

An updated checklist of the marine fishes of Turkey

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Abstract: The current status of marine fishes distributed along the Turkish coasts is reviewed and an updated checklist including 512 species is presented. In this study, 5 species are recorded for the first time from Turkey (*Lepidion lepidion* (Risso, 1810); *Bathophilus nigerrimus* Giglioli, 1882; *Gonostoma denudatum* Rafinesque, 1810; *Solea aegyptiaca* Chabanaud, 1927; and *Gobius roulei* de Buen, 1928), while 7 species are new to the Turkish Aegean Sea coast (*Notacanthus bonaparte* Risso, 1840; *Nettastoma melanurum* Rafinesque, 1810; *Apletodon dentatus* (Facciola, 1887); *Apletodon incognitus* Hofrichter & Patzner, 1997; *Callionymus filamentosus* Valenciennes, 1837; *Cynoglossus sinuorabici* (Chabanaud, 1931); *Torquigener flavimaculosus* Hardy & Randall, 1983) and 3 species are newly reported from the Levantine coast (*Dysomma brevirostre* (Facciola, 1887); *Apletodon dentatus* (Facciola, 1887); *Zebrus zebrus* (Risso, 1827)).

Key words: Marine fish diversity, Black Sea, Sea of Marmara, Aegean Sea, Levantine Sea

1. Introduction

Fishes are the most primitive members of the subphylum Craniata, constituting more than half of the living vertebrate species. Despite the general tendency among biologists to restrict the term “fish” to jawed bony fishes, living representatives of these aquatic craniates are currently treated under 6 classes as follows: Myxini (hagfish), Cephalaspidomorphi (lampreys), Elasmobranchii (cartilaginous fishes), Holocephali (chimaeras), Actinopterygii (ray-finned fishes), and Sarcopterygii (lobe-finned fishes). According to the most comprehensive account, the number of valid marine fish species described to date is approximately 17,000, which is likely to increase at least by 30% within the next 4 decades (Eschmeyer et al., 2010).

There is complete agreement between marine biologists regarding the existence of a relatively rich biota in the Mediterranean Sea, although it covers less than 1% of the global ocean surface. Among the entire faunal assemblages, fishes are one of the most intensely studied groups, with nearly 650 species recorded throughout the basin (Quignard and Tomasini, 2000; Coll et al., 2010). Recent extensive faunal assessments have revealed a lower number of fish species distributed along the Turkish coasts (see Bilecenoglu et al., 2002a; Fricke et al., 2007) that

seems to be more related to the scarcity of taxonomical studies, rather than the oligotrophic nature of the eastern Mediterranean basin.

The pioneering ichthyological observations at modern Turkey's coastline started almost 23 centuries ago. Aristotle (384–322 BC) laid the foundations of zoology in his monumental work *Historia Animalium*, which contains extraordinary rich explanations on animal biology and ecology. His description of 116 fish species from the eastern Aegean Sea is the precursor of all subsequent studies in ichthyology, such that nothing comparable was published thereafter for several centuries. This unique pioneering work mentions the distribution of particular fishes (mostly scombriforms, such as *Sarda sarda*, *Scomber* spp.) from the present-day coasts of Turkey, especially from the Bosphorus region. Detailed information on the migratory behavior of some commercially important species was presented by Aristotle, i.e. “many of the colias (*Scomber colias*) do not enter the Pontus (Black Sea), but they pass the summer and rear their young in the Propontis (Sea of Marmara) and winter in the Aegean” (*Historia Animalium*, translated by Cresswell, 1878).

Given the historical and geographical importance of the Sea of Marmara and Black Sea, many ancient naturalists dealt specifically with the fishery activities in

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these regions, where fish figured prominently in the diets of local people, as is the case today. The Greek geographer Strabo (64 BC–AD 24, born in modern Amasya, Turkey) described the migration of *Sarda sarda*, which he believed hatched in the marshes of Lake Maeotis (Sea of Azov) and moved along the Asian shores (after they gained a little strength) as far as to Trapezus (Trabzon) and Pharnacia (Giresun), where the best fishery took place at Sinop. Strabo also noted that, once the schools of *S. sarda* reach the Sea of Marmara, they immediately turn away from the Chalcedon (Kadıköy) shores to the opposite Byzantine coast, and so Chalcedonians never had a chance to profit from this valuable supply (*Geographica*, translated by Hamilton and Falconer, 1854). Several ichthyological observations made by Aristotle and Strabo were mentioned by the Roman natural historian Pliny the Elder (or Gaius Plinius Secundus, AD 23–79), with specific descriptions of fishes confined to the Sea of Marmara (e.g., soles) and those able to penetrate to the Black Sea (e.g., turbot) (*Naturalis Historia*, translated by Bostock and Riley, 1855).

A native of the Cilician city Anazarbus (present day Adana), Oppian (AD 2nd century) authored a didactic poem comprising 5 books with some 3500 lines on habitats and characteristics fish species, by giving instructions for fishing techniques (*Halieutica*, translated by Diaper, 1722). The majority of the Oppian's observations on Mediterranean fish were not associated with precise localities, while he clearly indicated the seasonal fish migrations occurring from the Sea of Marmara to the Black Sea. In a later work by Athenaeus (AD 3rd century), cookery recipes for Mediterranean fish were compiled, some of which provided remarkable ichthyological data from the Anatolian coast. Athenaeus highlighted the delicacy of anchovy (*Engraulis encrasicolus*) from the Chalcedon coasts, rays (Rajidae) from Smyrna (İzmir), mullets (*Mullus barbatus*) from Teichioussa (Didim, Aydın) and Sinope, and scarus (probably *Sparisoma cretense*) from Ephesus (*Deipnosophistae*, translated by Yonge, 1854).

The extensive translation of classical Greek and Latin antique texts in Europe during the 15th–16th centuries was a real source of motivation for numerous zoologists, who also carried out fisheries surveys along the Anatolian coasts. In 1535, Suleiman I (Kanuni Sultan Süleyman) signed a treaty with the king of France (Francis I), commonly known as the Capitulations, which permitted Europeans to live and work in the Ottoman Empire according to their own laws and under their own consuls (Allorge, 2006). The French zoologist, botanist, and diplomat Pierre Belon (1517–1564) arrived in Ottoman lands as an ambassador during the first Capitulation; he travelled to several Anatolian cities from 1545 to 1550 and published a series of natural history books. Belon

provided the first ichthyological data from the Ottoman period, including descriptions of a few fish species from the Aegean, Marmara, and Black Sea coasts such as *Acipenser* sp., *Scomber scombrus*, and even the great white shark (*Carcharodon carcharias*), associated with artisanal fishery methods (i.e. fishing gears, grounds, season, etc.) used by the Bosphorus fishermen (Belon, 1553, 1555). The French natural scientist and topographer Petri Gyllii (=Pierre Gilles) also extensively studied the bosporic area in various aspects, by also providing valuable information on the Ottoman fishery activities during the 16th century. Gyllii (1562) stated that “*pisciu copia excellit Marsilia, Tarentum, Venetia, sed omnia superat Bosporus: quo velut per portam duplicis maris pisces transire solent* - Marseilles, Venice, and Taranto are all famous for fish, yet Constantinople exceeds (doubles) them all in terms of abundance”. Similar observations were mentioned by Ogier Ghiselin de Busbecq (appointed by Austrian monarch Ferdinand I, as an ambassador to the Ottoman Empire in 1554) with the following lines emphasizing the scombrids, sparids, and swordfishes of the Sea of Marmara “*mare piscibus omni ex parte refertissimum* - the sea is perfectly crowded with shoals of fish” (Busbecq, 1595).

Two authors provided significant information on Turkish marine fish during the 17th century. One of them was Evliya Çelebi (1611–ca. 1682), who mentioned the occurrence of some 20 species by their common Turkish names along the Marmara coastline in his 10 volume travelogue (Seyâhatnâme) (Faroqi, 2013), followed by the Italian naturalist Count Luigi Ferdinando Marsigli (1658–1730), who carried out extensive oceanographical surveys at the Bosphorus, emphasizing also local fish species and their migratory behavior to the Black Sea (Marsigli, 1681). In the late 18th century, 2 of the Linnaeus's disciples (Hasselquist, 1757; Forsskål, 1775) carried out ichthyological surveys within a wide geographical range of the “terra incognitum”, covering also the Anatolian coast (specifically at İzmir and İstanbul), listing 10 and 32 species, respectively. New species recordings have continued in the next century mainly with contributions by Cuvier and Valenciennes (1832, 1836), Bennett (1835), Rathke (1837), Colombo (1885), and Ostroumoff (1894, 1896).

The general structure of the Turkish ichthyofauna was more intensely studied during the 20th century, where an overall picture was obtained by notable surveys carried out in the Sea of Marmara (Devedjian, 1915; Erazi, 1942a, 1942b), Black Sea (Slattenenko, 1955–1956), Aegean Sea (Geldiay, 1969), and Levantine Sea (Akyüz, 1957). By the outstanding endeavor of Curt Kosswig from 1937 to 1955, an obvious increase in fisheries research occurred together with increased awareness among Turkish researchers of fish taxonomy. Following the pioneering comprehensive faunal assessment by Akşiray (1954), a couple of inventory

studies enabled us to better evaluate the structure of the fish fauna (i.e. Mater and Meriç, 1996; Bilecenoglu et al., 2002a). Mostly in relation to the pronounced affinity of researchers in the last decade to biodiversity studies, we now have a clearer vision of Turkish marine ichthyofauna, and we herein present an updated checklist to reveal the most recent status of the relevant diversity, including new information on range expansions and first records of fishes from Turkey.

2. Materials and methods

All marine fish species distributed along the Turkish coastline (Black Sea, Sea of Marmara, Aegean Sea, and Levantine Sea) are presented in this paper. East of the Dalaman creek (36°42'N–28°43'E) is considered the Levantine coast. The previous checklist published by Bilecenoglu et al. (2002a) was taken as a baseline, but the taxonomical categories have been updated in accordance with the online version of Catalog of Fishes (2014; <http://researcharchive.calacademy.org/research/Ichthyology/>), synonymized taxa were re-assessed in the light of recently published studies, and additional new records are included. The Turkish coasts have been divided into equivalent squares of 15 × 15 km, where all recorded fish (exclusively those associated with exact coordinates; unpublished data and gray literature are not included) was plotted using the ArcGIS 9.3 software. The natural breaks method was used to indicate the areas with the highest number of species. Newly recorded species are kept in the collections of Adnan Menderes, Ege, and Dokuz Eylül universities.

3. Results

3.1. Assessment of fish taxa

While compiling the checklist, some taxonomical corrections were made. For example, a couple of species appearing in Bilecenoglu et al. (2002a) are excluded herein, because 1) they were reported to be true freshwater species (i.e. *Eudontomyzon mariae* and *Pungitius platygaster*; see Renaud (2011)), 2) taxa were synonymized (as in the case of *Caranx hippos*, which is now synonymized under *C. fischeri* and probably not occurring in Turkey (Smith-Vaniz and Carpenter, 2007)), and 3) occurrence records were probably wrong (for example those of *Carcharhinus melanopterus*, *Sphyrna tudes*, *Istiophorus albicans*, and *Microchirus azevia*; these species are to be excluded from the list until a specimen is collected from Turkey). Despite previous records of *Arnoglossus grohmanni* (Bonaparte, 1837) from Turkey, this species should be considered a synonym of *A. thori* Kyle, 1913 (a re-examination of the morphometric characters and figures presented by Erazi (1942b) for *A. grohmanni* and *A. thori* revealed them to be the same species). A wide distributional range (Atlantic and Pacific oceans and the Mediterranean Sea) was given

for *Macroramphosus gracilis* (Lowe, 1839) including the Aegean and Levantine coasts of Turkey (Bilecenoglu, 2006), but recent genetic analyses failed to discriminate the species from *M. scolopax* Linnaeus, 1758 because either the speciation is so recent or 2 interbreeding morphological types co-exist (Robalo et al., 2009). Two recent records from Turkey were disregarded, since 1) they were not associated with essential descriptive and diagnostic characters to allow precise species identification, or 2) they were erroneously identified; the *Symphodus bailloni* record from the Black Sea (Göktürk et al., 2012) is most probably based on a misidentification of *S. roissali*, and the *Coelorinchus caelorhincus* record from the Sea of Marmara (Artüz et al., 2010) is doubtless a misidentified specimen of *Nezumia* sp. (the authors counted 7–8 pelvic finrays, where representatives of the genus *Coelorinchus* never have more than 7 pelvic rays). *Spicara flexuosa* Rafinesque, 1810 has long been accepted as a synonym of *S. maena* (Linnaeus, 1758); however, recent morphological (Minos et al., 2013) and genetic studies (Imsiridou et al., 2011) revealed them to be 2 distinct species.

3.2. Brief analysis of Turkish marine fish biodiversity

As of May 2014, the Turkish marine fish fauna comprises 512 species (Table). The majority of the taxa belong to classes of Actinopterygii (446 sp.), followed by Elasmobranchii (64 sp.) and one species each of Cephalaspidomorphi and Holocephali. Among the families, Gobiidae (43 sp.), Sparidae (21 sp.), Blenniidae (20 sp.), and Labridae (20 sp.) were the most diverse, while 73 families were represented only by a single species. In terms of distribution of fish taxa in the seas surrounding Turkey, the Aegean Sea had the highest diversity (449 sp.), followed by Levantine coast (441 sp.), Sea of Marmara (257 sp.), and Black Sea (154 sp.). The diversity map created (Figure 1) not only indicates the densely studied localities, but also the existing information gaps throughout the Turkish coasts.

Historical progress in number of recorded marine fish from Turkey is given in Figure 2. Until 1914, only 70 species were known, but a major advance was achieved during the 1915–1934 period when a total of 114 species were added to the fauna. Among the most notable ichthyologists who listed prominent numbers of species (>30 sp.) as first records for the Turkish fauna are Karekin Devedjian (60 sp.), R A Rhasis Erazi (43 sp.), Murat Bilecenoglu (43 sp.), Erdoğan Akyüz (40 sp.), Peter Forsskål (32 sp.) and E Ninni (32 sp.), who together are responsible for registering almost half of the present-day ichthyofauna. As an indication of the increased efforts paid to taxonomical studies carried out in poorly known habitats such as the shallow inshore waters and the deep sea, 65 species were reported just within the last decade, yet the impact of the accelerated influx of alien fish should also not be overlooked.

Table. Updated checklist of Turkish marine fish. Only first and/or substantiated records are included, where numbers in columns indicate the relevant reference listed at the end of the table (BS: Black Sea; SM: Sea of Marmara; AS: Aegean Sea; LS: Levantine Sea; PS: present study).

Family/Species	BS	SM	AS	LS
Petromyzontidae				
<i>Petromyzon marinus</i> Linnaeus, 1758			1	2
Hexanchidae				
<i>Heptranchias perlo</i> (Bonnaterre, 1788)			3	4
<i>Hexanchus griseus</i> (Bonnaterre, 1788)	5, 6	7	5	4
Odontaspidae				
<i>Carcharias taurus</i> Rafinesque, 1810			5	5
<i>Odontaspis ferox</i> (Risso, 1810)			5	5
Lamnidae				
<i>Carcharodon carcharias</i> (Linnaeus, 1758)		7	5	4
<i>Isurus oxyrinchus</i> Rafinesque, 1810			5	4
<i>Lamna nasus</i> (Bonnaterre, 1788)		7	5	4
Cetorhinidae				
<i>Cetorhinus maximus</i> (Gunnerus, 1765)			5	4
Alopiidae				
<i>Alopias superciliosus</i> Lowe, 1841		8	9	10
<i>Alopias vulpinus</i> (Bonnaterre, 1788)	5	7	5	11
Scyliorhinidae				
<i>Galeus melastomus</i> Rafinesque, 1810		12	5	4
<i>Scyliorhinus canicula</i> (Linnaeus, 1758)	11	7	13	14
<i>Scyliorhinus stellaris</i> (Linnaeus, 1758)		15	15	4
Triakidae				
<i>Galeorhinus galeus</i> (Linnaeus, 1758)		7	5	4
<i>Mustelus asterias</i> Cloquet, 1821	16	11	5	11
<i>Mustelus mustelus</i> (Linnaeus, 1758)		7	17	4
<i>Mustelus punctulatus</i> Risso, 1827			3	3
Carcharhinidae				
<i>Carcharhinus altimus</i> (Springer, 1950)				18
<i>Carcharhinus brevipinna</i> (Müller & Henle, 1839)			3	3
<i>Carcharhinus limbatus</i> (Müller & Henle, 1839)				3
<i>Carcharhinus plumbeus</i> (Nardo, 1827)			5	5
<i>Prionace glauca</i> (Linnaeus, 1758)		7	5	4
Sphyrnidae				
<i>Sphyrna zygaena</i> (Linnaeus, 1758)			3	4
Dalatiidae				
<i>Dalatias licha</i> (Bonnaterre, 1788)		19	20	4
Etmopteridae				
<i>Etmopterus spinax</i> (Linnaeus, 1758)			5	4

Table. (Continued).

Oxynotidae				
<i>Oxynotus centrina</i> (Linnaeus, 1758)		11	21	11
Centrophoridae				
<i>Centrophorus granulosus</i> (Bloch & Schneider, 1801)		22	3	3
<i>Centrophorus uyato</i> (Rafinesque, 1810)		19		
Squalidae				
<i>Squalus acanthias</i> Linnaeus, 1758	23	23	23	23
<i>Squalus blainville</i> (Risso, 1827)	11	15	13	11
Echinorhinidae				
<i>Echinorhinus brucus</i> (Bonnaterre, 1788)		15	5	4
Squatinae				
<i>Squatina aculeata</i> Cuvier, 1829			24	25
<i>Squatina oculata</i> Bonaparte, 1840		13	20	20
<i>Squatina squatina</i> (Linnaeus, 1758)	5	7	5	14
Torpedinidae				
<i>Torpedo nobiliana</i> Bonaparte, 1835		26	5	4
<i>Torpedo marmorata</i> Risso, 1810		7	5	4
<i>Torpedo torpedo</i> (Linnaeus, 1758)		15	17	4
Rhinobatidae				
<i>Rhinobatos cemiculus</i> Geoffroy St. Hilaire, 1817			3	3
<i>Rhinobatos rhinobatos</i> (Linnaeus, 1758)			5	4
Rajidae				
<i>Dipturus batis</i> (Linnaeus, 1758)		7	5	4
<i>Dipturus oxyrinchus</i> (Linnaeus, 1758)		15	5	4
<i>Leucoraja circularis</i> (Couch, 1838)			27	28
<i>Leucoraja fullonica</i> (Linnaeus, 1758)			5	5
<i>Leucoraja naevus</i> (Müller & Henle, 1841)		29	3	26
<i>Raja asterias</i> Delaroche, 1809		26	30	4
<i>Raja clavata</i> Linnaeus, 1758	11	7	13	11
<i>Raja miraletus</i> Linnaeus, 1758		26	5	14
<i>Raja montagui</i> Fowler, 1910		26	26	26
<i>Raja polystigma</i> Regan, 1923			26	
<i>Raja radula</i> Delaroche, 1809		31	32	5
<i>Raja undulata</i> Lacepède, 1802			20	26
<i>Rostroraja alba</i> (Lacepède, 1803)			5	4
Dasyatidae				
<i>Dasyatis centroura</i> (Mitchill, 1815)			3	3
<i>Dasyatis marmorata</i> (Steindachner, 1892)				33, 34
<i>Dasyatis pastinaca</i> (Linnaeus, 1758)	11	23	13	11
<i>Dasyatis tortonesei</i> Capapé, 1975			3	3
<i>Himantura uarnak</i> (Forsskål, 1775)				35

Table. (Continued).

<i>Pteroplatytrygon violacea</i> (Bonaparte, 1832)			5	5
<i>Taeniura grabata</i> (Geoffroy St. Hilaire, 1817)				4
Gymnuridae				
<i>Gymnura altavela</i> (Linnaeus, 1758)	3	3	5	4
Myliobatidae				
<i>Myliobatis aquila</i> (Linnaeus, 1758)		7	5	11
<i>Pteromylaeus bovinus</i> (Geoffroy St. Hilaire, 1817)			5	3
<i>Rhinoptera marginata</i> (Geoffroy St. Hilaire, 1817)			3	4
<i>Mobula mobular</i> (Bonnaterre, 1788)			5	4
Chimaeridae				
<i>Chimaera monstrosa</i> Linnaeus, 1758		36	5	5
Acipenseridae				
<i>Acipenser gueldenstaedtii</i> Brandt & Ratzeburg, 1833	11	11	5	
<i>Acipenser nudiiventris</i> Lovetsky, 1828	11	5		
<i>Acipenser stellatus</i> Pallas, 1770	11	7	11	
<i>Acipenser sturio</i> Linnaeus, 1758	15	7	11	
<i>Huso huso</i> (Linnaeus, 1758)	11	7	11	
Notacanthidae				
<i>Notacanthus bonaparte</i> Risso, 1840			PS	37,38
Anguillidae				
<i>Anguilla anguilla</i> (Linnaeus, 1758)	15	39	39	14
Heterenchelyidae				
<i>Panturichthys fowleri</i> (Ben-Tuvia, 1953)				40
Chlopsidae				
<i>Chlopsis bicolor</i> Rafinesque, 1810				41
Muraenidae				
<i>Enchelycore anatina</i> (Lowe, 1838)			42	43
<i>Gymnothorax unicolor</i> (Delaroche, 1809)			3	3
<i>Muraena helena</i> Linnaeus, 1758		11	5	11
Synphobranchidae				
<i>Dysomma brevirostre</i> (Facciola, 1887)			44	PS
Ophichthidae				
<i>Apterichtus caecus</i> (Linnaeus, 1758)				45
<i>Dalophis imberbis</i> (Delaroche, 1809)			3	3
<i>Echelus myrus</i> (Linnaeus, 1758)			5	5
<i>Ophichthus rufus</i> (Rafinesque, 1810)			3	3
<i>Ophisurus serpens</i> (Linnaeus, 1758)			21	5
<i>Pisodonophis semicinctus</i> (Richardson, 1848)			46	
Congridae				
<i>Ariosoma balearicum</i> (Delaroche, 1809)			3	4
<i>Conger conger</i> (Linnaeus, 1758)	11	7	13	11
<i>Gnathophiphis mystax</i> (Delaroche, 1809)			3	3
Nemichthyidae				
<i>Nemichthys scolopaceus</i> Richardson, 1848			47	48

Table. (Continued).

Nettastomatidae				
<i>Nettastoma melanurum</i> Rafinesque, 1810			PS	37
<i>Facciolella oxyrhyncha</i> (Bellotti, 1883)			49	50
Clupeidae				
<i>Alosa fallax</i> (Lacepede, 1803)	15	7	39	11
<i>Alosa caspia</i> (Eichwald, 1838)	11	11		
<i>Alosa immaculata</i> Bennett, 1835	51			
<i>Alosa maeotica</i> (Grimm, 1901)	11	11		
<i>Alosa tanaica</i> (Grimm, 1901)	11	11		
<i>Clupeonella cultriventris</i> (Nordmann, 1840)	11	26		
<i>Etrumeus golanii</i> DiBattista, Randall & Bowen, 2012			42	52
<i>Herklotsichthys punctatus</i> (Rüppell, 1837)				3
<i>Sardina pilchardus</i> (Walbaum, 1792)	15	7	15	11
<i>Sardinella aurita</i> Valenciennes, 1847	11	15	13	14
<i>Sardinella maderensis</i> (Lowe, 1838)			5	4
<i>Sprattus sprattus</i> (Linnaeus, 1758)	11	7	13	11
Dussumieriidae				
<i>Dussumieria elopsoides</i> Bleeker, 1849				53
Engraulidae				
<i>Engraulis encrasicolus</i> (Linnaeus, 1758)	54	7	13	11
<i>Stolephorus insularis</i> Hardenberg, 1933				55
Chanidae				
<i>Chanos chanos</i> (Forsskal, 1775)				56
Argentinidae				
<i>Argentina sphyraena</i> Linnaeus, 1758		13	5	4
<i>Glossanodon leioglossus</i> (Valenciennes, 1848)			57	
Microstomatidae				
<i>Microstoma microstoma</i> (Risso, 1810)			3	
<i>Nansenia oblita</i> (Facciola, 1887)			20	
Salmonidae				
<i>Salmo labrax</i> Pallas, 1814	54			
Gonostomatidae				
<i>Cyclothone braueri</i> Jespersen & Täning, 1926			58	3
<i>Cyclothone pygmaea</i> Jespersen & Täning, 1926				3
<i>Gonostoma denudatum</i> Rafinesque, 1810				PS
Sternoptychidae				
<i>Mauroliscus muelleri</i> (Gmelin, 1789)		59	26	
<i>Argyropelecus hemigymnus</i> Cocco, 1829		60	3	28
Phosichthyidae				
<i>Vinciguerria attenuata</i> (Cocco, 1838)			58	3
<i>Vinciguerria poweriae</i> (Cocco, 1838)			3	
Stomiidae				
<i>Bathophilus nigerrimus</i> Giglioli, 1882			PS	
<i>Chauliodus sloani</i> Bloch & Schneider, 1801			12	61

Table. (Continued).

<i>Stomias boa</i> (Risso, 1810)	60, 62	3	28
Aulopidae			
<i>Aulopus filamentosus</i> (Bloch, 1792)		5	63
Chlorophthalmidae			
<i>Chlorophthalmus agassizi</i> Bonaparte, 1840		5	5
Ipnopidae			
<i>Bathypterois dubius</i> Vaillant, 1888		64	
Synodontidae			
<i>Saurida undosquamis</i> (Richardson, 1848)		65	35
<i>Synodus saurus</i> (Linnaeus, 1758)		5	14
Paralepididae			
<i>Arctozenus risso</i> (Bonaparte, 1840)		20	3
<i>Lestidiops jayakari</i> (Boulenger, 1889)		3	20
<i>Lestidiops sphyrenoides</i> (Risso, 1820)		3	
<i>Sudis hyalina</i> Rafinesque, 1810		26	20, 99
Evermannellidae			
<i>Evermannella balbo</i> (Risso, 1820)			38
Myctophidae			
<i>Benthosema glaciale</i> (Reinhardt, 1837)	66	3	11
<i>Ceratoscopelus maderensis</i> (Lowe, 1839)		66	3
<i>Diaphus holti</i> Täning, 1918		64	3
<i>Diaphus metopoclampus</i> (Cocco, 1829)		41	38
<i>Diaphus rafinesquii</i> (Cocco, 1838)		67	
<i>Electrona risso</i> (Cocco, 1829)			3
<i>Gonichthys cocco</i> (Cocco, 1829)			3
<i>Hygophum benoiti</i> (Cocco, 1838)	66	3	11
<i>Lampanyctus crocodilus</i> (Risso, 1810)	66	3	11
<i>Lampanyctus pusillus</i> (Johnson, 1890)			3
<i>Lobianchia dofleini</i> (Zugmayer, 1911)		64	3
<i>Lobianchia gemellarii</i> (Cocco, 1838)		67	
<i>Myctophum punctatum</i> Rafinesque, 1810	11	64	11
<i>Notoscopelus bolini</i> Nafpaktitis, 1975			3
<i>Notoscopelus elongatus</i> (Costa, 1844)	68	69	
<i>Notoscopelus kroyeri</i> (Malm, 1861)		70	
<i>Symbolophorus veranyi</i> (Moreau, 1888)			3
Lampridae			
<i>Lampris guttatus</i> (Brünnich, 1788)		3	
Lophotidae			
<i>Lophotus lacepede</i> Giorna, 1809		71	
Trachipteridae			
<i>Trachipterus trachipterus</i> (Gmelin, 1789)	7	17	4
<i>Zu cristatus</i> (Bonelli, 1819)		5	4
Regalecidae			
<i>Regalecus glesne</i> Ascanius, 1772		3	3

Table. (Continued).

Bregmacerotidae				
<i>Bregmaceros atlanticus</i> Goode & Bean, 1886			72	73
Macrouridae				
<i>Coelorinchus caelorhincus</i> (Risso, 1810)			74	74
<i>Hymenocephalus italicus</i> Giglioli, 1884			3	3
<i>Nezumia aequalis</i> (Günther, 1878)	19		20	75
<i>Nezumia sclerorhynchus</i> Valenciennes, 1838	74		20	74
<i>Trachyrincus scabrus</i> (Rafinesque, 1810)			64	26
Moridae				
<i>Gadella maraldi</i> (Risso, 1810)			41, 75	38, 75
<i>Lepidion lepidion</i> Risso, 1810			PS	
<i>Mora moro</i> (Risso, 1810)				76
Gadidae				
<i>Gadiculus argenteus</i> Guichenot, 1850	74		20	26
<i>Merlangius merlangus</i> (Linnaeus, 1758)	11		7	11
<i>Micromesistius poutassou</i> (Risso, 1827)	20		30	30
<i>Trisopterus minutus</i> (Linnaeus, 1758)	15		5	5
Lotidae				
<i>Gaidropsarus biscayensis</i> (Collett, 1890)		77	3	
<i>Gaidropsarus mediterraneus</i> (Linnaeus, 1758)	11	39	39	11
<i>Gaidropsarus vulgaris</i> (Cloquet, 1824)		59	26	
<i>Molva macrophthalmus</i> (Rafinesque, 1810)			5	4
Phycidae				
<i>Phycis blennoides</i> (Brünnich, 1768)			5	5
<i>Phycis phycis</i> (Linné, 1766)			5	4
Merlucciidae				
<i>Merluccius merluccius</i> (Linnaeus, 1758)	15	59	15	14
Ophidiidae				
<i>Benthocometes robustus</i> (Goode & Bean, 1886)			47	38
<i>Ophidion barbatum</i> Linnaeus, 1758	11	7	13	11
<i>Ophidion rochei</i> Müller, 1845	3	26	3	
<i>Parophidion vassali</i> (Risso, 1810)		15	20	
Carapidae				
<i>Carapus acus</i> (Brünnich, 1768)		11	5	11
<i>Echiodon dentatus</i> (Cuvier, 1829)			72	
Bythitidae				
<i>Bellottia apoda</i> Giglioli, 1883			41	78
Lophiidae				
<i>Lophius budegassa</i> Spinola, 1807	3	11	5	11
<i>Lophius piscatorius</i> Linnaeus, 1758	11	7	13	11
Gobiesocidae				
<i>Apletodon dentatus</i> (Facciola, 1887)	79	80	PS	PS
<i>Apletodon incognitus</i> Hofrichter & Patzner, 1997			PS	81
<i>Diplecogaster bimaculata</i> (Bonnaterre, 1788)	11	82	13	11

Table. (Continued).

<i>Gouania willdenowi</i> (Risso, 1810)			3	3
<i>Lepadogaster candolii</i> Risso, 1810	80	80	13	11
<i>Lepadogaster lepadogaster</i> (Bonnaterre, 1788)	11	11	13	11
<i>Opeatogenys gracilis</i> (Canestrini, 1864)			45	81
Atherinidae				
<i>Atherina boyeri</i> Risso, 1810	13	7	13	11
<i>Atherina hepsetus</i> Linnaeus, 1758	11	39	32	11
<i>Atherinomorus forskalii</i> (Rüppell, 1838)			5	83
Scomberesocidae				
<i>Scomberesox saurus</i> (Walbaum, 1792)		11	5	11
Belonidae				
<i>Belone belone</i> (Linnaeus, 1761)	15	39	13	11
<i>Belone svetovidovi</i> Collette & Parin, 1970			84	85
<i>Tylosurus acus</i> (Lacepède, 1803)			26	3
Hemiramphidae				
<i>Hemiramphus far</i> (Forsskål, 1775)			83	83
<i>Hyporhamphus picarti</i> (Valenciennes, 1847)				3
Exocoetidae				
<i>Cheilopogon heterurus</i> (Rafinesque, 1810)				86
<i>Hirundichthys rondeletii</i> (Valenciennes, 1847)		7	5	4
<i>Parexocoetus mento</i> (Valenciennes, 1847)			35	35
Trachichthyidae				
<i>Hoplostethus mediterraneus</i> Cuvier, 1829			20	20
Holocentridae				
<i>Sargocentron rubrum</i> (Forsskål, 1775)			83	83
Zeidae				
<i>Zeus faber</i> Linnaeus, 1758	15	7	17	11
Gasterosteidae				
<i>Gasterosteus aculeatus</i> Linnaeus, 1758	11	15	3	11
Fistulariidae				
<i>Fistularia commersonii</i> Rüppell, 1838			27	87
Centriscidae				
<i>Macroramphosus scolopax</i> (Linnaeus, 1758)			3	4
Syngnathidae				
<i>Hippocampus fuscus</i> Rüppell, 1838				88
<i>Hippocampus guttulatus</i> Cuvier, 1829	11	59	13	11
<i>Hippocampus hippocampus</i> (Linnaeus, 1758)	3	89	3	11
<i>Nerophis maculatus</i> Rafinesque, 1810		86		
<i>Nerophis ophidion</i> (Linnaeus, 1758)	11	11	13	11
<i>Syngnathus abaster</i> Risso, 1827	11	11	13	11
<i>Syngnathus acus</i> Linnaeus, 1758	51	7	13	11
<i>Syngnathus phlegon</i> Risso, 1827		60	3	4
<i>Syngnathus schmidtii</i> Popov, 1927	11	13		
<i>Syngnathus tenuirostris</i> Rathke, 1837	11	11	90	11

Table. (Continued).

<i>Syngnathus typhle</i> Linnaeus, 1758	23	89	17	11
<i>Syngnathus variegatus</i> Pallas, 1814	11			
Sebastidae				
<i>Helicolenus dactylopterus</i> (Delaroche, 1809)		74	5	5
Scorpaenidae				
<i>Pterois miles</i> (Bennett, 1828)				189
<i>Scorpaena elongata</i> Cadenat, 1943			20	20
<i>Scorpaena loppei</i> Cadenat, 1943			190	91
<i>Scorpaena maderensis</i> Valenciennes, 1833			20	26
<i>Scorpaena notata</i> Rafinesque, 1810	13	15	13	5
<i>Scorpaena porcus</i> Linnaeus, 1758	92	39	39	11
<i>Scorpaena scrofa</i> Linnaeus, 1758		60	92	11
Synanceiidae				
<i>Synanceia verrucosa</i> Bloch & Schneider, 1801				93
Dactylopteridae				
<i>Dactylopterus volitans</i> (Linnaeus, 1758)		7	5	14
Triglidae				
<i>Chelidonichthys cuculus</i> (Linnaeus, 1758)	11	11	13	14
<i>Chelidonichthys gurnardus</i> (Linnaeus, 1758)	11	39	39	14
<i>Chelidonichthys lastoviza</i> (Bonnaterre, 1788)		7	5	11
<i>Chelidonichthys lucernus</i> (Linnaeus, 1758)	51	7	13	14
<i>Chelidonichthys obscurus</i> (Walbaum, 1792)			5	5
<i>Lepidotrigla cavillone</i> (Lacepède, 1801)		11	92	11
<i>Lepidotrigla dieuzeidei</i> Blanc & Hureau, 1973		94	20	85
<i>Trigla lyra</i> Linnaeus, 1758		95	17	14
Peristediidae				
<i>Peristedion cataphractum</i> (Linnaeus, 1758)		7	15	11
Moronidae				
<i>Dicentrarchus labrax</i> (Linnaeus, 1758)	15	7	17	11
<i>Dicentrarchus punctatus</i> Bloch, 1792			5	5
Polyprionidae				
<i>Polyprion americanus</i> (Bloch & Schneider, 1801)		7	15	5
Serranidae				
<i>Anthias anthias</i> (Linnaeus, 1758)		7, 96	3	4
<i>Epinephelus aeneus</i> (Geoffroy St. Hilaire, 1817)			5	4
<i>Epinephelus caninus</i> (Valenciennes, 1843)			5	5
<i>Epinephelus costae</i> (Steindachner, 1878)			5	14
<i>Epinephelus haifensis</i> Ben-Tuvia, 1953			97	3
<i>Epinephelus marginatus</i> (Lowe, 1834)		39	39	4
<i>Mycteroperca rubra</i> (Bloch, 1793)			5	4
<i>Serranus cabrilla</i> (Linnaeus, 1758)	15	39	13	11
<i>Serranus hepatus</i> (Linnaeus, 1758)	98	60	92	11
<i>Serranus scriba</i> (Linnaeus, 1758)	11	60	17	11
Callanthidae				
<i>Callanthias ruber</i> (Rafinesque, 1810)			3	4

Table. (Continued).

Terapontidae				
<i>Pelates quadrilineatus</i> (Bloch, 1790)				99
Apogonidae				
<i>Apogon imberbis</i> (Linnaeus, 1758)	15	15	4	
<i>Apogonichthyoides pharaonis</i> (Bellotti 1874)		42	99	
<i>Apogon smithi</i> (Kotthaus, 1970)			100	
<i>Apogon queketti</i> Gilchrist, 1903		101	102	
<i>Apogon fasciatus</i> (White, 1790)		103	104	
Epigonidae				
<i>Epigonus constanciae</i> (Giglioli, 1880)		105		
<i>Epigonus denticulatus</i> Dieuzeide, 1950		20		
<i>Epigonus telescopus</i> (Risso, 1810)		64		
<i>Microichthys coccoi</i> Rüppell, 1852		106		
Sillaginidae				
<i>Sillago sihama</i> (Forsskål, 1775)		107	108	
Pomatomidae				
<i>Pomatomus saltatrix</i> (Linnaeus, 1766)	15	39	15	11
Rachycentridae				
<i>Rachycentron canadum</i> (Linnaeus, 1766)			109	
Echeneidae				
<i>Echeneis naucrates</i> Linnaeus, 1758	11	20	11	
<i>Remora australis</i> (Bennett, 1840)		26	26	
<i>Remora remora</i> (Linnaeus, 1758)	11	5	11	
<i>Remora osteochir</i> (Cuvier, 1829)		110	111	
Carangidae				
<i>Alectis alexandrinus</i> (Geoffroy St. Hilaire, 1817)		20	4	
<i>Alepes djedaba</i> (Forsskål, 1775)		5	4	
<i>Campogramma glaycos</i> (Lacepède, 1801)		20	4	
<i>Caranx crysos</i> (Mitchill, 1815)		5	4	
<i>Caranx rhonchus</i> Geoffroy Saint-Hilaire, 1817		20	112	
<i>Decapterus russelli</i> (Rüppell, 1830)				104, 113
<i>Lichia amia</i> (Linnaeus, 1758)	15	7	15	11
<i>Naucrates ductor</i> (Linnaeus, 1758)	11	7	13	11
<i>Pseudocaranx dentex</i> (Bloch & Schneider, 1801)			5	4
<i>Seriola dumerili</i> (Risso, 1810)			5	5
<i>Seriola fasciata</i> (Bloch, 1793)				34
<i>Trachinotus ovatus</i> (Linnaeus, 1758)			5	4
<i>Trachurus indicus</i> Nekrasov, 1966				114
<i>Trachurus mediterraneus</i> (Steindachner, 1868)	115	15	5	4
<i>Trachurus picturatus</i> (Bowdich, 1825)			5	5
<i>Trachurus trachurus</i> (Linnaeus, 1758)	7	39	39	14
Coryphaenidae				
<i>Coryphaena hippurus</i> Linnaeus, 1758			5	5
Leiognathidae				
<i>Equulites klunzingeri</i> (Steindachner, 1898)			35	116

Table. (Continued).

Bramidae				
<i>Brama brama</i> (Bonnaterre, 1788)			5	5
Lobotidae				
<i>Lobotes surinamensis</i> (Bloch, 1790)			3	63
Haemulidae				
<i>Pomadasys incisus</i> (Bowdich, 1825)			3	3
<i>Pomadasys stridens</i> (Forsskål, 1775)				46
Sparidae				
<i>Boops boops</i> (Linnaeus, 1758)	15	39	39	11
<i>Dentex dentex</i> (Linnaeus, 1758)	15	7	15	11
<i>Dentex gibbosus</i> (Rafinesque, 1810)		30	5	4
<i>Dentex macrophthalmus</i> (Bloch, 1791)			5	5
<i>Dentex maroccanus</i> Valenciennes, 1830			3	4
<i>Diplodus annularis</i> (Linnaeus, 1758)	11	39	39	11
<i>Diplodus cervinus</i> (Lowe, 1838)			3	117
<i>Diplodus puntazzo</i> (Cetti, 1777)	11	7	13	11
<i>Diplodus sargus</i> (Linnaeus, 1758)	15	39	39	11
<i>Diplodus vulgaris</i> (Geoffroy St. Hilaire, 1817)	15	7	5	11
<i>Lithognathus mormyrus</i> (Linnaeus, 1758)		39	39	89
<i>Oblada melanura</i> (Linnaeus, 1758)	5	39	39	4
<i>Pagellus acarne</i> (Risso, 1827)		11	5	11
<i>Pagellus bogaraveo</i> (Brünnich, 1768)		7	5	11
<i>Pagellus erythrinus</i> (Linnaeus, 1758)	51	7	17	11
<i>Pagrus auriga</i> Valenciennes, 1843			3	3
<i>Pagrus caeruleostictus</i> (Valenciennes, 1830)			5	4
<i>Pagrus pagrus</i> (Linnaeus, 1758)		39	39	11
<i>Sarpa salpa</i> (Linnaeus, 1758)	13	39	39	11
<i>Sparus aurata</i> Linnaeus, 1758	15	15	32	11
<i>Spondylisoma cantharus</i> (Linnaeus, 1758)	15	39	39	11
Centracanthidae				
<i>Centracanthus cirrus</i> Rafinesque, 1810			30	30
<i>Spicara flexuosa</i> Rafinesque, 1810	3	3	3	3
<i>Spicara maena</i> (Linnaeus, 1758)	15	39	39	4
<i>Spicara smaris</i> (Linnaeus, 1758)	89	39	39	14
Lethrinidae				
<i>Monotaxis grandoculis</i> (Forsskål, 1775)				118
Nemipteridae				
<i>Nemipterus randalli</i> Russell, 1986			103, 119	120
Sciaenidae				
<i>Argyrosomus regius</i> (Asso, 1801)	15	7	5	4
<i>Sciaena umbra</i> Linnaeus, 1758	15	7	17	11
<i>Umbrina cirrosa</i> (Linnaeus, 1758)	15	7	13	11
Mullidae				
<i>Mullus barbatus</i> Linnaeus, 1758	54	39	39	14

Table. (Continued).

<i>Mullus surmuletus</i> Linnaeus, 1758	15	7	17	14
<i>Parupeneus forsskali</i> (Fourmanoir & Guézé, 1976)				121
<i>Upeneus moluccensis</i> (Bleeker, 1855)			65	83
<i>Upeneus pori</i> Ben-Tuvia & Golani, 1989			122	83
Pempheridae				
<i>Pempheris vanicolensis</i> Cuvier, 1831			123	123
Chaetodontidae				
<i>Heniochus intermedius</i> Steindachner, 1893				124
Pomacentridae				
<i>Chromis chromis</i> (Linnaeus, 1758)	11	11	17	11
Cepolidae				
<i>Cepola macrophthalmia</i> (Linnaeus, 1758)		7	92	14
Mugilidae				
<i>Chelon labrosus</i> (Risso, 1827)	11	15	13	14
<i>Liza aurata</i> (Risso, 1810)	11	15	13	14
<i>Liza carinata</i> (Valenciennes, 1836)			5	4
<i>Liza haematocheila</i> (Temminck & Schlegel, 1845)	125	126	126	
<i>Liza ramada</i> (Risso, 1810)	127	15	13	14
<i>Liza saliens</i> (Risso, 1810)	11	15	13	14
<i>Mugil cephalus</i> Linnaeus, 1758	127	39	39	14
<i>Oedalechilus labeo</i> (Cuvier, 1829)		128	5	4
Labridae				
<i>Acantholabrus palloni</i> (Risso, 1810)			3	3
<i>Coris julis</i> (Linnaeus, 1758)	11	39	92	11
<i>Ctenolabrus rupestris</i> (Linnaeus, 1758)	11	89	129	11
<i>Labrus bergylta</i> Ascanius, 1767		7	129	
<i>Labrus merula</i> Linnaeus, 1758		7	129	129
<i>Labrus mixtus</i> Linnaeus, 1758		7	5	11
<i>Labrus viridis</i> Linnaeus, 1758	11	11	11	11
<i>Lappanella fasciata</i> (Cocco, 1833)			191	
<i>Pteragogus pelycus</i> Randall, 1981			27	130
<i>Symphodus cinereus</i> (Bonnaterre, 1788)	51	15	129	11
<i>Symphodus doderleini</i> Jordan, 1890		77	3	3
<i>Symphodus mediterraneus</i> (Linnaeus, 1758)		15	129	11
<i>Symphodus melanocercus</i> (Risso, 1810)		11	129	11
<i>Symphodus melops</i> (Linnaeus, 1758)			20	
<i>Symphodus ocellatus</i> (Forsskål, 1775)	11	59	39	131
<i>Symphodus roissali</i> (Risso, 1810)	129	59	129	11
<i>Symphodus rostratus</i> (Bloch, 1791)	11	39	129	11
<i>Symphodus tinca</i> (Linnaeus, 1758)	129	39	129	129
<i>Thalassoma pavo</i> (Linnaeus, 1758)		15	17	4
<i>Xyrichtys novacula</i> (Linnaeus, 1758)		13	5	4
Scaridae				
<i>Scarus ghobban</i> Forsskål, 1775				132

Table. (Continued).

<i>Sparisoma cretense</i> (Linnaeus, 1758)			17	4
Champsodontidae				
<i>Champsodon capensis</i> Regan, 1908				133
<i>Champsodon nudivittis</i> (Ogilby, 1895)			134	135
<i>Champsodon vorax</i> Günther, 1867				136
Ammodytidae				
<i>Gymnammodytes cicereus</i> (Rafinesque, 1810)	11	7	13	11
Trachinidae				
<i>Echiichthys vipera</i> (Cuvier, 1829)		7	5	11
<i>Trachinus araneus</i> Cuvier, 1829		15	5	11
<i>Trachinus draco</i> Linnaeus, 1758	11	7	13	11
<i>Trachinus radiatus</i> Cuvier, 1829		11	5	11
Uranoscopidae				
<i>Uranoscopus scaber</i> Linnaeus, 1758	11	39	39	11
Tripterygiidae				
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970			3	3
<i>Tripterygion melanurus</i> Guichenot, 1850				3
<i>Tripterygion minor</i> Kolombatović, 1904			137	
<i>Tripterygion tripteronotus</i> (Risso, 1810)	11	11	13	11
Clinidae				
<i>Clinitrachus argentatus</i> (Risso, 1810)		89	138	11
Blenniidae				
<i>Aidablennius sphyinx</i> (Valenciennes, 1836)	139	140	13	11
<i>Blennius ocellaris</i> Linnaeus, 1758	11	7	13	11
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)	139	92	13	11
<i>Microlipophrys adriaticus</i> (Steindachner & Kolombatović, 1883)	5	5	5	
<i>Microlipophrys canevas</i> (Vinciguerra, 1880)			3	3
<i>Microlipophrys dalmatinus</i> (Steindachner & Kolombatović, 1883)			3	112
<i>Microlipophrys nigriceps</i> (Vinciguerra, 1883)			3	
<i>Omobranchus punctatus</i> (Valenciennes, 1836)				141
<i>Parablennius gattorugine</i> (Linnaeus, 1758)	139	15	5	11
<i>Parablennius incognitus</i> (Bath, 1968)	5	5	5	5
<i>Parablennius rouxi</i> (Cocco, 1833)			3	142
<i>Parablennius sanguinolentus</i> (Pallas, 1814)	139	140	13	11
<i>Parablennius tentacularis</i> (Brünnich, 1768)	139	82	13	11
<i>Parablennius thysanurus</i> (Jordan & Seale, 1907)				141
<i>Parablennius zvonimiri</i> (Kolombatović, 1892)	139	77	3	3
<i>Paralipophrys trigloides</i> (Valenciennes, 1836)		140	5	11
<i>Petroscirtes ancyodon</i> Rüppell, 1835			143	130
<i>Salaria basilisca</i> (Valenciennes, 1836)			144	5
<i>Salaria pavo</i> (Risso, 1810)	139	15	13	11
<i>Scartella cristata</i> (Linnaeus, 1758)			5	5
Callionymidae				
<i>Callionymus fasciatus</i> Valenciennes, 1837		3	3	3

Table. (Continued).

<i>Callionymus filamentosus</i> Valenciennes, 1837			PS	108
<i>Callionymus lyra</i> Linnaeus, 1758	3	7	5	11
<i>Callionymus maculatus</i> Rafinesque, 1810		5	5	5
<i>Callionymus pusillus</i> Delaroche, 1809	11	82	13	11
<i>Callionymus risso</i> LeSueur, 1814	11	15	13	11
<i>Synchiropus phaeton</i> (Günther, 1861)			92	3
<i>Synchiropus sechellensis</i> Regan, 1908				192
Gobiidae				
<i>Aphia minuta</i> (Risso, 1810)	92	11	13	11
<i>Chromogobius quadrivittatus</i> (Steindachner, 1863)		13	3	3
<i>Chromogobius zebratus</i> (Kolombatovic, 1891)			45	145
<i>Crystallogobius linearis</i> (Düben, 1845)			3	
<i>Deltentosteus collonianus</i> (Risso, 1820)				146
<i>Deltentosteus quadrimaculatus</i> (Valenciennes, 1837)		15	3	3
<i>Didogobius splechnai</i> Ahnelt & Patzner, 1995			147	
<i>Gobius auratus</i> Risso, 1810		15	3	142
<i>Gobius bucchichi</i> Steindachner, 1870	3	3	3	3
<i>Gobius cobitis</i> Pallas, 1814	80	148	13	11
<i>Gobius couchi</i> Miller & El-Tawil, 1974			149	
<i>Gobius cruentatus</i> Gmelin, 1789	150	151	5	4
<i>Gobius fallax</i> Sarato, 1889			45	45
<i>Gobius geniporus</i> Valenciennes, 1837		152	5	11
<i>Gobius kolombatovici</i> Kovačić & Miller, 2000			103	
<i>Gobius niger</i> Linnaeus, 1758	92	59	92	11
<i>Gobius paganellus</i> Linnaeus, 1758	152	39	39	11
<i>Gobius roulei</i> de Buen, 1928			PS	PS
<i>Gobius xanthocephalus</i> Heymer & Zander, 1992			153	
<i>Gobius vittatus</i> Vinciguerra, 1883			92	142
<i>Knipowitschia caucasica</i> (Berg, 1916)		11	13	5
<i>Lesueurigobius friesii</i> (Malm, 1874)		7	3	3
<i>Lesueurigobius suerii</i> Risso, 1810			3	3
<i>Mesogobius batrachocephalus</i> (Pallas, 1814)	11	7		
<i>Millerigobius macrocephalus</i> (Kolombatovic, 1891)			154	
<i>Neogobius eurycephalus</i> (Kessler, 1874)	3			
<i>Neogobius melanostomus</i> (Pallas, 1814)	152	155	156	
<i>Neogobius platyrostris</i> (Pallas, 1814)	152			
<i>Neogobius ratan</i> (Nordmann, 1840)	11			
<i>Ponticola syrman</i> (Nordmann, 1840)	11	152		
<i>Odondebuenia balearica</i> (Pellegrin & Fage, 1907)			92	
<i>Oxyurichthys papuensis</i> (Valenciennes, 1837)			157	158
<i>Pomatoschistus adriaticus</i> Miller, 1973		159	92	
<i>Pomatoschistus bathi</i> Miller, 1982		160	160	

Table. (Continued).

<i>Pomatoschistus marmoratus</i> (Risso, 1810)	13	13	13	3
<i>Pomatoschistus minutus</i> (Pallas, 1770)	11	15	161	
<i>Pomatoschistus quagga</i> (Heckel, 1839)			45	
<i>Thorogobius ephippiatus</i> (Lowe, 1839)			92	4
<i>Thorogobius macrolepis</i> (Kolombatovic, 1891)			147	147
<i>Trypauchen vagina</i> (Bloch and Schneider, 1801)				162
<i>Zebrus zebrus</i> (Risso, 1827)	163		92	PS
<i>Vanderhorstia mertensi</i> Klausewitz, 1974			164	165
<i>Zosterisessor ophiocephalus</i> (Pallas, 1814)	152	15	13	11
Ephippidae				
<i>Platax teira</i> (Forsskål, 1775)			166	
Siganidae				
<i>Siganus luridus</i> (Rüppell, 1829)			65	30
<i>Siganus rivulatus</i> Forsskål, 1775			17	83
Luvaridae				
<i>Luvarus imperialis</i> Rafinesque, 1810			26	26
Sphyraenidae				
<i>Sphyraena chrysotaenia</i> Klunzinger, 1884			5	4
<i>Sphyraena flavicauda</i> Rüppell, 1838				87
<i>Sphyraena sphyraena</i> (Linnaeus, 1758)	11	7	13	11
<i>Sphyraena viridensis</i> Cuvier, 1829			167	142
Gempylidae				
<i>Ruvettus pretiosus</i> Cocco, 1833			20	168
Trichiuridae				
<i>Lepidopus caudatus</i> (Euphrasen, 1788)			169	74
<i>Trichiurus lepturus</i> Linnaeus, 1758			3	4
Scombridae				
<i>Auxis rochei</i> (Risso, 1810)	30	11	30	11
<i>Euthynnus alletteratus</i> (Rafinesque, 1810)	170	15	170	4
<i>Katsuwonus pelamis</i> (Linnaeus, 1758)		15	5	4
<i>Orcynopsis unicolor</i> (Geoffroy St. Hilaire, 1817)			30	30
<i>Sarda sarda</i> (Bloch, 1793)	15	39	39	89
<i>Scomber colias</i> Gmelin, 1789	15	39	39	15, 14
<i>Scomber scombrus</i> Linnaeus, 1758	54	7	15	15
<i>Scomberomorus commerson</i> (Lacepède, 1800)			171	20
<i>Thunnus alalunga</i> (Bonnaterre, 1788)	172	7	30	4
<i>Thunnus thynnus</i> (Linnaeus, 1758)	173	173	15	14
Xiphiidae				
<i>Xiphias gladius</i> Linnaeus, 1758	15	173	115	14
Istiophoridae				
<i>Tetrapturus belone</i> Rafinesque, 1810			3	4

Table. (Continued).

Centrolophidae				
<i>Centrolophus niger</i> (Gmelin, 1789)			5	5
<i>Schedophilus ovalis</i> (Cuvier, 1833)			27	3
Nomeidae				
<i>Cubiceps gracilis</i> (Lowe, 1843)			174	50
Stromaetidae				
<i>Stromateus fiatola</i> Linnaeus, 1758			5	5
Caproidae				
<i>Capros aper</i> (Linnaeus, 1758)	59		5	4
Citharidae				
<i>Citharus linguatula</i> (Linnaeus, 1758)	15		5	14
Scophthalmidae				
<i>Lepidorhombus boscii</i> (Risso, 1810)		5	5	5
<i>Lepidorhombus whiffiagonis</i> (Walbaum, 1792)		175	30	30
<i>Scophthalmus maximus</i> (Linnaeus 1758)	54	7	5	
<i>Scophthalmus rhombus</i> (Linnaeus, 1758)	89	7	89	89
<i>Zeugopterus regius</i> (Bonnaterre, 1788)		11	64	11
Bothidae				
<i>Arnoglossus imperialis</i> (Rafinesque, 1810)		11	20	11
<i>Arnoglossus kessleri</i> Schmidt, 1915	11	11	176	11
<i>Arnoglossus laterna</i> (Walbaum, 1792)	177	59	5	11
<i>Arnoglossus rueppelii</i> (Cocco, 1844)			3	112
<i>Arnoglossus thori</i> Kyle, 1913	177	60	176	11
<i>Bothus podas</i> (Delaroche, 1809)			3	177
Pleuronectidae				
<i>Platichthys luscus</i> (Pallas, 1814)	11	39	39	11
Soleidae				
<i>Buglossidium luteum</i> (Risso, 1810)	5	15	5	11
<i>Dicologlossa cuneata</i> (Moreau, 1881)		11	178	
<i>Microchirus ocellatus</i> (Linnaeus, 1758)		11	179	11
<i>Microchirus variegatus</i> (Donovan, 1808)	177	11	177	11
<i>Monochirus hispidus</i> Rafinesque, 1814		60	5	4
<i>Pegusa impar</i> (Bennett, 1831)		15	179	3
<i>Pegusa nasuta</i> (Pallas, 1814)	11	11	5	
<i>Pegusa lascaris</i> (Risso, 1810)	11	15	13	14
<i>Solea aegyptiaca</i> Chabanaud, 1927				PS
<i>Solea solea</i> (Linnaeus, 1758)	5	39	39	14
<i>Synapturichthys kleinii</i> (Risso, 1827)		5	5	5
Cynoglossidae				
<i>Cynoglossus sinusarabici</i> (Chabanaud, 1931)			PS	4
<i>Symphurus nigrescens</i> Rafinesque, 1810			177	177

Table. (Continued).

Balistidae				
<i>Balistes capriscus</i> Gmelin, 1789	15	7	13	11
Monacanthidae				
<i>Stephanolepis diaspros</i> Fraser-Brunner, 1940		103	83	83
Tetraodontidae				
<i>Lagocephalus lagocephalus</i> (Linnaeus, 1758)			3	4
<i>Lagocephalus sceleratus</i> (Gmelin, 1789)			180	181
<i>Lagocephalus spadiceus</i> (Richardson 1845)		182	35	83
<i>Lagocephalus suezensis</i> Clark & Gohar, 1953			87	183
<i>Sphoeroides pachygaster</i> (Müller & Troschel, 1848)			184	142
<i>Torquigener flavimaculosus</i> Hardy & Randall, 1983			PS	185
<i>Tylerius spinosissimus</i> (Regan, 1908)				186
Diodontidae				
<i>Cyclichthys spilostylus</i> (Leis & Randall, 1982)				187
Molidae				
<i>Mola mola</i> (Linnaeus, 1758)		7	188	4
<i>Ranzania laevis</i> (Pennant, 1776)			188	3

1) Thessalou-Legaki et al. (2012); 2) Çevik et al. (2010); 3) Whitehead et al. (1984–1986); 4) Akyüz (1957); 5) Geldiay (1969); 6) Kabasakal (2005); 7) Devedjian (1915); 8) Kabasakal and Karhan (2007); 9) Mater (2005); 10) Kabasakal (2011); 11) Erazi (1942a); 12) Akşiray (1987); 13) Slastenenko (1955–1956); 14) Gruvel (1931); 15) Ninni (1923); 16) Eryılmaz et al. (2011); 17) Tortonese (1947); 18) Başusta and Erdem (2000); 19) Meriç (1995); 20) Fischer et al. (1987); 21) Geldiay and Mater (1968); 22) Benli et al. (1993); 23) Rathke (1837); 24) Filiz et al. (2005); 25) Başusta (1998); 26) Mater and Meriç (1996); 27) Bilecenoğlu et al. (2002a); 28) Deval et al. (2014); 29) Okuş and Yüksek (2001); 30) Fischer (1973); 31) Yaka and Yücel (2006); 32) Carus (1893); 33) Diamant et al. (2010); 34) Kapisir et al. (2014); 35) Ben-Tuvia (1966); 36) Dalyan (2010); 37) Başusta et al. (2001); 38) Deval (2013); 39) Forsskal (1775); 40) Smith et al. (2012); 41) Kaya and Bilecenoğlu (2000); 42) Okuş et al. (2004); 43) Yokeş et al. (2002); 44) Aydın et al. (2009); 45) Fricke et al. (2007); 46) Bilecenoğlu et al. (2009); 47) Bilecenoğlu et al. (2006a); 48) Gökoğlu et al. (2009); 49) Leblebici et al. (2010); 50) Golani et al. (2006); 51) Bennett (1835); 52) Başusta et al. (1997); 53) Ben-Tuvia (1953); 54) Abbot (1835); 55) Dalyan et al. (in press); 56) Özvarol and Gökoğlu (2012); 57) Bilecenoğlu et al. (2005); 58) Jespersen and Täning (1926); 59) Ostroumoff (1896); 60) Colombo (1885); 61) Dalyan and Eryılmaz (2008); 62) M.Demir (1958); 63) Akşiray (1954); 64) Kaya (1993); 65) Ben-Tuvia (1973); 66) Täning (1918); 67) Cihangir et al. (2003); 68) N.Demir (1958); 69) Tuncer et al. (2009); 70) Keskin and Eryılmaz (2010); 71) Bilecenoğlu et al. (2001); 72) Filiz et al. (2007a); 73) Yılmaz et al. (2004); 74) JICA (1993); 75) Cohen et al. (1990); 76) Bilecenoğlu et al. (2002b); 77) Hureau and Monod (1973); 78) Ergüden et al. (2010); 79) Bat et al. (2006); 80) Slastenenko (1938); 81) Bilecenoğlu and Kaya (2006a); 82) Ostroumoff (1894); 83) Kosswig (1950); 84) Meriç and Altun (1999); 85) Dalyan and Eryılmaz (2006); 86) Meriç et al. (1996); 87) Bilecenoğlu et al. (2002c); 88) Gökoğlu et al. (2004); 89) Ayaşlı (1937); 90) Tortonese (1985); 91) Keskin and Eryılmaz (2009); 92) Fage (1918); 93) Bilecenoğlu (2012); 94) Eryılmaz (2002a); 95) Steindachner (1895); 96) Tuncer et al. (2011); 97) Öziç and Yılmaz (2006); 98) Dalgıç et al. (2013); 99) Mater and Kaya (1987); 100) Goren et al. (2008); 101) Filiz et al. (2012); 102) Eryılmaz and Dalyan (2006); 103) Bilecenoğlu et al. (2013); 104) Akamca et al. (2010); 105) Özyaydın et al. (2007); 106) Mater et al. (1988); 107) Bilecenoğlu (2004); 108) Gücü et al. (1994); 109) Akyol and Ünal (2013); 110) Tuncer et al. (2012); 111) Kapisir and Ondrias (1984); 112) Gücü and Bingel (1994); 113) Sakınan and Örek (2010); 114) Dalyan and Eryılmaz (2009); 115) Kosswig (1953); 116) Erazi (1943a); 117) Ünsal (1984); 118) Bilecenoğlu (2007); 119) Gülşahin and Kara (2013); 120) Bilecenoğlu and Russell (2008); 121) Çınar et al. (2006); 122) Akyol et al. (2006); 123) Papaconstantinou (1988); 124) Gökoğlu et al. (2003); 125) Ünsal (1992); 126) Kaya et al. (1998); 127) Devedjian (1926); 128) Denizci (1958); 129) Erazi (1943b); 130) Taşkavak et al. (2000); 131) Gourret (1893); 132) Turan et al. (2014a); 133) Dalyan et al. (2012); 134) Filiz et al. (2013); 135) Çiçek and Bilecenoğlu (2009); 136) Gökoğlu and Özvarol (2013); 137) Abel (1983); 138) Kocataş (1978); 139) Slastenenko (1934); 140) Erazi (1941); 141) Özbek et al. (2014); 142) Mater and Bilecenoğlu (1999); 143) Okuş et al. (2006); 144) Cuvier and Valenciennes (1836); 145) Engin and Dalgıç (2008); 146) Golani (1996); 147) Francour et al. (2007); 148) Ninni (1938); 149) Özen et al. (2009); 150) Engin et al. (2007); 151) Kocataş et al. (1993); 152) Sözer (1941); 153) Gökalp (2011); 154) Bogorodsky et al. (2010); 155) Steindachner (1894); 156) Eryılmaz (2002b); 157) Benli et al. (1999); 158) Kaya et al. (1992); 159) Miller (1973); 160) Miller (1982); 161) Özen et al. (2007); 162) Akamca et al. (2011); 163) Kovacic and Engin (2009); 164) Çınar et al. (2011); 165) Bilecenoğlu et al. (2008); 166) Bilecenoğlu and Kaya (2006b); 167) Bizsel and Cihangir (1996); 168) Kaya and Bilecenoğlu (1999); 169) Artüz (1957); 170) Belloc (1955); 171) Buhan et al. (1997); 172) Akyüz and Artüz (1957); 173) Cuvier and Valenciennes (1832); 174) Filiz et al. (2007b); 175) Amaoka et al. (2001); 176) Kyle (1913); 177) Mengi (1971); 178) Ulutürk et al. (2011); 179) Erazi (1942b); 180) Akyol et al. (2005); 181) Bilecenoğlu et al. (2006b); 182) Tuncer et al. (2008); 183) Avşar and Çiçek (1999); 184) Eryılmaz et al. (2003); 185) Bilecenoğlu (2003); 186) Turan and Yağlıoğlu (2011); 187) Ergüden et al. (2012); 188) Akşiray (1958); 189) Turan et al. (2014b); 190) Filiz et al. (2010); 191) Keskin et al. (in press); 192) Gökoğlu et al. (2014)

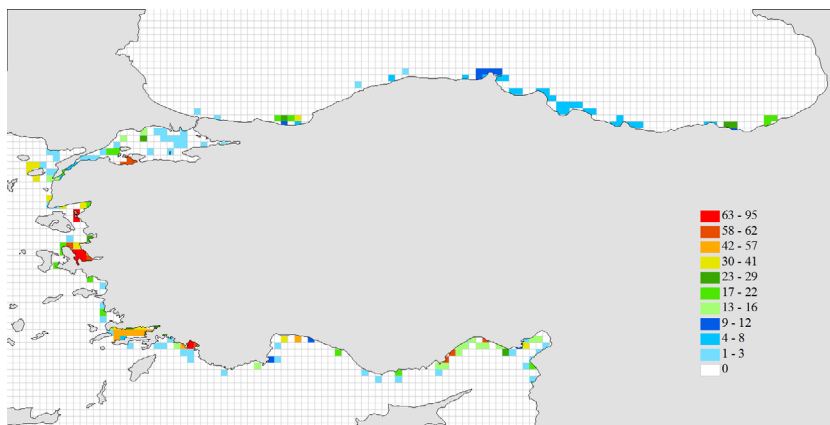


Figure 1. Map showing the distribution of fish diversity along Turkish coasts.

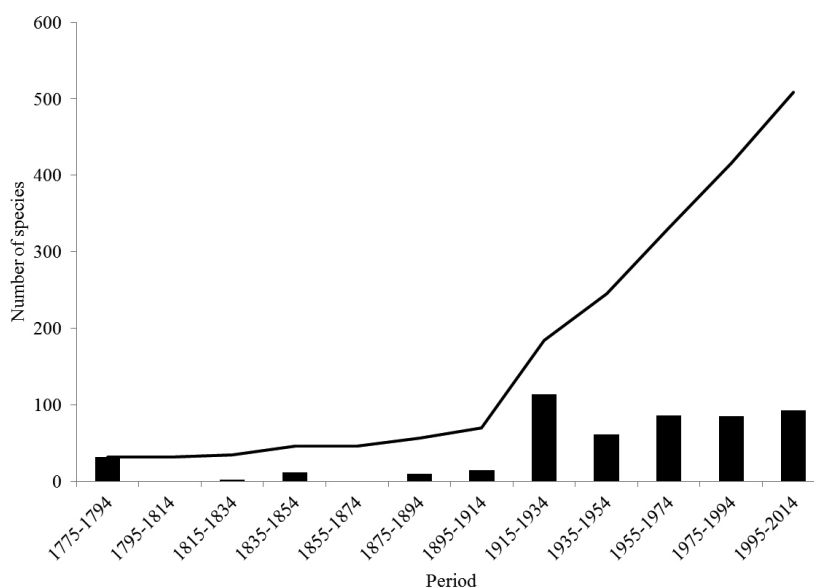


Figure 2. Historical progress of ichthyological studies in Turkey, within intervals of 2 decades (bars indicate the total number of species recorded, solid line indicates the cumulative increase in fish diversity).

3.3. New records

In this paper, we report the following 5 fish species (Figure 3) that were previously unknown from Turkey:

Lepidion lepidion (Risso, 1810): 2 specimens with 154–158 mm SL, northern Aegean Sea (40°17'N–25°42'E), 580–600 m depth, bottom trawl on board the R/V K. Piri Reis. First dorsal finrays 4, second dorsal finrays 54, anal finrays 49–51, pelvic finrays 8. A prominent small barbel on anterior part of mandible. Prolonged rays on first dorsal and pelvic fins. Gill openings wide, extending upward above level of pectoral fins. Minute teeth on both jaws in several rows; vomer teeth present but none on palatines. Head length 21.8%–22.4%, maximum body depth

15.7%–17.2%, preanal length 39.2%–39.6%, postanal length 57.6%–59.1%, all of SL. Snout length 27.8%–29.2%, postocular length 42.4%–42.5%, eye diameter 28.1%–28.5%, all of head length. Largest ray of the first dorsal fin 30.5%–31.0% of SL. Interorbital distance 77.9%–83.5% of eye diameter. Body color of preserved specimens is uniformly light brown. Dark pigmentation along the outer margin of second dorsal finrays. Eyes encircled by a narrow dark brown stripe.

Bathophilus nigerrimus Giglioli, 1882: 1 specimen of 62 mm SL, Gökova Bay (36°45'N–27°17'E), 620–640 m depth, bottom trawl on board the R/V K. Piri Reis. Dorsal finrays 11, anal finrays 12, pelvic finrays 17, pectoral finrays



Figure 3. Fish species new to the Turkish marine fauna (photographs are not to scale). A) *Lepidion lepidion* (154 mm SL), B) *Bathophilus nigerrimus* (62 mm SL), C) *Gonostoma denudatum* (118 mm SL), D) *Solea aegyptiaca* (130 mm SL), E) *Gobius roulei* (52 mm SL).

slightly more than 32 (some rays broken from the base). Body depth is found 7.75 times SL. Postorbital luminous organ oval and small; its length is found twice eye diameter. Large mouth includes several fang-like teeth; upper jaw with 20 and lower jaw with 30 strong acute teeth. Chin barbel long (its length more than head length) and slender, without a modified tip; barbel extends as far as to pelvic fin base. Dorsal and anal fins located at the posterior margin of the body; anal fin under the 3rd ray of dorsal fin. Pelvic and pectoral finrays long and bristle shaped; pectoral fins located low, pelvic fins located high on the body. Two rows of minute photophores occur laterally below the pelvic fin base. Head length 21.29%, body depth 12.90%, caudal peduncle depth 3.23%, predorsal length 79.03%, preanal length 53.23%, and prepelvic length 51.61%, all of SL. Horizontal eye diameter 26.51%, snout length 18.94%, all of head length. Interorbital distance 91.43% of eye diameter. Body color of the preserved specimen is dark brown. Postorbital photophore appears creamy white, and the caudal peduncle is light brown.

Gonostoma denudatum Rafinesque, 1810: 1 specimen of 118 mm SL, İskenderun Bay (36°08'N–35°27'E), 200 m depth, commercial bottom trawl. Dorsal finrays 14, pectoral finrays 11, pelvic finrays 8, anal fin damaged and thus not countable. A small adipose fin located posterior to the dorsal fin. Mouth large; angle of jaw extending posterior to the eye. Head length 24.6%, predorsal length 59.7%, preanal length 58.9%, all of SL. Eye diameter 17.2%, snout length 24.1%, postorbital length 58.6%, all of head length. Eye diameter 90.9% of interorbital distance. Not all photophores could be counted, except for SO 1, ORB 1, OP 3, BR 9, OA 13. Preserved material has a distinct black

gular and ventral region, also a dark pigmentation at the dorsal fin base.

Solea aegyptiaca Chabanaud, 1927: 2 specimens with 127–130 mm SL from İskenderun Bay (36°31'N–35°16'E), 18 m depth, bottom trawl on board the R/V Beluga. Dorsal finrays 67–70, Anal finrays 55–61, Pectoral finrays 9, lateral line scales 123–126. Body oval with dorsal fin beginning on upper profile of head. A poorly developed membrane between caudal fin and dorsal/anal fins. Head length 21.4%–22.7%, maximum body depth 31.5%–34.6%, predorsal 2.1%–2.2%, length preanal length 18.9%–21.9%, all of SL. Upper eye diameter 12.8%–13.7%, postorbital length 55.2%–55.4%, snout length 30.9%–31.9%, all of head length. Fresh specimens were brown to dark brown; pectoral fin of eyed side with a black blotch reaching tip of fin.

Gobius roulei de Buen, 1928: 1 specimen of 56 mm SL from İzmir Bay (Aegean Sea), sampled by a dredge from 10 m depth, exact coordinates not available; 2 specimens of 46–52 mm SL from Fethiye Bay (Levantine Sea; 36°42'N–28°54'E), scuba diving at a depth of 20 m. Description based on the Aegean Sea specimen. Anterior nostril short and tubular. Branchiostegal membrane attached to entire side of isthmus. Fins: D1 VI; D2 I/12; A I/11; C 14 branched rays, 14 articulated rays; P left 18 and right 17; V I/5+I/5. P free moderately developed; V elliptical and complete, anterior membrane height in midline about ½ length of pelvic spinous ray. Body with ctenoid scales in lateral line series 33. Head, predorsal area, and cheek naked. Color preserved: body uniformly light brown, with remains of dark pattern of blotches along lateral midline and of dots on D1, D2, and C. Head with anterior and posterior

oculoscapular, and preopercular canals, with pores σ , λ , κ , ω , α , β , ρ , ρ^1 , ρ^2 , and γ , δ , ϵ , respectively. Pores large, α pore 4.35% of head length. Rows of sensory papillae: No suborbital row *a*. Six transverse suborbital rows of sensory papillae. Transverse suborbital rows 2 and 3 more begin near orbit. Inferior segment of row 6 not greatly extended below level of row *d* (1: 10, 2: 9, 3: 5, 4: 6, 5: 7, 6s: 3, 6i: 6). Longitudinal row *b* (8) extending forward to row 5. Longitudinal row *d* (22) continuous. Opercular transversal row *ot* (20); superior longitudinal row *os* (10); and inferior longitudinal row *oi* (9).

Apart from the above-mentioned first occurrences of fishes from Turkey, we here present 10 range expansion records (7 spp. from the Aegean Sea and 3 from the Levantine Sea; these species will not be described herein, but rather indicated as “PS - present study” in the Table): First records for the Aegean Sea: *Notacanthus bonaparte* Risso, 1840 (2 specimens from Gökova Bay, 36°53'N–27°39'E, depth 630–650 m); *Nettastoma melanurum* Rafinesque, 1810 (single specimen obtained from Gökova Bay, 36°49'N–27°51'E, depth 380–400 m); *Apletodon dentatus* (Facciola, 1887) (2 specimens from Karaburun, 38°39'N–26°31'E, depth 12 m); *Apletodon incognitus* Hofrichter & Patzner, 1997 (single specimen from Çandarlı Bay, 38°52'N–26°53'E, depth 8 m); *Callionymus filamentosus* Valenciennes, 1837 (1 specimen from Marmaris, 36°50'N–28°16'E, depth 22–30 m); *Cynoglossus sinusarabici* (Chabanaud, 1931) (1 specimen from Ekincik Bay, 36°49'N–28°33'E, depth 18–20 m); *Torquigener flavimaculosus* Hardy & Randall, 1983 (3 specimens from Marmaris, exact coordinates not available, fish were captured by a fishing rod at a depth of 15–20 m). First records for the Levantine coast of Turkey: *Dysomma*

brevirostre (Facciola, 1887) (1 specimen from İskenderun Bay, 35°59'N–35°54'E, depth 250–260 m); *Apletodon dentatus* (Facciola, 1887) (8 specimens from Fethiye Bay, 36°39'N–29°03'E, depth 5–30 m); *Zebrus zebrus* (Risso, 1827) (1 specimen from Fethiye Bay, 36°35'N–28°50'E, depth 12 m).

4. Discussion

In comparison to the baseline checklist published by Bilecenoğlu et al. (2002a), a quantitative increase of ca. 14.5% has occurred in the local fish biodiversity (from 449 spp. to 512 spp.). Among factors contributing to this faunal enrichment, both the rise in the number of taxonomical studies and the influence of the continuous influx of tropical (Red Sea, Indian Ocean, and Indo-Pacific) origin species are quite evident. However, as can be seen in Figure 2, studies have concentrated on some distinct localities and several more have been left unexplored. We think that by the further planning of faunal surveys at data-poor localities it is doubtless possible to find many of the previously overlooked unreported species. Such data are not only vital for monitoring local biodiversity, but also of crucial importance in prioritizing the marine protected areas scheduled to be established.

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