15	30	15	1	Riede 2004
<i>Isurus paucus</i> Guitart, 1966	V	200	0	1750	1	0	0	0	0	0	0	1	0	1	81	9	26	17	1	Riede 2004
<i>Kyphosus vaigiensis</i> (Quoy & Gaimard, 1825)	C	50	0	40	0	1	0	0	0	0	1	0	0	3	73	20	28	8	1	Riede 2004
<i>Lampanyctus intricarius</i> Tåning, 1928	C	15	40	750	1	0	0	0	0	0	0	1	0	4	111	7	15	9	1	Riede 2004; Hulley & Paxton 2016
<i>Lutjanus jocu</i> (Bloch & Schneider, 1801)	A	60	2	40	0	1	0	0	0	0	0	1	0	1	68	23	28	5	0	
<i>Microchirus boscanion</i> (Chabanaud, 1926)	RE	10	12	100	0	0	1	0	0	0	0	1	0	1	44	16	28	12	0	
<i>Mobula japonica</i> (Müller & Henle, 1841)	V	225	0	200	1	0	0	0	0	1	0	0	0	3	70	18	29	12	0	Whites et al. 2006
<i>Mycteroperca fusca</i> (Lowe, 1838)	C	50	1	30	0	1	0	0	0	0	0	1	0	1	27	16	25	9	0	
<i>Ophioblennius atlanticus</i> (Valenciennes, 1836)	C	20	1	15	0	1	0	0	0	0	1	0	0	1	38	15	28	13	0	Wirtz 2011; Locarnini et al. 2018
<i>Pagellus bellottii</i> Steindachner, 1882	RE	25	10	50	0	1	1	0	0	0	0	1	0	4	54	18	28	10	0	
<i>Parablennius pilicornis</i> (Cuvier, 1829)	RE	12	1	25	0	1	0	0	0	0	0	1	0	1	100	18	28	10	0	
<i>Paranthias furcifer</i> (Valenciennes, 1828)	A	20	8	100	0	1	0	0	0	1	0	0	0	3	60	21	28	7	0	
<i>Pinguipes brasilianus</i> Cuvier, 1829	A	24	60	150	0	0	1	0	0	0	0	1	0	1	20	4	10	6	0	
<i>Pisodonophis semicinctus</i> (Richardson, 1848)	RE	60	10	30	0	0	1	0	0	0	0	1	0	1	54	24	28	4	0	
<i>Priacanthus arenatus</i> Cuvier, 1829	C	35	15	100	0	1	0	0	0	0	0	1	0	3	84	17	28	11	0	
<i>Psenes pellucidus</i> Lütken, 1880	RE	50	50	1000	1	0	0	0	0	1	0	1	0	1	66	1	20	19	0	Louisy 2015

<i>Pseudupeneus prayensis</i> (Cuvier, 1829)	RE	35	10	75	0	0	1	0	0	0	0	1	0	3	52	18	28	10	0	
<i>Rhizoprionodon acutus</i> (Rüppell, 1837)	V	110	1	200	0	0	1	0	0	0	0	1	0	1	71	20	28	9	1	Riede 2004
<i>Sciaenops ocellatus</i> (Linnaeus, 1766)	A	100	10	40	0	0	1	0	0	0	0	1	0	3	43	16	27	12	1	Riede 2004; Powers et al. 2012; Wenner 1992; Buskill 2017
<i>Scorpaena stephanica</i> Cadenat, 1943	C	20	46	200	0	1	1	0	0	0	0	1	0	1	38	13	18	5	0	Temperature range given by Froese & Pauly (2018) contrasts the tropical distribution of the species.
<i>Selene dorsalis</i> (Gill, 1862)	C	24	20	100	0	0	1	0	0	0	0	1	0	4	67	18	26	8	0	Smith-Vaniz 2016
<i>Seriola carpenteri</i> Mather, 1971	RE	40	0	200	1	0	0	0	0	0	0	1	0	4	56	16	24	9	0	Smith-Vaniz 2016
<i>Seriola fasciata</i> (Bloch, 1993)	RE	50	55	130	0	0	0	0	1	0	0	1	0	4	73	18	26	8	0	Smith-Vaniz 2016
<i>Seriola rivoliana</i> Valenciennes, 1833	RE	90	5	245	0	0	0	0	1	0	0	1	0	4	81	22	29	7	0	Smith-Vaniz 2016
<i>Solea senegalensis</i> Kaup, 1858	RE	45	12	65	0	0	1	0	0	0	0	1	0	1	63	13	22	9	0	
<i>Sphoeroides marmoratus</i> (Lowe, 1838)	C	15	3	90	0	1	1	0	0	0	0	1	0	1	57	20	28	8	0	
<i>Sphoeroides pachygaster</i> (Müller & Troschel, 1848)	RE	26	50	250	0	1	1	0	0	0	0	1	0	1	112	11	28	17	0	
<i>Sphyrna mokarran</i> (Rüppell, 1837)	V	370	1	300	1	0	0	0	0	0	0	1	0	1	82	21	29	8	1	Riede 2004
<i>Stegastes variabilis</i> (Castelnau, 1855)	A	10	0	30	0	1	0	0	0	0	0	0	1	1	24	22	28	6	0	
<i>Synaptura lusitanica</i> de Brito Capello, 1868	RE	30	5	60	0	0	1	0	0	0	0	1	0	1	39	23	28	5	0	
<i>Syngnathus rostellatus</i> Nilsson, 1855	C	15	0	15	0	0	1	1	0	1	0	0	0	1	18	9	12	4	0	
<i>Taractes rubescens</i> (Jordan & Evermann, 1887)	C	30	0	600	0	0	0	0	1	0	0	1	0	1	63	13	26	13	1	Riede 2004
<i>Trachyscorpia cristulata</i> ssp. <i>echinata</i> (Köhler, 1896)	RE	25	200	2500	0	0	1	0	0	0	0	1	0	1	46	7	11	4	0	
<i>Zenopsis conchifera</i> (Lowe, 1852)	RE	50	50	600	0	0	1	0	0	0	0	1	0	3	86	6	20	14	0	

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Table S2. Mediterranean species reported as of Atlantic origin but which are not considered recent Atlantic ‘newcomers’ in the present work.

Species are organised into three categories according to the main reason for exclusion from the list of ‘newcomers’:

- (a) Misidentification or uncertain identification
- (b) Known only from older (pre-1960) records and/or uncertainty regarding current occurrence
- (c) Generally considered to be native or having historical (pre-1850) records from the Mediterranean

(a) Species omitted due to misidentification or uncertain identification

Species	Remarks and references
<i>Bregmaceros atlanticus</i> Goode & Bean, 1886	Recorded by Yılmaz et al. (2004), Goren & Galil (2008), Filiz et al. (2007), Aydin & Akyol (2013), Turan et al. (2011). Excluded since all records refer to a misidentification of <i>Bregmaceros nectabanus</i> , a Lessepsian immigrant (Harold & Golani, 2016).
<i>Coelorhynchus occa</i> (Goode & Bean, 1885)	Recorded by Allue (1983) (as cited in Ben Rais Lasram et al., 2008). Excluded since considered a misidentification of <i>Coelorhynchus mediterraneus</i> (Psomadakis et al., 2012).
<i>Kyphosus incisor</i> (Cuvier, 1831)	Following Knudsen & Clements (2013, 2016) and Mannino et al. (2015), <i>Kyphosus incisor</i> is considered a synonym of <i>Kyphosus vaigiensis</i> . Excluded as a separate species, but records included with those for <i>K. vaigiensis</i> (see Knudsen & Clements, 2013; Mannino et al., 2015; Lo Brutto, 2017).
<i>Sargocentron hastatum</i> (Valenciennes, 1829)	Recorded by Evans & Schembri (2016) but identification based on images only. Excluded since Bariche et al. (2015) indicate ‘ <i>Sargocentron rubrum</i> ’ to be a species complex with multiple unrecognized species in the Mediterranean, raising doubts about identification of any Mediterranean <i>Sargocentron</i> species from images alone.
<i>Sphyrna tudes</i> (Valenciennes, 1822)	Listed as an Atlantic immigrant by Psomasakis et al. (2012); Froese & Pauly (2018) consider it native in the Mediterranean, while Mycock et al. (2006) and Louisy (2015) consider that Mediterranean records are in error. The original records from the Mediterranean by Valenciennes (1822) and the current lectotype of this species (MNH 1049 from Nice, France) most likely represent <i>Sphyrna couardi</i> (Mycock et al., 2006). Excluded due to old first record and probable misidentification.
<i>Torpedo fuscomaculata</i> Peters, 1855	Recorded by Mazhar (1982) (as cited in Ben Rais Lasram et al., 2008). Excluded since considered a probable misidentification of <i>Torpedo marmorata</i> (Psomadakis et al., 2012).

(b) Species known only from older (pre-1960) records and/or where there is uncertainty regarding current occurrence

Species	Remarks and references
<i>Entelurus aequoreus</i> (Linnaeus, 1758)	Recorded by Risso (1810) and treated as a successful Mediterranean coloniser by Ben Rais Lasram et al. (2008); listed as native in Psomadakis et al. (2012), but does not occur in the Mediterranean according to Louisy (2015) and Froese & Pauly (2018). Excluded due to old first record and confusion regarding current occurrence in Mediterranean.
<i>Exocoetus obtusirostris</i> Günther, 1866	Possibly rare native species (Psomadakis et al., 2012; Froese and Pauly, 2018) but only confirmed Mediterranean record is by Tortonese (1937). Excluded due to absence of records made after 1960.
<i>Nerophis lumbriciformis</i> (Jenyns, 1835)	Recorded by Lozano Rey (1947) (as cited in Ben Rais Lasram et al., 2008); listed as native to the Mediterranean by Psomadakis et al. (2012) but not by Froese & Pauly (2018). Excluded due to confusion regarding native status and apparent absence of records made after 1960.
<i>Pristis pectinata</i> Latham, 1794	Listed as Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Risso (1810), but old Mediterranean records of sawfishes should be considered doubtful (Psomadakis et al., 2012); a specimen recorded by Costa (1837) is considered <i>Pristis</i> sp. but its specific identity has not been established (Psomadakis et al., 2012). Excluded due absence of records made after 1960.

(c) Species that are generally considered to be native or having historical (pre-1850) records from the Mediterranean

Species	Remarks and references
<i>Callionymus reticulatus</i> Valenciennes, 1837	Records from the Balearic Islands in 2014 and 2016 represent the first from the Mediterranean since the collection of the holotype from Malaga (Spain) before 1831 (Fricke & Ordines, 2017); the pre-1831 record indicates that the Mediterranean lies within the historical native range of the species.
<i>Carcharhinus brachyurus</i> (Günther, 1870)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Moreno & Hoyos (1983), but the species is considered native to the Mediterranean (Compagno, 1984; Psomadakis et al., 2012; Froese & Pauly, 2018).
<i>Ephippion guttifer</i> (Bennett, 1831)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Gaidropsarus granti</i> (Regan, 1903)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Zachariou Mamalingua (1999), but Psomadakis et al. (2012) and Golani et al. (2017) state it is not possible to determine if native or a recent immigrant, while the species is considered native to the Mediterranean by other authors (Louisy, 2015; Froese & Pauly, 2018).
<i>Galeoides decadactylus</i> (Bloch, 1795)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Galeus atlanticus</i> (Vaillant, 1888)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Munoz Chapuli & Perz Ortega (1985), but the species is considered native to the Mediterranean; old records are lacking due to past confusion with <i>Galeus melastomus</i> (Munoz Chapuli & Perz Ortega, 1985; Rey et al., 2006, 2010; Psomadakis et al., 2012).
<i>Gobius couchi</i> Miller & El-Tawil, 1974	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Stefanni & Mazzoldi (1999), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Golani et al., 2017; Froese & Pauly, 2018).
<i>Hyperoglyphe perciformis</i> (Mitchill, 1818)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Karrer (1986), but the species is considered native to the Mediterranean (Psomadakis et al., 20012; Froese & Pauly, 2018).
<i>Kyphosus sectatrix</i> (Linnaeus, 1758)	Records of this species in 1846, 1883 and 1903 indicate that it historically occurred in the Mediterranean and cannot be considered a recent newcomer (Lo Brutto, 2017); considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Laemonema latifrons</i> (Holt & Byrne, 1908)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Matallanas (1985), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Golani et al., 2017; Froese & Pauly, 2018).
<i>Lagocephalus lagocephalus</i> (Linnaeus, 1758)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Carus (1893), but date of record indicates that Mediterranean forms part of its historical range and it cannot be considered a recent newcomer, while the species is also considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Lepidion guentheri</i> (Giglioli, 1880)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Allue et al. (1981), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Golani et al., 2017; Froese & Pauly, 2018).
<i>Lesueurigobius sanzoi</i> (de Buen, 1918)	Listed as Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Lipophrys pholis</i> (Linnaeus, 1758)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but Psomadakis et al.

	(2012) state it is not possible to determine if native or a recent immigrant, while the species is considered native to the Mediterranean by other authors (Louisy, 2015; Froese & Pauly, 2018).
<i>Microchirus azevia</i> (de Brito Capello, 1867)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Parapristipoma octolineatum</i> (Valenciennes, 1833)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Pomadasys incisus</i> (Bowdich, 1825)	Often considered an Atlantic immigrant, but first Mediterranean record dates back to 1840 and had reached Israel by 1893; hence species is not a recent newcomer (see Bodilis et al., 2013). Species also considered native by some authors (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Pontinus kuhlii</i> (Bowdich, 1825)	Often considered an Atlantic immigrant (including by Ben Rais Lasram et al., 2008), but first Mediterranean record dates back to 1838 (Sauvage, 1878), hence species is not a recent newcomer. Species also considered native by some authors (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Serranus atricauda</i> Günther, 1874	Listed as Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987) but there are older records from the Mediterranean (Dieuzeide et al., 1954) and the species is considered native to this region (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).
<i>Serrivomer brevidentatus</i> (Schmidt, 1916)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Froese & Pauly, 2018).
<i>Squalus megalops</i> (Macleay, 1881)	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Munoz Chapuli et al. (1984), but the species is considered native to the Mediterranean; old records are lacking due to confusion with <i>Squalus blainville</i> , while taxonomy of genus is not fully resolved (Psomadakis et al., 2012; Golani et al., 2017; Verissimo et al., 2017).
<i>Tetrapturus georgii</i> Lowe, 1841	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but there are older records from the Mediterranean and the species is considered native to this region (Nakumura, 1985; Shivji et al., 2006; Psomadakis et al., 2012; Froese & Pauly, 2018).
<i>Umbrina canariensis</i> Valenciennes, 1843	Listed as an Atlantic immigrant by Ben Rais Lasram et al. (2008) based on record by Fredj & Maurin (1987), but the species is considered native to the Mediterranean (Psomadakis et al., 2012; Louisy, 2015; Froese & Pauly, 2018).

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Table S3. Mediterranean species considered recent Atlantic ‘newcomers’ in the present work, with rationale for categorisation as alien (A), cryptogenic (C), range-expanding (RE) and vagrant (V) species

Detailed records of each species from different parts of the Mediterranean are given in Table S4

Species	Category	Rationale
<i>Abudefduf hoefleri</i> (Steindachner 1881)	C	Cryptogenic since only known from one isolated record
<i>Abudefduf saxatilis</i> Linnaeus, 1758	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Acanthocybium solandri</i> (Cuvier, 1832)	V	Vagrant since only known from two records made more than a century apart
<i>Acanthurus chirurgus</i> (Bloch, 1787)	A	Alien species since native range restricted to western Atlantic and Senegal; Mediterranean records are attributed to aquarium release (Langeneck et al., 2015; Evans et al., 2017)
<i>Acanthurus coeruleus</i> Bloch & Schneider, 1801	A	Alien species since native range restricted to western Atlantic and Ascension Island
<i>Acanthurus monroviae</i> Steindachner, 1876	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Aluterus monoceros</i> (Linnaeus, 1758)	V	Vagrant since only known from two isolated records that are attributed to immigration from east Atlantic (Ben Souissi et al., 2011)
<i>Anarhichas lupus</i> (Linnaeus, 1758)	V	Vagrant since only known from one isolated record, human-mediated introduction is highly unlikely, and species is oceanodromous
<i>Beryx splendens</i> Lowe, 1934	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Carcharhinus altimus</i> (Springer, 1950)	V	Vagrant since only known from two isolated West Mediterranean records and human-mediated introduction is not plausible; origin of East Mediterranean records unclear since species also occurs in western Indian Ocean and Red Sea (Froese & Pauly, 2018)
<i>Carcharhinus falciformis</i> (Müller & Henle, 1839)	V	Vagrant since only known from three isolated records and human-mediated introduction is not plausible
<i>Carlarius parkii</i> (Günther, 1864)	C	Cryptogenic since only known from one isolated record
<i>Centrolabrus exoletus</i> (Linnaeus, 1758)	C	Cryptogenic since only known from one isolated record
<i>Cephalopholis nigri</i> (Günther, 1859)	C	Cryptogenic since only known from one isolated record
<i>Cephalopholis taeniops</i> (Valenciennes, 1828)	RE	Range expansion as considered to be established in the central Mediterranean (Zenetos et al., 2010)

<i>Chaunax suttkusi</i> Caruso, 1989	V	Vagrant since only known from two isolated records and human-mediated introduction is not plausible
<i>Cheilopogon furcatus</i> (Mitchill, 1815)	C	Cryptogenic since only known from one isolated record
<i>Chilomycterus reticulatus</i> (Linnaeus, 1758)	C	Cryptogenic since only known from one isolated record
<i>Chilomycterus spinosus mauretanicus</i> (Le Danois, 1954)	C	Cryptogenic since only known from one isolated record
<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	C	Cryptogenic since only known from one isolated record
<i>Cyclopterus lumpus</i> Linnaeus, 1758	V	Vagrant since only known from one isolated record, human-mediated introduction is highly unlikely, and species is oceanodromous
<i>Dentex canariensis</i> Steindachner, 1881	C	Cryptogenic since only known from one isolated record
<i>Diaphus dumerilii</i> (Bleeker, 1856)	C	Cryptogenic since only known from one isolated record
<i>Dicologlossa hexophthalma</i> (Bennett, 1831)	RE	Range expansion as there are at least three records which show an eastward progression in the Mediterranean
<i>Diodon hystrix</i> Linnaeus, 1758	C	Cryptogenic as there are only two isolated records, and since the species has a circumtropical distribution that includes the Eastern Atlantic and also the Red Sea, so Lessepsian immigration cannot be definitively excluded
<i>Diplodus bellottii</i> (Steindachner, 1882)	RE	Range expansion since there are at least three records from the Mediterranean; considered to be established in the western Mediterranean (Zenetos et al., 2010)
<i>Enchelycore anatina</i> (Lowe, 1838)	RE	Range expansion given the numerous records from the Mediterranean in recent years; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Fistularia petimba</i> Lacepède, 1803	C	Cryptogenic since there are only two isolated records, one of which could be due to Lessepsian immigration (Stern et al., 2017)
<i>Gadus morhua</i> Linnaeus, 1758	V	Vagrant since only known from one isolated record and human-mediated introduction is not plausible (see Morey et al., 2012)
<i>Galeocerdo cuvier</i> (Péron & LeSueur, 1822)	V	Vagrant since only known from three isolated records and human-mediated introduction is not plausible
<i>Gephyroberyx darwini</i> (Johnson, 1866)	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Gymnammodytes semisquamatus</i> (Jourdain, 1879)	RE	Range expansion as considered to be established in the western Mediterranean (Zenetos et al., 2010)
<i>Halosaurus ovenii</i> Johnson, 1863	C	With four Mediterranean records this species could meet the criteria for 'range-expansion', but it is a deep-water species with a very wide distribution range in the eastern Atlantic, suggesting it may also be a rare deep-water species in the Mediterranean; for the moment we therefore treat this species as cryptogenic
<i>Holacanthus africanus</i> Cadenat, 1951	C	Cryptogenic since only known from one isolated record
<i>Holacanthus ciliaris</i> (Linnaeus, 1758)	C	Cryptogenic since only known from one isolated record

<i>Holocentrus adscensionis</i> (Osbeck, 1765)	C	Cryptogenic since only known from one isolated record
<i>Istiompax indica</i> (Cuvier, 1832)	V	Vagrant since only known from one isolated record and human-mediated introduction is not plausible
<i>Isurus paucus</i> Guitart, 1966	V	Vagrant since only known from two isolated records and human-mediated introduction is not plausible
<i>Kyphosus vaigiensis</i> (Quoy & Gaimard, 1825)	C	Cryptogenic since both autonomous spread and human-mediated introduction are possible (rudderfish are known to actively follow vessels)
<i>Lampanyctus intricarius</i> Tåning, 1928	C	Cryptogenic since only known from one isolated record
<i>Lutjanus jocu</i> (Bloch & Schneider, 1801)	A	Alien species since native range is restricted to the western Atlantic; a few individuals reported from Ascension Island and one specimen from Tinhosa Grande in the south-east Atlantic (see Psomadakis et al., 2012)
<i>Microchirus boscanion</i> (Chabanaud, 1926)	RE	Range expansion since considered to be established in the western Mediterranean (Zenetos et al., 2010)
<i>Mobula japanica</i> (Müller & Henle, 1841)	V	A human-mediated introduction is not plausible for this species and with recent records from three regions in the Mediterranean it could meet the criteria for 'range-expansion'. However all records were made within a short time of each other and to date there have been no further reports of this species from the Mediterranean; for the moment we therefore treat this species as vagrant
<i>Mycteroperca fusca</i> (Lowe, 1838)	C	Cryptogenic since only known from one isolated record
<i>Ophioblennius atlanticus</i> (Valenciennes, 1836)	C	Cryptogenic since only known from two isolated records and both autonomous spread and human-mediated introduction are possible
<i>Pagellus bellottii</i> Steindachner, 1882	RE	Range expansion as there are at least three records which show an eastward progression in the Mediterranean; considered to be established in the western Mediterranean (Zenetos et al., 2010)
<i>Parablennius pilicornis</i> (Cuvier, 1829)	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Paranthias furcifer</i> (Valenciennes, 1828)	A	Alien species since native range restricted to western Atlantic
<i>Pinguipes brasilianus</i> Cuvier, 1829	A	Alien species since native distribution is south-west Atlantic
<i>Pisodonophis semicinctus</i> (Richardson, 1848)	RE	Range expansion given the numerous records from the Mediterranean in recent years; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Priacanthus arenatus</i> Cuvier, 1829	C	Cryptogenic since only known from two isolated records
<i>Psenes pellucidus</i> Lütken, 1880	RE	Range expansion given the numerous records from the Mediterranean in recent years
<i>Pseudupeneus prayensis</i> (Cuvier, 1829)	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Rhizoprionodon acutus</i> (Rüppell, 1837)	V	Vagrant since only known from one isolated record and human-mediated introduction is not plausible

<i>Sciaenops ocellatus</i> (Linnaeus, 1766)	A	Alien species since native range restricted to western Atlantic; Mediterranean records are attributed to aquaculture escapees (Golani et al., 2015; Langeneck et al., 2017)
<i>Scorpaena stephanica</i> Cadenat, 1943	C	Cryptogenic since only known from one isolated record
<i>Selene dorsalis</i> (Gill, 1862)	C	Cryptogenic since only known from one isolated record
<i>Seriola carpenteri</i> Mather, 1971	RE	Range expansion since recorded at least three times from the Mediterranean, including mature specimens; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Seriola fasciata</i> (Bloch, 1993)	RE	Range expansion given the numerous records from the Mediterranean in recent years; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Seriola rivoliana</i> Valenciennes, 1833	RE	Range expansion given that there are six separate records from the Mediterranean in recent years
<i>Solea senegalensis</i> Kaup, 1858	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Sphoeroides marmoratus</i> (Lowe, 1838)	C	With three Mediterranean records this species could meet the criteria for 'range-expansion', but these records do not show an eastward progression given that the first Mediterranean record is the easternmost one to date. In addition, there has been past taxonomic confusion with <i>S. spengleri</i> (Bloch, 1785); for the moment we therefore treat this species as cryptogenic
<i>Sphoeroides pachygaster</i> (Müller & Troschel, 1848)	RE	Range expansion given the numerous records from the Mediterranean in recent years; considered to be established in the Mediterranean (Zenetos et al., 2010)
<i>Sphyrna mokarran</i> (Rüppell, 1837)	V	Vagrant since only known from one isolated record and human-mediated introduction is not plausible
<i>Stegastes variabilis</i> (Castelnau, 1855)	A	Alien species since native range restricted to western Atlantic
<i>Synaptura lusitanica</i> de Brito Capello, 1868	RE	Range expansion since considered to be established in the western Mediterranean (Zenetos et al., 2010)
<i>Syngnathus rostellatus</i> Nilsson, 1855	C	Cryptogenic since there is only one verified record; reports from the central and eastern Mediterranean were made in error (see Hablützel & Wilson, 2011)
<i>Taractes rubescens</i> (Jordan & Evermann, 1887)	C	Cryptogenic since only known from one isolated record
<i>Trachyscorpia cristulata</i> ssp. <i>echinata</i> (Köhler, 1896)	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean
<i>Zenopsis conchifera</i> (Lowe, 1852)	RE	Range expansion since there are at least three records which show an eastward progression in the Mediterranean

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Table S4. Year of first record of Mediterranean fish species of Atlantic origin in different sectors of the Mediterranean Sea

Species	First record	Strait of Gibraltar / Alboran	Morocco / Algeria	Spain / Balearic Islands	Gulf of Lion	Corsica / Ligurian Sea	Sardinia / Tyrrhenian Sea	Sicily Channel	Tunisia	Libya	South Italy / Ionian Sea	Adriatic Sea	Aegean / Thracian Sea	Rhodes / Crete	Turkey	Cyprus	Lebanon / Syria	Egypt / Israel	Remarks and additional references
<i>Abudefduf hoefleri</i> (Steindachner 1881)	2014							2014											Vella et al. (2016a)
<i>Abudefduf saxatilis</i> Linnaeus, 1758	2009			2009				2013										2013	Azzurro et al. (2013); Deidun & Castriota (2014); Tsadok et al. (2015); Vella et al. (2016b)
<i>Acanthocybium solandri</i> (Cuvier, 1832)	1872							1872											Has been recorded a second time in 2005, also from the Sicily Channel; Doderlein (1872); Romeo et al. (2005)
<i>Acanthurus chirurgus</i> (Bloch, 1787)	2015						2015	2016											Langeneck et al. (2015); Evans et al. (2017)
<i>Acanthurus coeruleus</i> Bloch and Schneider, 1801	2011							2013								2011		2014	Langeneck et al. (2012); Evans et al. (2015); Golani et al. (2015a)
<i>Acanthurus monroviae</i> Steindachner, 1876	1981	1981	2001					2013	2010				2015					1996	Crespo et al. (1987); Golani & Sonin (1996); Hemida et al. (2004); Ben Souissi et al. (2011); Langeneck et al. (2012); Batjakas et al. (2015); Evans et al. (2015)
<i>Aluterus monoceros</i> (Linnaeus, 1758)	2000			2000					2010										Gualart & Vicent (2009); Ben Souissi et al. (2011)
<i>Anarhichas lupus</i> (Linnaeus, 1758)	1958					1958													Tortonese (1958)

<i>Beryx splendens</i> Lowe, 1934	1990					1990	2001	2007											Gavagnin et al (1992); Orsi-Relini et al. (1995); Psomadakis et al. (2006); Bianchini & Ragonese (2007); Ligas et al. (2010); Psomadakis et al. (2012a)
<i>Carcharhinus altimus</i> (Springer, 1950)	1983	1983	2001													1997		1996	Moreno & Hoyos (1983); Baştusta & Erdem (2000), Mofrah et al. (2011), Golani et al. (2017)
<i>Carcharhinus falciformis</i> (Müller & Henle, 1839)	1987	1987	2001			2001				2002									Moreno (1987); Bradai et al (2004); Garibaldi & Orsi Relini (2012); Golani et al. (2017)
<i>Carlarius parkii</i> (Günther, 1864)	1983																	1983	Golani & Ben-Tuvia (1986); Golani & Sonin (1996)
<i>Centrolabrus exoletus</i> (Linnaeus, 1758)	1981	1981																	Nuñez & Piote (1981)
<i>Cephalopholis nigri</i> (Günther, 1859)	2016							2016											Vella et al. (2016c)
<i>Cephalopholis taeniops</i> (Valenciennes, 1828)	2002							2008		2002								2008	Ben Abdallah et al. (2007); Salameh et al. (2009); Guidetti et al. (2010); Evans & Schembri (2017)
<i>Chaunax suttkusi</i> Caruso, 1989	1997		1997						2000										Ragonese & Giusto (1997); Ragonese et al. (2001)
<i>Cheilopogon furcatus</i> (Mitchill, 1815)	2004								2004										Ben Souissi et al. (2005)
<i>Chilomycterus reticulatus</i> (Linnaeus, 1758)	2008						2008												Follesa et al. (2009)
<i>Chilomycterus spinosus mauretanicus</i> (Le Danois, 1954)	2008	2008																	Garrido et al. (2014)
<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	1997		1997																Peña Rivas et al. (2013)
<i>Cyclopterus lumpus</i> Linnaeus, 1758	2004											2004							Dulčić & Golani (2006)

<i>Dentex canariensis</i> Steindachner, 1881	2017	2017																							Peña-Rivas et al. (2018)	
<i>Diaphus dumerilii</i> (Bleeker, 1856)	2015																2015									Cavallaro et al. (2016)
<i>Dicologlossa hexophthalma</i> (Bennett, 1831)	1984		2004	1984	1984	1988								1987												Matallanas (1984a); Li Greci et al. (1987); Quignard & Tomasini (2000); Massutí et al. (2004)
<i>Diodon hystrix</i> Linnaeus, 1758	1963			2016										1963												Torchio (1963); Ordines et al. (2018)
<i>Diplodus bellottii</i> (Steindachner, 1882)	1981	1981	1983	1982																						Reina-Hervás et al. (1981, 1983); Matallanas et al. (1981)
<i>Enchelycore anatina</i> (Lowe, 1838)	1979									2013				2011	2014	<2002	2010	2000	2009					1979		Kalogirou (2010); Ben-Tuvia & Golani (1984); Yokeş et al. (2000); Bilecenoğlu (2010) and references therein; Katsanevakis et al. (2014); Dulčić et al. (2014); Deidun et al. (2015)
<i>Fistularia petimba</i> Lacepède, 1803	1997	1997																						2016		The record fom the East Mediterranean may be due to Lessepsian immigration (Stern et al., 2017) Cárdenas et al. (1997); Stern et al. (2017)
<i>Gadus morhua</i> Linnaeus, 1758	2009			2009																						Morey et al. (2012)
<i>Galeocerdo cuvier</i> (Péron & LeSueur, 1822)	1985	1985											2015	1998												Pinto de la Rosa (1994); Celona (2000); Tobuni et al. (2016)
<i>Gephyroberyx darwini</i> (Johnson, 1866)	1961		1961					2011	2007																	Dieuzeide (1963a); Bianchini & Ragonese (2007); Andarolo et al. (2012)
<i>Gymnamodytes semisquamatus</i> (Jourdain, 1879)	1990			1990																						Sabatés et al. (1990)
<i>Halosaurus ovenii</i> Johnson, 1863	1960		1960	2001				1979																		Dieuzeide (1963b); Cau & Deiana (1979); D'Onghia et al. (2004); Pais et al. (2009)
<i>Holacanthus africanus</i> Cadenat, 1951	2017								2017																	Deidun et al. (2017)

<i>Holacanthus ciliaris</i> (Linnaeus, 1758)	2011																		2011		Dulčić J. & B. Dragičević (2013a)
<i>Holocentrus adscensionis</i> (Osbeck, 1765)	2016									2016											Vella et al. (2016d)
<i>Istiompax indica</i> (Cuvier, 1832)	1986								1986												Orsi Relini & Costa (1986)
<i>Isurus paucus</i> Guitart, 1966	2001			2001	?																Moreno (1995); Hemida & Capapé (2008)
<i>Kyphosus vaigiensis</i> (Quoy & Gaimard, 1825)	1998	1998						2009		2015									2016		Azzurro et al. (2013); Orsi-Relini et al. (2010); Vella et al. (2016e); Goren et al. (2016); Lo Brutto (2017) and references therein
<i>Lampanyctus intricarius</i> Tåning, 1928	1984				1984																Allue & Rubies (1984)
<i>Lutjanus jocu</i> (Bloch & Schneider, 1801)	2005							2005													Vacchi et al. (2010)
<i>Microchirus boscanion</i> (Chabanaud, 1926)	1998				1998					2007											Bianchini & Ragonese (2007); Massuti et al. (2002)
<i>Mobula japonica</i> (Müller & Henle, 1841)	2014			2016							2014							2016			Capapé et al. (2015); Rafrafi-Nouira et al. (2015); Hemida et al. (2016); Sakalli et al. (2016)
<i>Mycteroperca fusca</i> (Lowe, 1838)	2010																		2010		Heemstra et al. (2010)
<i>Ophioblennius atlanticus</i> (Valenciennes, 1836)										2014											Falzon (2015); Azzurro et al. (2018)
<i>Pagellus bellottii</i> Steindachner, 1882	1960	1960	1960	1982														1992	2010		Dieuzeide (1960); Lucena et al. (1982); Sbaihi & Saad (1992); Fricke et al. (2014)
<i>Parablennius pilicornis</i> (Cuvier, 1829)	1963	1965	1963	1985	1987	1988	1982	1998												2004	Bath (1977); Falzon (1999); Pastor & Francour (2010) and references therein

<i>Paranthias furcifer</i> (Valenciennes, 1828)	2007																				2007	Dulčić & Dragičević (2013b); Pećarević et al. (2013); Crocetta et al. (2015)	
<i>Pinguipes brasilianus</i> Cuvier, 1829	1990																						Orsi Relini (2002)
<i>Pisodonophis semicinctus</i> (Richardson, 1848)	1957			1957																			Dieuzeide & Roland (1958); Bodilis et al. (2012) and references therein
<i>Priacanthus arenatus</i> Cuvier, 1829	1984																						Tortonese & Cau (1984); Costa (1991)
<i>Psenes pellucidus</i> Lütken, 1880	1948	1962	1948	1995	2000																		Dieuzeide & Roland (1955); Maurin (1962, 1968); Costa & Fanara (1994); Riera et al. (1995); Quignard & Tomasini (2000); Follesa et al. (2006); Ghanem et al. (2016)
<i>Pseudupeneus prayensis</i> (Cuvier, 1829)	1987	1987		2002																			Reina-Hervás (1987); Mercader (2002); Azzouz et al. (2011)
<i>Rhizoprionodon acutus</i> (Rüppell, 1837)	1985																						Pastore & Tortonese (1985); Occhipinti-Ambrogi et al. (2011)
<i>Sciaenops ocellatus</i> (Linnaeus, 1766)	1999																						1999 Golani & Mires (2000); Golani et al. (2015b); Langeneck et al. (2017)
<i>Scorpaena stephanica</i> Cadenat, 1943	1977			1977																			Allué et al. (1981)
<i>Selene dorsalis</i> (Gill, 1862)	2007																						Vella & Deidun (2008)
<i>Seriola carpenteri</i> Mather, 1971	1996																						Pizzicori et al. (2000); Capapé et al. (2018)
<i>Seriola fasciata</i> (Bloch, 1993)	1989			1989	2000	2005	2002	1994	2000	2003	1993												Massutí & Stefanescu (1993); Costa (1999); Bradai et al. (2004); Andaloro et al. (2005); Corsini et al. (2006); Sonin et al. (2009); Deidun et al. (2011); Kapisir et al. (2014); Crocetta et al. (2015); Jawad et al. (2015); Shakman et al. (2017)

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