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# EUPHRATES AND TIGRIS, MESOPOTAMIAN ECOLOGY AND DESTINY

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# 8 The fishes of the Tigris and Euphrates rivers

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The inhabitants of the Fertile Crescent have been involved with the fishes of the Tigris and Euphrates rivers for over 4000 years. The oldest-known fishponds were built in temples by the Sumerians and, before long, many of the settlements throughout the region had their own fishponds. In view of the long-established interest in fishes in this part of the world, it comes as a surprise to realize that our present-day knowledge of the fish fauna and its zoogeographical affinities is extremely scanty.

The headwaters of the Tigris and Euphrates originate in the highlands of Turkey, and are separated by high, narrow watersheds from rivers flowing into the Black and Caspian Seas. To the northwest, much lower watersheds in the arid areas of Syria and southern Turkey separate the Euphrates from rivers draining into the Mediterranean. The lower reaches of the Tigris and Euphrates are confined between Iran's Zagros mountains in the east and the Alwadyan desert of Iraq and Arabia to the west.

Below Baghdad, the rivers flow through a marshy, alluvial plain until they join at Basrah to form the Shatt-el-Arab, which shortly empties into the Persian Gulf. Interconnections between the Tigris and Euphrates are plentiful and there is no doubt that the two rivers can be treated as a single unit from a zoogeographical point of view. The headwaters arise close together to the east of Lake Van, whilst at Basrah the rivers join. Elsewhere in the system there are small, natural interconnections as well as many artificial irrigation channels.

There are some 'lakes' (standing waters) within the catchment area. The isolated Lake Van basin, although formerly part of the system and possessing certain faunal similarities (Kuru, 1971), is not considered in this chapter. In the south there are extensive swamps with areas of open water. The largest of these is Hawr al Hammar with a surface area of 5200 km$^2$ at high water and 3500 km$^2$ at low water level. The immense volume of silt deposited by the Tigris and Euphrates has made Hawr al Hammar shallow and eutrophic, and it is a major centre for freshwater fisheries. Mileth Thartar is a shallow sump fed by the Wath Thartar which lies between the Tigris and Euphrates and is connected to the latter by a canal. Mileth Thartar is extremely variable in its dimensions. The deepest lake in the system is Habaniyah, to the west of the Euphrates, which is only 13 m deep when flooded and 6 m deep at the end of summer. The swamps, which can be regarded as eutrophic lakes, more than double in area when they are flooded, at which time local basins may be 3 m deep.

The present-day disposition of water in the Tigris and Euphrates catchment is ephemeral. Archaeological research has provided ample evidence for floods of both salt and fresh water at various sites around the lower reaches of the rivers. The present-day catchment, the Mesopotamian Plain, came into existence at the end of the Zagros orogeny (Miocene-Pliocene) and has been gradually subsiding ever since (Lees & Falcon, 1952). These authors suggested that prior to the Zagros orogeny the rivers from central Iran flowed along mature valleys to the Tigris and Euphrates and/or the Persian Gulf. (It should be noted that their opinion has not been substantiated). Later uplift caused increased erosion producing the river terraces or isolated plateaux. The apparent upstream movement of the delta in the immediate post-glacial period was caused more by a rise in sea-level than by the sinking of the land. Lees & Falcon (*op. cit.*) point out that even within the last 2500 years, salt water floods have extended upstream of the junction of the Tigris, Euphrates and Karun Rivers. They argue that these salt water encroachments probably resulted from local subsidence. Indeed, the extensive marshes owe their existence to this phenomenon. The largest marsh, Hawr al Hammar, has a historically recent origin. Lees & Falcon (1952) quote Le Strange (1905) who translated old writings recording the breeching of dykes at the end of the fifth century A.D. and finally, the creation of the great swamp by a massive flood and subsidence in about 636 A.D. (see other interpretations in Chapter 5).

It is axiomatic that, prior to discussions on the zoogeographical affinities of the Tigris and Euphrates ichthyofauna, the composition of that ichthyofauna must be known. This is a problem to which the only solution presently available, and an unsatisfactory one at that, must be based on a review of the literature. There are certain dangers inherent in this approach. Firstly, confirmation of the identification is generally impossible although, in some cases, the alleged presence of a species has been confirmed by reference to collections in the British Museum (Natural History). Secondly, the taxonomic status of some species is in doubt. In certain cases, doubt arises over whether a taxon recognized from the Tigris and Euphrates could have specific or subspecific rank. The difficulties associated with ranking at this level are exaggerated by our inadequate knowledge of infraspecific variation, as Kuru (1971) has shown. Further doubt, due entirely to a lack of detailed study, concerns the generic placement of certain species. Errors already present in the literature have been progressively compounded by subsequent authors who have not checked their original sources. Some of the most spectacular errors are itemized below.

Khalaf (1962) and Mahdi (1962) independently produced the first two check lists in recent times. Both authors list 41 primary freshwater fish species but these two lists have only 27 nominal species in common, thereby implying a total of 55 species in the Tigris and Euphrates Rivers. Al-Hamed (1966) produced a check list essentially the same as Khalaf's (*op. cit.*). Mahdi & Georg (1969) listed 45 freshwater fishes which excluded, without comment, some of the species included in the senior author's 1962 list. The most recent, and most extensive, check list (Al-Nasiri & Hoda, 1976) is a compilation from those of Mahdi & Georg (*op. cit.*) and Khalaf (*op. cit.*), with the addition of a few Syrian species, which the authors thought might live in Iraq, taken from Beckman (1962).

The uncritical use and compilation of check lists can result in some alarming errors. For example, Al-Nasiri & Hoda (1976) include the species *Euglyptosternum coum* (L) in the family Siluridae, *Glyptothorax cous* (L) in the Sisoridae and *Arius cous* Heckel (*sic*) in the Ariidae. In reality, all three names refer to a sisorid catfish. Its inclusion as a silurid stems from a mis-reading of Khalaf (1962). Further confusion originates from Ladiges (1964) who reported the occurrence of *Arius cous* Heckel 1843 (*sic*) in the Tigris. Reference to Heckel, 1843: 1094 shows that this 'ariid' is the sisorid mentioned above and that Heckel (*loc. cit.)* merely referred this species to the genus *Arius* and did not, as Ladiges implies, describe it. Al-Nasiri & Hoda (1976) record *Arius cous* and even provide an illustration of it (Al-Nasiri & Hoda 1976: fig. 101). The descriptions of *Euglyptosternum coum* and *Glyptothorax cous* in Al-Nasiri & Hoda (1976) refer to figures of these two 'species', respectively figs. 67 and 71. Perhaps significantly, there is no fig. 67!

Although it can be established that only one species is involved (the sisorid), even the correct generic name for this species is in doubt. If it is not referable to *Glyptothorax* as limited by Hora (1923) then it must be included in *Aclyptosternon* of Bleeker, 1863). My inclusion of the species *coum* in *Aclyptosternon* is no more than an act of convenience.

The case of *Aclyptosternon coum* is not unique. Species attributed variously to the genera *Leuciscus*, *Alburnus*, *Acanthobrama* and *Abramis* in particular, have appeared, disappeared and been re-assigned in various check lists. However, it must be admitted that, with the recent exception of *Acanthobrama* (Goren, Fishelson and Trewavas, 1973) these genera are extremely ill-defined and are very probably artificial, polyphyletic assemblages.

A particular case in another cyprinid assemblage can be cited. *Systomus albus* Heckel 1843 was synonymized with *Barbus luteus* (Heckel, 1843) by Günther in 1868. Al-Nasiri & Hoda (*op. cit.*) placed *albus* in *Barynotus* Guñther in 1868 and their check list contains both *Barynotus albus* and *Barbus luteus.*

Bearing in mind all these various limitations, and especially the lack of adequate revisionary studies at the species level, the Table represents as accurate a faunal list as it is possible to compile. It incorporates the latest, generally accepted revisions, and includes all the nominal species of the check lists mentioned above. Specific comments on the non-acceptance of certain generic re-arrangements advocated by the revisors are discussed below. There are several comments and qualifications that must be made concerning the contents of the Table. For example, *Phoxinellus zeregi* is listed as present by Mahdi & Georg (1969) but, according to Beckman (1962) and Karaman (1972), is only found in the rivers to the west of the Tigris and Euphrates. Similarly, *Garra lamta* is confined to northern India in the opinion of Menon (1964). Should these, apparently anomalous, listings have been based on misidentifications, it is impossible to suggest which species may have been misidentified.

Secondly, a few species in the table (e.g. *Hemigrammocapoeta nanus*) are included on the basis of preserved specimens in the collections of the British Museum (Natural History); they have not previously been recorded from the Tigris and Euphrates. The presence of *Heteropneustes fossilis* in these rivers is a recent event. Khalaf (1962) reported that in 1960 large numbers of this species appeared for the first time in the Shatt-el-Arab and subsequently dispersed through the system. *Heteropneustes fossilis* is native to the freshwaters from Pakistan eastwards and it is assumed that a large scale migration led to its establishment in the Tigris and Euphrates.

Thirdly, there is the problem of generic attribution, a matter of no small importance in the discussion of zoogeographical affinities. For example, when Karaman (1971) revised the *Barbus* species of this region he placed *B. sharpeyi* and *B. luteus*, respectively, in his newly erected genera *Mesopotamichthys* and *Carassobarbus*. *Barbus subquincunciatus* he referred to *Bertinus* of Fang 1943 and *Barbus grypus* to *Tor* of Gray 1834. Karaman's generic re-arrangements have not met with universal acceptance. Banarescu (1973) has expressed doubts about the validity of some of Karaman's genera, and the use of *Bertinus*, in particular, has been criticized by Banister & Clarke (in press). This 'genus' is characterized by the presence of only four teeth in the inner pharyngeal row (five is the usual number in *Barbus*) and the teeth are enlarged and molariform. Very similar modifications to the pharyngeal dentition occur in unrelated *Barbus* species (e.g. *Barbus eurystomus* from Lake Malawi) and it has been argued that they represent a response to a molluscan diet (Banister & Clarke, in press). It would seem most unwise to change the generic attribution on such dubious, or at least, unproven characters. It is, however, extremely likely that not only *Barbus*, but also some of the other 'genera' are polyphyletic. Since detailed phylogenetic analyses are lacking, discussions on the faunal affinities have, of necessity, to be based on what may well be non-monophyletic assemblages.

The primary freshwater fish fauna is dominated by members of the Superorder Ostariophysii or, to put it another way, there is a remarkable absence of non-ostariophysan fishes. Apart from the Trout (which although not a primary freshwater fish included in the Table for convenience) the only non-ostariophysan fish is *Mastacembelus mastacembelus* a member of the Superorder Percomorphii.

The almost complete domination of the fauna by ostariophysans is unique in a sub-tropical river system of this size. Although throughout southern Asia generally the majority of fish species in the rivers belong to the Ostariophysii, there is a substantial contribution from species belonging to other groups (*e.g.* Centropomidae, Channidae and anabantoids). In small rivers, especially in arid areas with a sparse fauna (e.g. Arabia, see Banister & Clarke, 1977), the fauna can be entirely ostariophysan. However, in these cases only a few species are involved (8 in the case of the Arabian peninsula, in contrast to the 59 nominal species in the Tigris and Euphrates).

Apart from the Trout, which is confined to the Anatolian headwaters of the system (Kuru, 1971), nothing is known of the distribution of species throughout the Tigris and Euphrates. Other Anatolian species listed by Kuru (*op. cit*) also occur in subsequent check lists, without any comment, so it must be assumed that they are widely distributed throughout these rivers. There may well be seasonal movements of fishes, as Al-Hamed (1966) reported. This author noted that as the water level fell during the summer, the water warmed up and the fishes either migrated upstream or into the deepest parts of 'lakes' and marshes to reach cooler conditions.

Families and genera of freshwater fishes common to Africa and Asia have long exercised the ingenuities of biogeographers. The discontinuous distribution shown by *Clarias*, *Barilius* and the Anabantidae has suggested to some authors a Gondwanic origin for these groups. Others, however, have disagreed and the opposing views, exemplified by *Clarias* distribution, are collated and discussed in Banister & Clarke (1977). None of the three taxa mentioned occurs in the Tigris and Euphrates; *Barilius mesopotamicus* has now been shown to be a *Leucaspius* (Howes, in press).

*Mastacembelus* and to an even greater extent, *Garra* present a less clear-cut problem. Both genera have representatives in Africa, Asia as well as in the Tigris and Euphrates, but these genera have a relatively continuous distribution from Africa to eastern Asia (Banister & Clarke, 1977).

The distribution of the family Mastacembelidae is interesting. In Africa many species occur in the Zaire basin, but fewer live in north-east Africa. In Asia, the family is widespread, from the Tigris and Euphrates into Pakistan, India, Sri Lanka, Burma, through the Malay Peninsula to Sumatra and Borneo and in Indo-China as well as southern China. Sufi (1956) recognizes 16 species, belonging to two genera, throughout the Asian region. In the Middle East only one species is present, in the Tigris and Euphrates. Although *Mastacembelus mastacembelus* was described from a river near Aleppo in Syria (variously the river Quweik, Kueik or Kowick) it has not been found there during recent surveys (Beckman, 1962). The River Quweik is a closed system, flowing southwards from the highlands of southern Turkey into the Syrian desert. As *Mastacembelus mastacembelus* is not found in the Orontes river, one is led to presume that the Quweik and Euphrates may formerly have been confluent. The watershed between these two rivers is extremely low and their present separation would seem to be due more to contemporary aridity than to the presence of physiographical barriers. The highlands between the Orontes and the Quweik present a more formidable physiographical barrier to the extension of the range of *Mastacembelus*, although the orogeny of this range has not been dated.

Apart from the Quweik River, *Mastacembelus mastacembelus* is not found outside the Tigris and Euphrates system. Within that system it appears to be widespread although it has not been reported from the headwaters. Mastacembelids are absent from Iran but are represented in Baluchistan by *M. armatus*, which also occurs in the Indus River (Berg, 1949). This species ranges from Baluchistan to southern China and Java (Sufi, 1956).

The cyprinid genus *Garra* has representatives throughout most of the soudanian region of Africa and in suitable biotopes in Arabia, the Tigris and Euphrates system, Baluchistan, Pakistan and southern Asia from south China to Borneo (Menon, 1964). This genus has never been subjected to an adequate phylogenetic analysis, although in the only recent review Menon (*op. cit.*) attempted to group species into supra-specific complexes. He aligned *Garra rufa* with *Garra barriemiae* from Oman and the United Arab Emirates. Although the characters used for associating these two species have not been properly evaluated phylogenetically, the distribution of the two species is such that their association could well be valid. Today the saline barrier of the Persian Gulf and the arid areas of northern Arabia separate the two species. Formerly, however, these barriers did not exist. Until about 10 000 years ago, the Persian Gulf was filled with the freshwater discharge of the Tigris and Euphrates (Kassler, 1973) which, coupled with a wetter climate (Banister & Clarke, 1977) afforded the possibility of the complete occupation of the area encompassing the now discontinuous home ranges. However, it is still unknown to which other species *Garra rufa* and *Garra barriemiae* are related.

The loaches of the Tigris and Euphrates have been subject to even less study than have the cyprinids. The Spined Loach, *Cobitis taenia* is one of the most widely distributed Eurasian fishes, being found in suitable waters from Europe to Taiwan (Berg, 1964). *Sabanajewia aurata* is, by these standards, much more localized, occurring from the middle Danube and other Black Sea tributaries through Asia Minor to the Aral Sea drainage. Loaches of the genus *Noemacheilus* also occur throughout Eurasia and their absence from the Tigris and Euphrates would be of more significance than their presence.

The southern limit of distribution of the European catfish, the Wels *Silurus glanis* is the Tigris and Euphrates system. There is some doubt as to whether *Silurus triostegus* is specifically distinct from *Silurus glanis* and whether *Silurus chantrei* Sauvage occurs in the system. Sauvage (1882) described *S. chantrei* from Tiflis (Tbilsi) on the Kura River. Berg (1933, 1964) made the unsupported statements that *Silurus chantrei* is (a) a species of *Parasilurus* and (b) that '. . . its home, (is) allegedly the Kura River (actually Syria or the Tigris basin) . . .'. Haig (1952: 72) provided evidence that *Parasilurus* is not a valid genus but she retained *Silurus chantrei* as a distinct species; she also noted, but did not comment on, Berg's observations on the type locality. Unfortunately, there is no mention of *Silurus triostegus* in her revision. Berg (1949) records *Silurus triostegus* (as *Parasilurus triostegus*) from the Tigris and Euphrates. Hora & Misra (1943) put forward some arguments to suggest that *Silurus triostegus* is no more than a variant of *Silurus glanis*. They also wrote that *Silurus chantrei* 'is probably a synonym' of *Silurus asotus* L from China, Japan and eastern Russia. In view of the confusion surrounding this (or these) species no useful comments of a zoogeographical nature can be made.

The sisorid catfishes of the genus *Glyptothorax* and *Aclyptosternon coum* (see p. 97) from the Tigris and Euphrates are the westernmost representatives of their family. The other members of this family inhabit small rivers of southern and western Asia. Although species of the family Bagridae occur in both Africa and Asia, the single bagrid in the Tigris and Euphrates (*Mystus pelusius*) is a member of a genus limited to, but widespread in, southern Asia and peninsular India.

Thus, the catfishes occurring in the Tigris and Euphrates are representative of both European and southern Asian faunal elements.

It can be seen from the affinities of particular genera and species of primary freshwater fish discussed above (and on p. 104–106) that the Tigris and Euphrates have acquired a mixed fauna with a low endemicity.

This observation has been made by previous commentators on zoogeographical problems. DeBeaufort (1951), for example, regarded Mesopotamia as being in the holarctic, but also as belonging to a zone of transition between the holarctic and oriental regions. This transition zone has, as deBeaufort (*op. cit.*) pointed out, been regarded as a part of a larger (Tyrrhenian) zone incorporating holarctic-ethiopian transition regions as well as the holarctic-oriental transition region. Kuru (1971) evaluated the zoogeographical affinities of the 34 fish species he found in the Anatolian headwaters of the Tigris and Euphrates. He concluded that four elements were present: (1) western Palaearctic (European); (2) western Asian; (3) south-east Asian and Indian (with some African links – a Mesopotamian fauna); and (4) a Samartian (proto-Black Sea) component. Banarescu (1975) divided his Sino-Indian region (Oriental region, *auctt*) into four subregions. The most westerly (his west Asian region) includes the Tigris and Euphrates, the rivers of Syria, Lebanon, Israel, most of Iran, Afghanistan and a part of Pakistan. He regarded the west Asian region as possessed of a poor ichthyofauna, a result of the aridity of the region, and as having European ('Leuciscines', *Cobitis* and *Sabanejewia*) or Indo-Malayan (the 'Barbines') affinities. In particular, Banarescu decided, but did not attempt to substantiate his decision, that the genus *Barbus* had its origin in that region.

Kosswig (1956) suggested that the exchange of tropical and palaearctic faunas began in the Pliocene with the retreat of the Syrian-Iranian Sea (also known as the Fars Sea, the Sea having been named from its extensive deposits). With this sea in existence, the fauna of Anatolia was an entirely palaearctic one. Once the sea had retreated, Eremian (of desert origin) elements entered Anatolia from the south and east, and tropical elements via Jordan. Subsequently, the fauna of the Anatolian lakes was affected by glaciation.

As far as I can discover, no comprehensive reconstruction of the palaeogeography of this part of the world has been published. However, thanks to the kindness of Dr. G. F. Elliott of the British Museum (Natural History) the following reconstruction can be offered, based on unpublished information and his knowledge of the geology and geography of the region.

The Zagros orogeny started in the late Tertiary and continued as the Fars Sea dried up. The emerging Zagros mountains at first formed the eastern shore of the sea. The orogeny continued westwards, culminating in the uplift of the Anatolian plateau during the Pliocene. The uplift was partially responsible for the retreat and desiccation of the Fars Sea but as the plateau was uplifted lakes formed in the block faults and contained remnants of the Fars fauna (e.g. the mysid shrimp *Mesomysis*, see Kosswig, 1956). Some lakes dried out, leaving salt deposits, others were sumps for new rivers and gradually became less saline. The differing angles of plateau tilt, as the uplift continued, changed drainage direction and allowed many opportunities for river and lake capture. The Tigris and Euphrates would first have formed in the Pliocene when the water from the developing Zagros mountains drained away to the west and then flowed south into what is now the Persian Gulf. The establishment of the Anatolian highlands resulted in the northern extension of the Tigris and Euphrates as run-off increased the rate of back-cutting. During the Quaternary the lakes on the plateau were much larger than now and it is very likely that central Anatolia consisted of one very large lake (Lahn, 1948).

There is some evidence that the Mesopotamian region has long had a mixed fauna. Mecquenem (1924–1925) described early Pliocene mammal fossils from volcanic tuffs in north-west Iran and remarked that they had European, African and Asiatic affinities.

In the light of the geological history of the region, and in the absence of any phylogenetic studies on the fauna, the impossibility of arriving at any definitive conclusions on the zoogeographical affinities of the fishes of this region becomes understandable. The fauna has mixed origins, with substantial contributions from Europe as well as elements of a widespread, but generally Asiatic fauna and a smaller contribution from the rivers immediately to the east. The low endemicity may well reflect the unsettled nature of the pattern of water distribution, with few water bodies being isolated for a sufficient length of time to allow speciation to proceed.

Table. A compilation of all the names of species listed as occurring in the Tigris and Euphrates. In the left hand column (column 1) the genera and species are arranged alphabetically by families. The numbers in parentheses refer to the postscripts where the genera in question are discussed in detail. Column 2 contains the names by which the species in Column 1 are now known. A blank indicated that the name remains unchanged. Column 3 lists the authorities for the name changes.

| Listed name | Current status | Authority |
|---|---|---|
| SALMONIDAE | | |
| *Salmo trutta* L | | |
| CYPRINIDAE | | |
| (1) *Acanthobrama arrhada* Heckel | *Acanthobrama marmid* | Karaman 1972 |
| *Acanthobrama centisquama* (Heckel) | | |
| *Acanthobrama marmid* Heckel | | |
| *Acanthobrama orontis* Berg | *Acanthobrama marmid* | Karaman 1972 |
| *Alburnoides bipunctatus fasciatus* (Nordmann) | | |
| (2) *Alburnus caerulus* Heckel | | |
| *Alburnus capito* Heckel | *Chalcalburnus mossulensis* | Berg 1949 |
| *Alburnus mossulensis* Heckel | *Chalcalburnus mossulensis* | Berg 1949 |
| *Alburnus orontis* Sauvage | | |
| *Alburnus pallidus* Heckel | | |
| *Alburnus schejtan* Heckel | *Chalcalburnus mossulensis* | Berg 1949 |
| *Alburnus sellal* Heckel | *Chalcalburnus sellal* | Berg 1949 |
| (3) *Aspius vorax* Heckel | | |
| (4) *Barbus barbulus* Heckel | *Barbus rajanorum* | Karaman 1971 |
| *Barbus belayewi* Menon | | |
| *Barbus canis* Valenciennes | | |
| *Barbus chantrei* (Sauvage) | *Barbus canis* | Karaman 1971 |
| *Barbus esocinus* (Heckel) | | |

| | | |
|---|---|---|
| *Barbus euphrati* (Sauvage) | *Barbus esocinus* | Karaman 1971 |
| *Barbus faoensis* Günther | *Barbus sharpeyi* | Karaman 1971 |
| *Barbus grypus* Heckel | | |
| *Barbus kersin* Heckel | *Barbus capito* | Karaman 1971 |
| *Barbus kotschyi* Heckel | *Barbus grypus* | Karaman 1971 |
| *Barbus lacerta* Heckel | *Barbus plebejus* | Karaman 1971 |
| *Barbus longiceps* Valenciennes | | |
| *Barbus lorteti* Sauvage | *Barbus longiceps* | Karaman 1971 |
| *Barbus luteus* (Heckel) | | |
| *Barbus mystaceus* (Heckel) | *Barbus rajanorum* | Karaman 1971 |
| *Barbus orontis* (Sauvage) | *Barbus capito* | Karaman 1971 |
| *Barbus pectoralis* Heckel | *Barbus capito* | Karaman 1971 |
| *Barbus rajanorum* Heckel | | |
| *Barbus scheich* Heckel | *Barbus rajanorum* | Karaman 1971 |
| *Barbus scincus* Heckel | *Barbus plebejus* | Karaman 1971 |
| *Barbus sharpeyi* Günther | | |
| *Barbus subquincunciatus* Günther | | |
| *Barbus xanthopterus* (Heckel) | | |
| *Barilius mesopotamicus* Berg | *Leucaspius mesopotamicus* | Howes (in press) |
| *Barynotus albus* (Heckel) | *Barbus luteus* | Karaman 1971 |
| (5) *Capoeta barroisi* Lortet | | |
| *Chondrostoma nasus* (L) | | |
| *Chondrostoma regium* (Heckel) | | |
| (6) *Cyprinion kais* Heckel | *Cyprinion macrostomum* | Berg 1949 |
| *Cyprinion macrostomum* Heckel | | |
| *Cyprinion tenuiradius* Heckel | | |
| (7) *Garra gymnothorax* Berg | *Garra rufa* | Menon 1964 |
| *Garra lamta* (Hamilton) | | |
| *Garra obtusa* (Heckel) | *Garra rufa* | Menon 1964 |
| *Garra rufa* (Heckel) | | |
| *Garra variabilis* (Heckel) | | |
| *Hemigrammacapoeta nanus* (Heckel) | | |
| *Leuciscus berak* (Heckel) | | |
| *Leuciscus cephalus orientalis* | | |
| *Leuciscus lepidus* (Heckel) | | |
| *Leuciscus zeregi* (Heckel) | *Phoxinellus zeregi* | Karaman 1972 |
| *Rutilus tricolor* Lortet | *Acanthobrama tricolor* | Karaman 1972 |
| *Tylognathus elegans* Günther | *Hemigarra elegans* | Karaman 1971 |
| *Typhlogarra widdowsoni* Trewavas | | |
| *Varicorhinus damascinus* (Valenciennes) | *Capoeta capoeta* | Karaman 1969 |
| *Varicorhinus trutta* (Heckel) | *Capoeta trutta* | Karaman 1969 |
| *Varicorhinus umbla* (Heckel) | *Capoeta capoeta* | Karaman 1969 |
| COBITIDAE | | |
| *Cobitis aurata* (de Filippi) | *Sabanajewia aurata* | Banarescu *et al.* 1972 |
| *Cobitis taenia* L | | |
| *Noemacheilus angorae* Steindachner | | |
| *Noemacheilus argyrogramma* (Heckel) | | |
| *Noemacheilus frenatus* (Heckel) | | |
| *Noemacheilus insignis* (Heckel) | | |
| *Noemacheilus panthera* (Heckel) | | |
| *Noemacheilus malapterurus* (Valenciennes) | | |
| *Noemacheilus tigris* (Heckel) | | |
| *Turcinonoemacheilus kosswigi* Banarescu & Nalbant | | |

| | | |
|---|---|---|
| ARIIDAE | | |
| *Arius cous* see p. 97 | *Aclyptosternon coum* (SISORIDAE) | This paper |
| SISORIDAE | | |
| *Glyptothorax cous* see p. 97 | *Aclyptosternon coum* | This paper |
| *Glyptothorax armeniacum* Berg | | |
| *Glyptothorax kurdistanicum* Berg | | |
| *Glyptothorax steindachneri* (Pietschmann) | | |
| SILURIDAE | | |
| *Euglyptosternum coum* see p. 97 | *Aclyptosternon coum* (SISORIDAE) | This paper |
| *Silurus glanis* L. | | |
| *Silurus triostegus* Heckel | | |
| BAGRIDAE | | |
| *Mystus colvilli* (Günther) | *Mystus pelusius* | Jayaram 1954 |
| *Mystus pelusius* (Solander) | | |
| HETEROPNEUSTIDAE | | |
| *Saccobranchus fossilis* Valenciennes | *Heteropneustes fossilis* | Hora 1936 |
| *Heteropneustes fossilis* (Bloch) | | |
| MASTACEMBELIDAE | | |
| *Mastacembelus hallepensis* Günther | *Mastacembelus mastacembelus* | Sufi 1956 |
| *Mastacembelus mastacembelus* (Solander) | | |

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(1) Species of the cyprinid genus *Acanthobrama* (*sensu* Goren *et alii*, 1973 not of Karaman, 1972) inhabit rivers from the eastern edge of the Mediterranean to the Tigris and Euphrates. The genus is not found east of the Tigris and Euphrates system. In the past there has been some confusion in the attribution of certain species to *Acanthobrama* or *Phoxinellus*. Ķaraman (1972) included the north African species *callensis* in *Acanthobrama*, but this species has now been shown by Howes (in press) to have been correctly placed in *Phoxinellus* by Pellegrin (1920). The presence of *Phoxinellus zeregi* (as *Leuciscus zeregi*) in the Tigris and Euphrates was noted by Al-Nasiri & Hoda (1976), but Karaman (1972) in his revision of *Phoxinellus* makes no mention of its presence in that river system. If, however, a species of *Phoxinellus* really does occur in the Tigris-Euphrates system then the genus has a most interesting distribution. As interpreted by Karaman (1972), *Phoxinellus* is a circum-Mediterranean genus. Subspecies of *zeregi* are found in Israel, Lebanon, Syria, Turkey and Azerbaijan. In Tunisia and Algeria are found *P. chaignoni* and *P. callensis*. Subspecies of *P. stimphalicus* and *P. adspersus* occur in Jugoslavia and Greece. *Phoxinellus pleurobipunctatus* is recorded from Greece and the island of Corfu. The significance of this circum-Mediterranean distribution remains obscure; perhaps a greater knowledge of the geomorphology of the region will increase our understanding.

(2) The degree of kinship between *Chalcalburnus* and *Alburnus* is unknown. Berg (1964) separated the two genera on the relative lengths of the ventral keel and the relative stoutness of the last unbranched ray in the dorsal fin, two characters which, at the 'generic' level, should be

treated with a great deal of suspicion in the absence of any corroborating evidence. As re-defined by Berg (1964) *Alburnus* has representatives throughout the European palaearctic region, whereas *Chalcalburnus* is confined to regions around the Black, Aral and Caspian seas.

(3) *Aspius vorax* is, by definition, most closely related to its only congener, the European *Aspius aspius*. A subspecies of the widespread European species (*Aspius aspius taeniatus*) is reported from rivers flowing into the southern part of the Caspian Sea (Berg, 1964). The two species can apparently be distinguished by the presence of more scales in the lateral line series of *Aspius vorax* (94–105 *fide* Beckman, 1962 *cf.* 65–74 for *Aspius aspius fide* Wheeler, 1969). However, according to Berg (1964) the Caspian subspecies has 67–90 scales in the lateral line series. Counts of the lateral line scales taken on specimens of *Aspius vorax* in the British Museum (Natural History) range from 93–101. It is therefore likely that the two species of *Aspius* may not be as morphologically distinct as had been thought. Indeed, the fact the Caspian subspecies is meristically, as well as geographically, closer to *Aspius vorax* than is the European subspecies suggests that a clinal phenomenon may be involved. Nonetheless, the presence of *Aspius* in the Tigris and Euphrates indicates a European influence on its fauna.

(4) The most speciose genus in the system is *Barbus*. *Barbus grypus* is a contender for the title of the largest fish in the Tigris and Euphrates; specimens nearly 2 m long and weighing 100 kg have been reliably reported (Beckman, 1962 and Elliott, 1977). *Barbus* presents many difficulties to systematists. The species are morphologically very variable, and it is this variability, whether it be predominantly genotypically or phenotypically controlled, that has led to the description of many nominal species. Only when extremely large series of specimens have been studied can we have any degree of confidence that the taxonomist's species bear any relation to those in nature. The variability, both intra- and interspecific, may be so marked as to lead workers into erecting new genera (see p. 98). The majority of the *Barbus* species in the Table can be divided into two stocks, each of which may be monophyletic. These are the 'European' stock (fishes with a cylindrical body, small scales and a serrated dorsal spine) and the 'Afro-Indian' stock (fishes with a compressed body, large scales and a smooth dorsal spine). Of the 12 recognized species in this region, seven (*B. belayewi*, *B. esocinus*, *B. longiceps*, *B. plebejus*, *B. rajanorum*, *B. subquincunciatus* and *B. xanthopterus*) belong to the 'European' stock. The species *B. capito*, *B. grypus* and *B. sharpeyi* have the characters of the 'Afro-Indian' stock. Parenthetically, it may be mentioned that some of the Indian species of the 'Afro-Indian' stock, the Mahseers, are characterized by their large size, a trend noticeably manifest in *B. grypus*. The two remaining species, *Barbus luteus* and *B. canis* are less satisfactorily placed in a complex. Although superficially like the 'Afro-Indian' stock species, they differ in having six, not five, branched rays in the anal fin. The derived condition of the extra ray in the anal fin, along with the characters typical of the 'Afro-Indian' stock also occurs in the Arabian species *Barbus exulatus* and *B. apoensis* and it has been argued that the four species are closely related (Banister & Clarke, 1977).

Overall, the zoogeographical affinities of the *Barbus* species of the Tigris and Euphrates are mixed, apparently containing endemic species as well as Afro-Indian and European components.

(5) Members of the cyprinid taxon *Capoeta* have a wide ventral mouth and the lower jaw covered by a sharp-edged 'horny' sheath. The pharyngeal teeth have characteristic horseshoe-shaped crowns. Following the revision of Karaman (1969) the genus includes species formerly placed in the African genus *Varicorhinus*. *Capoeta* is endemic to the region from northern Asiatic Turkey to northern Afghanistan (both the internal basins and the Aral drainage, Karaman, 1969). *Capoeta capoeta* is the most widespread species, its range encompassing those of all the other species. The relationships of *Capoeta* to any other cyprinids are unknown.

(6) The cyprinid genus *Cyprinion* is endemic to the freshwaters between Syria and India, that indefinable region often loosely called the Middle East. Berg (1949) revised the genus and concluded that he could identify some supra-specific complexes. His most speciose group, the '*C. watsoni*' complex is characterized by the possession of less than eleven branched rays in the dorsal fin, and occupies the east and north-eastern parts of the generic range. Neither of the species alleged to be present in the Tigris and Euphrates belongs to this group (they have more

than 12 branched rays in the dorsal fin) so their affinities cannot lie with the eastern species. The relationships of the genus as a whole, and of *Cyprinion macrostomum* and *C. tenuiradius* in particular, are unknown.

It is possible, however, that the present-day distribution of the genus is less extensive than it was formerly. Hora (1956) described fish paintings on pots from the third millennium B.C. from Lal in Baluchistan, and discussed the zoogeographical implications of the genera depicted. The quality of the paintings is such that many of the genera depicted can be identified beyond doubt; the identification of other genera represented is, however, less certain. One of these is the fish identified by Hora as a *Cyprinion*. Here, let me say that I think Hora's identification is the most likely; it is impossible to be dogmatic on this issue, but there are no other extant genera with which the fishes in these paintings could have been confused, especially if the standard of accuracy is constant throughout all the pictures. Hora argues that the significance of these discoveries is that *Cyprinion* has become extinct in that region since the third millennium B.C. and formerly the rivers were more extensive, thus indicating a wetter climate and an enlarged ichthyofauna.

(7) Menon (1964) regarded *Garra variabilis* as related to *Garra rossica* from Afghanistan and he thought that these two species represents 'the most primitive known group of species within the genus'. However, the validity of relationships based on shared primitive characters has recently been questioned, so for the moment the postulated relationship of *Garra rossica* and *Garra variabilis* must be left in abeyance. The record of *Garra lamta* in the Tigris and Euphrates is regarded with some suspicion (see p. 97). If Menon's (*op. cit*) conclusions are correct, then the *Garra* species of the Tigris and Euphrates are each, and separately, more closely related to species from the east and west than they are to one another.

Whilst considering the genus *Garra*, mention should be made of the blind, hypogean species *Typhlogarra widdowsoni*. Implicit in the choice of generic name for this species is a close relationship with the epigean *Garra. Typhlogarra* is found in underground streams near Haditha, the waters of which ultimately drain into the Tigris and Euphrates. In the wetter climate pre 10 000 B.P., discussed above, it is likely that surface streams existed where there are now only subterranean ones. It might have been thought with only two epigean *Garra* spp. in the region the sister group (or groups) of the eyeless species would be easy to determine. Recent researches (which are far from complete) have suggested that this is not so. Firstly, and rather surprisingly for a cavernicolous fish, *Typhlogarra* has massive, enlarged pharyngeal bones with only three large, kidney-shaped, molariform teeth forming the inner row. The second row is usually absent, although in one specimen there are two minute teeth present. There is no trace of the third row. All the *Garra* species so far investigated have three rows of blade-like teeth arranged in a 5.3.2 pattern (fig. 28 in Banister & Clarke, 1977). In both *Garra rufa* and *Garra variabilis* the pharyngeal bones are relatively slender and fragile. Both *Garra fura* and *Typhlogarra* have four barbels and a mental disc. *Garra variabilis* has only two barbels. To confuse the issue further, two apparently distinct species inhabit the same underground system, the second species, however, has a slender pharyngeal bone and lacks the mental disc. On the basis of the characters so far examined, the new species is much more closely related to the epigean *Garra* spp than is *Typhlogarra*. The presence of *Typhlogarra* does nothing to aid any zoogeographical considerations on *Garra*.

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# Notes on the ecology of *Aphanius dispar* (Pisces, Cyprinodontidae) in the Sultanate of Oman

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SUMMARY. *Aphanius dispar* was observed in the field and some simple laboratory studies were undertaken in Oman. *A. dispar* is almost totally ubiquitous in all bodies of fresh water where it occupies a wide range of habitats differing in stream flow, water chemistry, temperature and substrate quality. It often is found in association with one or both of two cyprinid fishes, *Cyprinion* and *Garra*. *Aphanius* is tolerant of wide ranges of salinity up to full marine water and has a wide temperature range. *A. dispar* resembles *Cyprinodon* species in a number of particulars, probably reflecting phylogenetic relationships and a common evolutionary response to desert conditions. It breeds throughout the year with a probable peak in the months of April to June.

## Introduction

As would be expected in view of its arid climate, the Arabian peninsula has a depauperate fish fauna. Nine species of freshwater fishes are known to occur on the peninsula south of the northern border of Saudi Arabia (Banister & Clarke, 1977). Eight of these are cyprinids, one a cyprinodontid. In Oman, two of these cyprinids occur in most of the few permanent watercourses of that country [*Cyprinion micropthalmum* (Day), *Garra barreimiae* Fowler & Steinitz], one is known only from Saiq, a village in the mountains of Jabal al Akhdar, and *Aphanius dispar* (Rüppell) is ubiquitous in virtually all natural bodies of fresh water with permanent or periodic connection with the sea. *Aphanius dispar* is widely distributed throughout the coastal regions of the middle east bordering the Red Sea, Persian Gulf, Northern Arabian Sea and the eastern Mediterranean, possibly having existed in the latter area prior to the construction of the Suez Canal (Steinitz, 1951; Kattinger, 1966; Kornfield & Nevo, 1976; Banister & Clarke, 1977). Many studies have investigated aspects of the physiology of this very euryhaline species (see for example Lotan, 1969, 1971, 1972, 1973; Skadhauge & Lotan, 1974). Apparently few studies have investigated its ecology and/or natural history (Al-Daham, Huq & Sharma, 1977) and none have been reported on *Aphanius dispar* from Oman. This paper reports on some aspects of the natural history of *A. dispar* in the Sultanate of Oman.

## Methods

Field observations of occurrence, behaviour and association with other fish species were made in northern Oman during November and December 1978. Twelve locations were visited, including Wadi Sumail, Wadi Fanja, Wadi Bid-Bid, El Meah, Nizwa, Boshar, Birkit Al-Mawz, Nakhl, Rostaq, Falaj (near Awabi), Izki and Sherrayah (near Saiq, Jabal al Akhdar) (Fig. 1). Twenty-four hours of observations were made in the field at Boshar and forty at Wadi Fanja (six

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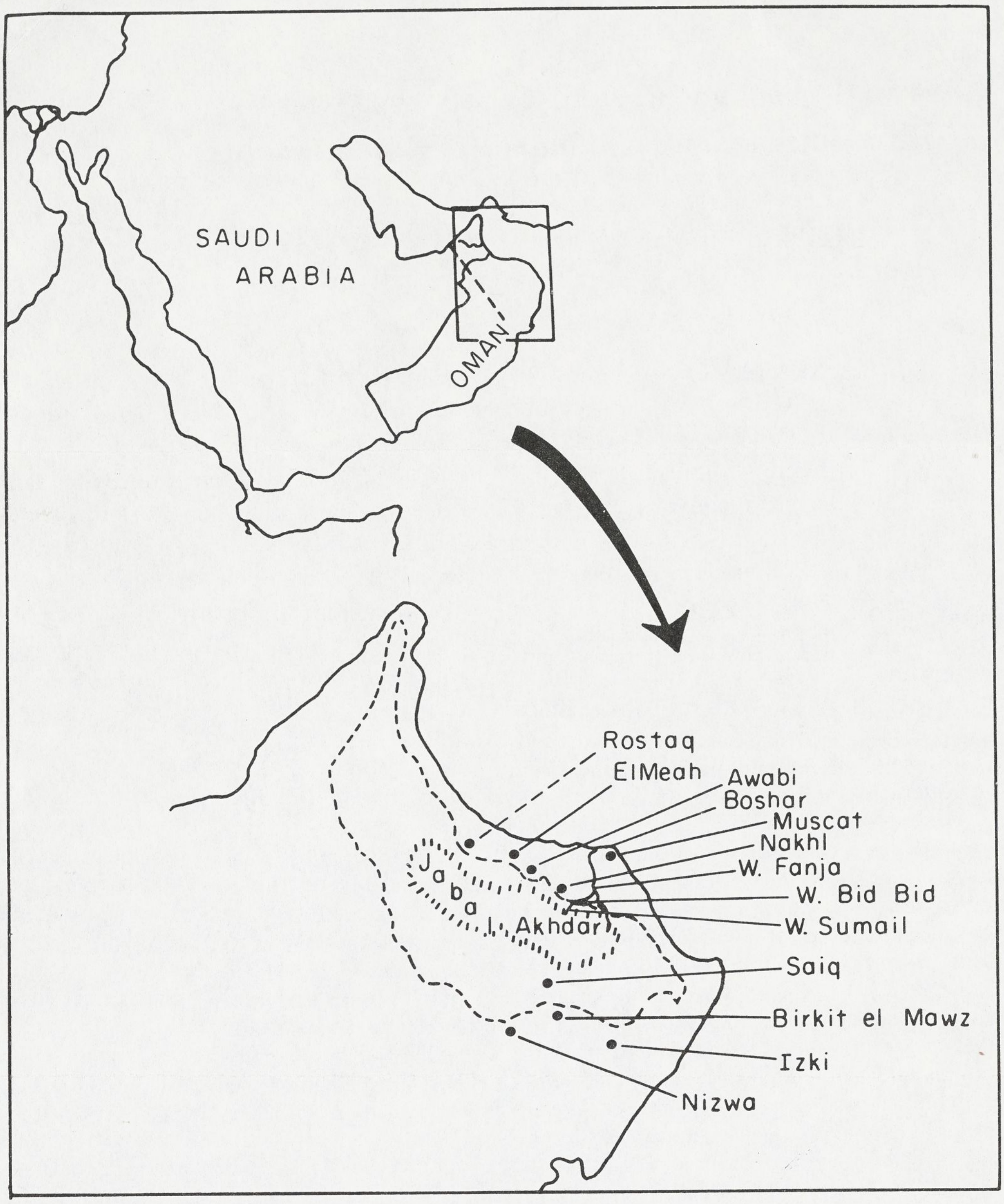

FIG. 1. Observation and collection sites in Oman.

and ten visits each for 4 h or more at each site), while observations were limited to 1–2 h at each of the other locations. Three females and one male of *Aphanius dispar* were observed for 4 weeks in a 30 × 30 × 45-cm aquarium constructed and maintained in the author's hotel room, where temperature and salinity tolerance experiments were also conducted. Fish preserved in April and June 1976 by Mr Said Matta, WHO Technical Officer, were examined for gut contents and reproductive state in addition to specimens collected by the author. Field studies at Wadi Fanja included underwater observation with face mask and snorkel. Water temperatures were measured at each site where *Aphanius* were located with a quick-reading Schultheiss mercury thermometer. pH was measured with two series of ranges of indicator paper (Dual-Tint, Baker Chemical Co., Phillipsburg, N.J., U.S.A.). Hardness was measured with Tetratest Harte titration methods (Tetra Werke, Melle, West Germany). Calcium, magnesium carbonate hardness and total hardness (carbonates plus Ca and Mg) are measured with this method.

## Results

### *Distribution*

In Oman, *Aphanius dispar* is commonly found in a wide variety of habitats both man-made and natural. In the coastal plain region of Northern Oman (the Batinah) there are no natural bodies of water. All open water is dependent on pumping from underground for irrigation and there are numerous wells and open cisterns. *Aphanius* has been introduced in a few of these sites to control mosquitoes and they appear to be reproductively successful, even in wells. In the non-coastal areas away from the Batinah, fish occur in birkets (man-made mud or cement-lined ground-level cisterns), wadis and in the falaj system. Falajs are narrow, man-made irrigation channels bringing water from the mountains (Jabal al Akhdar), in constant use and repair for hundreds of years and in which there is rapid water flow.

With two exceptions, wherever fish are found *Aphanius* were present, often as the only species. The two exceptions were a large swampy area heavily overgrown with *Typha* sp. (cattails) in Wadi Fanja near its confluence with Wadi Bid-Bid where at its greatest depth (*c.* 2 m) large numbers of *Cyprinion* occur, and at an elevation of about 2,000 m in the Jabal al Akhdar in a warm spring and dependant falaj for the village of Shurayah (near Saiq) where *Gara longipinnis* Banister & Clarke occurs alone (the only known location of this species). No fish occur in a hot spring and dependant falaj at Rostaq though other falajs in that town have both *Aphanius* and *Garra barreimiae*. At Boshar, *Aphanius* is the only fish, occurring in warm springs (35.2°C), falajs and cisterns, including one heavily polluted with soap.

*Aphanius* is a strong swimmer occurring in the most rapidly flowing falajs, yet it also thrives in cisterns with little or no water flow. Juvenile fish are found in isolated wadi pools as small as 1 $m^2$ and in shallow flows 3–4 cm deep. In these small water bodies *Aphanius* is usually the only species of fish. Herons were observed feeding in various wadis and are probably responsible for the lack of larger adult fish in small and/or shallow areas.

*Aphanius* occurs over sandy, rocky or soft detritus substrates. In water about a metre or so in depth it is confined to the bottom if the water is flowing. In cisterns it occupies all levels as it does in falajs along the sides where algae cover exists. Its most common associate is *Garra barreimiae*. *Aphanius, Garra* and *Cyprinion* occur together where water flow is both rapid and deep, as well as in larger wadi pools. Here *Aphanius* swims near the bottom, *Garra* is generally on the bottom (*Garra* resembles closely the North American genus *Catostomus* —both species have subterminal sucker mouths) and *Cyprinion* is a mid-depth swimmer (it resembles common North American minnows, e.g. *Notemigonus*). In the falajs *Aphanius* commonly occurs with *Garra,* rarely with *Cyprinion.*

### *Tolerance to water conditions*

*Aphanius* were present in temperatures measured at about 14.00 hours ranging from 28.4°C (Sumail) to 38.4°C (Nakhl) and pH 7.4–8.0 (Mr Said Matta has one record of *Aphanius* at pH 8.5). Water hardness ranged from 9 degrees carbonate hardness and 19 degrees total hardness to 29 degrees carbonate and 36 total hardness (1 degree hardness equals 10 mg Ca or 10 mg Ca + Mg per l of water).

Four fish (*c.* 3 cm total length, three males, one female) were placed in a series of 33%, 50%, 60%, 100% marine water at 24-h intervals. All tolerated each change with no sign of stress and continued feeding. Four each of *Garra* and *Cyprinion* subjected to the same conditions showed signs of stress at 33% salt water and died at 50%. Five additional *Aphanius* (three male and two females) were placed directly in 60% sea water, another five directly into 100% sea water. The latter died within 12 h, the others survived.

Maximum and minimum temperature tolerances were measured for *Aphanius* adults collected at Wadi Fanja (29.5°C) and a hot spring at Nakhl (38.4°C). Maximum temperature tolerances for four each of *Garra* and *Cyprinion* (Fanja) were also measured. Maximum temperature is that at which fish died; minimum temperature is that at which fish lost equilibrium and were totally unresponsive to prodding. This minimum temperature is not necessarily that which causes death. Death at lower temperatures is a function of both temperature and period of exposure. Four fish each were measured for maximum and minimum tolerances for each of the two *Aphanius* populations. Fish were placed in 1 l of water in a plastic bag suspended in a water bath, the temperature of which was changed at 15-min intervals by the addition of hot water or ice cubes. This resulted in a temperature change of about 3°C per 10 min.

Upper temperatures at which 20.5°C-acclimated fish died were between 39.8 and 42.4°C, for 38.4°C-acclimated fish the range was 45.1–46.0°C. Minimum temperatures were *c.* 5.8–5.0 for Fanja fish and 9.6–5.8°C for Nakhl fish. Lower temperature tolerances were difficult to ascertain. For example, though appearing to be lifeless, Fanja fish at 5.0 and Nakhl fish at 5.8°C recovered if warmed to 14–18°C. However, no recovery occurred if fish were subjected to 4.8 and 5.2°C, respectively. *Garra* died at 39.5–40.2°C, *Cyprinion* at 36.5–37.0°C.

### *Feeding habits*

*Aphanius* possesses small teeth in both jaws. It feeds almost constantly, especially in more quiet waters, by picking at rocks and other substrates. It also will take items at the surface, chase small fish and eat insect larvae. Six adult males, eight females and one juvenile were measured, dissected and gut length was measured and contents examined microscopically. Gut length expressed as percentage of standard length was 272.1 (range 214.5–305.7) for males, 229.3 (range 158.5–302.2) for females and 111.1 for the juvenile, indicative of a largely herbivorous diet. Gut contents (all were full) were about 90–95% unicellular algae (desmids, diatoms, etc.) and 5–10% filamentous algae. One fish had *c.* 80% dipteran larvae, another had a single aquatic snail.

Though gut contents and length indicate a herbivorous diet, when given the opportunity animal matter is eagerly taken as food. Two adult females and one male were fed mosquito larvae, both Culicine and Anopheline, counted and pipetted into the aquarium for 4 days. A total of 1142 larvae was consumed for an average consumption of 96 larvae per fish per day in the presence of abundant alternative foods (algae).

### *Reproduction*

Reproduction appears to occur throughout the year. In the wadis, young fish of 3–4 mm length were very numerous in dense grass thickets where there is some water flow, where males in reproductive coloration were also found. No reproduction nor males in reproductive state were observed in falajs where water flow was very rapid nor in those areas of the cisterns where there was no flow. In falajs, reproduction was observed in places where the falaj was widened for washing and watering domestic animals and in cisterns where currents were formed by inflow. *Aphanius dispar* appears to prefer to spawn where there is some water flow and where there are vertical surfaces provided by plant material or algae-covered rocks.

Reproductive males were easily recognized by their enhanced colours and very active territorial behaviour. Non-territorial males are paler and less active. Reproductive behaviour begins within an hour or so after sunrise and continues more or less throughout the day, reaching greatest intensity at midday. Little reproduction was observed in the later afternoon and evening. There was no indication that any given male maintains the same territory from one day to the next. Individual males seemed to shift locations, remaining in a territorial area throughout one day and then moving elsewhere. The number of territorial males appeared to be determined by suitable locations with stream flow and vertical surfaces.

In November–December a small portion of the males, *c.* 5–10% of the male population, were in reproductive state at any one time. These were usually males of a size-class just below the largest, about 4 cm total length. Brightly coloured territorial males moved constantly in circles and figure-of-eight patterns in and around some feature of their territories such as a rock, algae clump or patch of grass.

Males in an area of suitable breeding sites were often numerous. Constant agitated movement, small territory size (about 30 cm diameter) and frequent presence of many active males produced a maelstrom of aggression, reproduction and territorial patrolling. Male-male aggression as males came into close proximity to one another was short and very intense. Aggression consists of parallel alignment, head to head, maximal spreading of median and caudal fins, rapid circling and quick bites to one another's flanks followed by a short chase, separation and return of each fish to its territory. Non-reproductive males which ventured into a territory were chased out. Non-reproductive males moved more slowly, did not hold territories and rarely engaged in any but the mildest aggression (chasing one another).

Females never defended territories. They often were in large all-female aggregations with very loose and changing composition of individuals. Females ready to spawn approached territorial males and appeared to feed on a rock or plant clump. The territorial male rapidly approached and placed his chin on her nape. If the female did not then leave, in which case she was chased out of the territory, the pair spawned 2–3 eggs in rapid sequence. While spawning, a female turns about 45° along the long body axis and presses the vent against the vertical surface of the spawning site while the male presses against her side with his body arched in an S-shape, pressing his anal fin against hers while clasping her with his dorsal fin. Single eggs are expelled with a shudder or snap by both fish. From chin-on-head to release of an egg may take as little as 1–2 seconds.

Reproduction appears to peak in the spring and early summer months and to be at its lowest frequency in the winter months. Twenty-six females collected at Fanja in November–December were preserved in the field and later dissected for examination of size of ovary and presence of ripe eggs. Ripe eggs were easily identified by their large size and ease of dissection from the ovarian matrix. Sixteen additional females collected and preserved in the field by Mr Said Matta in June 1974 and one female collected in April 1976 were likewise examined.

Twenty percent (5) of the November–December fish had a few ripe eggs (3–5). These females ranged in size between 3.68 and 5.12 cm standard length (SL). Ovary size in females with eggs was between 17–20% of SL. Amongst the April and June fish, 69% had ripe eggs (mean = 20, range 3–41) and ovaries were 20–25% of SL. Females in both groups without eggs had small ovaries, less than 10% SL. The smallest female with eggs in the ovary was 2.6 cm SL. The number of small unripe eggs in a female carrying ripe eggs, fell within the same ranges as number of ripe eggs. It may be tentatively concluded that in the winter a few females produce some five eggs per day, whereas in the spring a larger number of females produce about twenty eggs per day.

## Discussion

Apparently *Aphanius dispar* has not been the subject of detailed study of its natural history. In Iraq this species has been reported to be sympatric with two congeners, *A. sophiae* and *A. mento*. All three are chiefly herbivorous, though *A. dispar* and *A. sophiae* also feed on mosquito larvae and both these, in contrast to the third species, form loose unisexual schools feeding together when not reproducing (Al-Daham *et al.*, 1977). Other reports dealing with *A. dispar* have been essentially limited to physiological questions associated with the well known euryhaline character of this and other cyprinodontid fishes (Lotan, 1969, 1971, 1973; Skadhauge & Lotan, 1974) and records of distribution (Yazdani & Bhargava, 1969; Kosswig, 1967; Steinitz & Ben-Trevia, 1972; Al Nasiri & Shamsul, 1958; Kornfield & Nevo, 1976).

*Aphanius dispar* resembles in its general natural history the rather well known North American cyprinodontid genus *Cyprinodon*. In the field the two genera so closely resemble one another as to be on first glance indistinguishable. In holarctic warm deserts, fishes most usually are cyprinodontids, though cypriniform fishes are not uncommon. This probably reflects the eurythermal and euryhaline nature of most species within the Cyprinodontidae. The onset of xeric conditions in Arabia (Kassler, 1973) and in the North American southwest (Miller, 1948; Deacon & Minckley, 1974) occurred relatively recently, sometime around the end of the Pleistocene some 1,000–30,000 years B.P. In North America, the genus *Cyprinodon*, in particular in the southwestern deserts, became extensively isolated with subsequent differentiation into many species and subspecies (Miller, 1948). In the Middle East, the development of xeric conditions since the Pleistocene has not resulted in such extensive speciation in *Aphanius*, probably because most populations have permanent or intermittant access to the sea and thus there is greater opportunity for gene-flow between populations. Cyprinodontid fishes of the Middle East are represented amongst *Aphanius* by three species groups comprising seven species, all Tethys Sea relicts (Steinitz, 1951). Minnows and minnow-like fishes (order Cypriniformes) are generally less tolerant of saline water than are cyprinodontids and, though numerous in species throughout the holarctic, they are poorly represented in relict freshwater habitats or xeric environments (Deacon & Minckley, 1974). It is of interest to note that two genera of minnows (*Gila* and *Rhinichthys*) and one sucker *(Catostomus)* occur in some combination with *Cyprinodon* in the Death Valley System of California and Nevada (Soltz & Naiman, 1978) while in Oman two cyprinids, one a rather typical minnow, with the other similar to *Catostomus* with an inferior-positioned mouth, occur commonly with *Aphanius*. In both geographical cases the association is of species with three broadly distinct feeding habits: i.e., a mid-level feeder *(Cyprinion, Gila, Rhinichthys),* a feeder restricted to the substrate *(Garra, Catostomus)* and an opportunistic omnivore *(Cyprinodon, Aphanius)*.

Most desert cyprinids have narrower temperature tolerances than those of desert cyprinodontids (Deacon & Minckley, 1974). *Cyprinion* and *Garra* temperature tolerances are consistant with this generality. *Cyprinodon atrorus* (Miller) is reported to tolerate temperatures of up to 47.2°C in nature (Deacon & Minckley, 1974) and *Cyprinodon macularius* (Baird & Girard) may tolerate temperatures as high as 48.9°C for short periods (Miller, 1948). Heat tolerances of desert fishes have aroused considerable interest and there is an extensive literature which gives figures for upper critical temperatures for both wild-caught and experimentally temperature-acclimated *Cyprinodon* from both thermally fluctuating and stable (hot springs) regimes. Upper lethal temperatures rise as a function of acclimation temperature (Lowe & Heath, 1969; Otto & Gerking, 1973; Deacon & Minckley, 1974) while, surprisingly, species or populations restricted to constant-temperature hot springs have as wide a temperature tolerance as those from fluctuating environments (Brown & Feldmeth, 1971).

Cyprinodontid fishes all lay eggs singly, placing them on or in the substrate or onto plants and rocks. Deposition of single eggs requires close synchrony and physical positioning of the pair (see Breder & Rosen, 1968). Thus, the terminal reproductive acts involving close contact, sigmoid positioning of the male and clasping by the male's dorsal of the female in *Aphanius* is indistinguishable from the terminal acts in *Cyprinodon* and resembles very closely that described for others of the same family (Foster, 1967).

It should be noted that the eagerness with which mosquito larvae are eaten by *Aphanius* plus its tolerance of a wide range of water conditions and ability to withstand considerable pollution make it an excellent candidate for use as a biological control agent against mosquito-borne human disease, in particular malaria. Since it so closely resembles *Cyprinodon* it may well be preferable, in areas of the world within its general distribution, to *Gambusia affinis,* a species widely introduced as a larvivore and one which is not so efficacious, as a mosquito control agent, as *Cyprinodon* and which in addition has reduced native fish faunas through competition (Danielson, 1968).

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# Notes on a population of the threespine stickleback, *Gasterosteus aculeatus,* from Syria[1])

## (Pisces: Osteichthyes: Gasterosteidae).

By

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With 2 tables and 1 map.

Abstract: The threespine stickleback, *Gasterosteus aculeatus,* is reported from the headwaters of Nahr Sūrit in western Syria. This is the most southerly, extant occurrence of the species in western Eurasia. A brief description of the population, which is characterized by a low number of lateral plates, is given.

## Introduction.

The threespine stickleback, *Gasterosteus aculeatus* LINNAEUS 1758, is distributed in fresh and salt waters of Europe and western Asia, the eastern boundary being drainages of the Black Sea. In southern Europe only freshwater populations are known, usually characterized by a low number of lateral plates (MÜNZING 1963, STEPHANIDIS 1974, GROSS 1977). The most southerly populations known are those of the Mitija plain, Algeria at 36°43'N, 03°00'E (BERTIN 1925) and the Nahr el Sourit (= Nahr Sūrit), Syria at 35°15'N, 35°58'E (GRUVEL 1931; present record, Map 1a). The indigenous origin of the Algerian population was questioned by BERTIN (1925), and HEUTS (1956) could not locate any extant populations in 1951.

The Syrian population was identified by GRUVEL (1931) as *Gasterosteus argyropomus* CUVIER & VALENCIENNES 1829, a synonym of *G. aculeatus,* characterized by BERTIN (1925) as having 4-7 lateral plates not extending past the second dorsal spine level, short dorsal spines not reaching the base of the succeeding spine when depressed, with few denticulations, ventral spines shorter than posterior process of the ventral skeleton, dorsal fin rays III, 11-12, anal fin rays I, 10, and pectoral fin rays 9. However GRUVEL (1931) did not describe his specimens and BECKMAN (1962) in reporting this species from Syria without further locality data appears to have based his record on GRUVEL (1931) and mistakenly described the population as lacking plates on the flanks. A search for *Gasterosteus* in BECKMAN's collection which is deposited in the British Museum (Nat. Hist.), and in GRUVEL's collection in the Muséum National d'Histoire naturelle, Paris, gave no results. The only other

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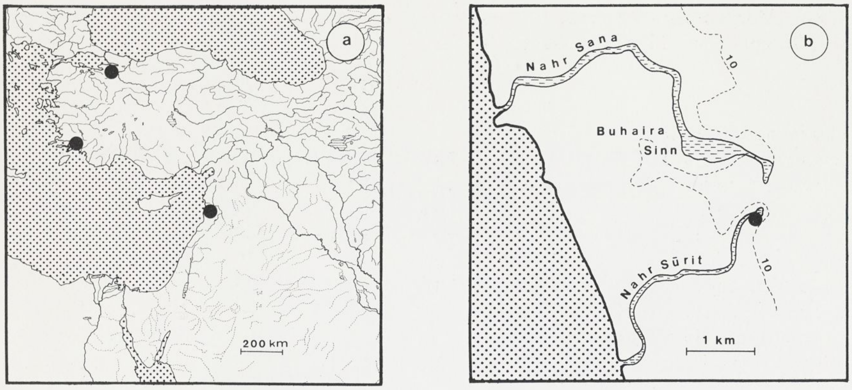
[1]) Results of the travels of R. KINZELBACH to the countries of the Middle East, No. 56.



Map 1. Known records of *Gasterosteus aculeatus.* — a) In Asia Minor and Syria, from N to S: İznik Gölü, Marmaris, Nahr Sūrit; b) position of Nahr Sūrit.

records of freshwater populations in Asia Minor are from near Marmaris in SW-Turkey reported, but not described, by Kosswig (1967) and from Lake İznik in NW-Turkey described by Münzing (1962; see Map 1a).

The purpose of this note is to describe a small sample of *Gasterosteus aculeatus* collected by one of us (F. K.) from Nahr Sūrit, Syria, the same locality from where Gruvel (1931) reported the species. The most southerly population examined by Gross (1977) in an extensive survey was located at 39°N in Greece. The sample described here is therefore of particular interest as the most southerly, extant population of this species in western Eurasia.

Material: Syria: Headwaters of Nahr Sūrit, 35°15′N, 35°58′E, 10 m above sea level, 12. VIII. 1980, F. Krupp & W. Schneider leg., 15 specimens, 11·4-35·0 mm SL (Senckenberg Museum, Frankfurt, SMF 17105); 5 spec., 27·1-45·0 mm SL (National Museum of Canada, NMC 83-0202).

Comparative material: Greece: Louros, 39°08′N, 20°44′E, 3 specimens (SMF 17106). — Sardinia: Cagliari, River Mannu, 39°15′N, 09°15′E, 49 spec. (NMC 81-0602). — Italy: Valle Grande, 45°35′N, 12°55′E, 11 spec. (NMC 81-0619); Verona, 45°26′N, 10°59′E, 93 spec. (NMC 81-0621). — Turkey: Muğla, Marmaris, 36°51′N, 28°16′E, 3 spec. (Zoologisches Museum Hamburg, ZMH 1835); Muğla, Akçapınar, 37°01′N, 28°23′E, 3 spec. (ZMH 3892); Bursa, İznikgölü, 40°26′N, 29°30′E, 60 spec. (NMC 81-0610), 124 spec. (NMC 81-0611).

## Description.

The description is based on the 15 largest specimens of the material from Nahr Sūrit. Five specimens were x-rayed.

Morphometric characters of *Gasterosteus aculeatus* from Nahr Sūrit and comparative material from Akçapınar and Marmaris, Turkey, collected by C. Kosswig, are given in Tab. 1. For meristic counts see Tab. 2.

Lateral line plates do not extend past the base of the second dorsal spine or its membrane. The dorsal spines are short and do not reach the base of the succeeding

Tab. 1. Morphometric characters of *Gasterosteus aculeatus* from Nahr Sūrit, Syria (n = 15), and Akçapınar and Marmaris, Turkey (n = 6).

| | Nahr Sūrit | | | Akçapınar and Marmaris | | |
|---|---|---|---|---|---|---|
| | x̄ | sd | range | x̄ | sd | range |
| Head length (HL) in standard length (SL) | 3·1 | 0·1 | 2·9-3·3 | 3·2 | 0·1 | 3·1-3·4 |
| Head depth in SL | 4·4 | 0·2 | 4·2-4·6 | 4·6 | 0·2 | 4·3-5·0 |
| Body depth in SL | 4·1 | 0·2 | 3·7-4·4 | 4·1 | 0·2 | 3·8-4·3 |
| Snout length in HL | 3·4 | 0·2 | 3·2-3·8 | 3·5 | 0·1 | 3·4-3·7 |
| Eye diameter in HL | 3·1 | 0·3 | 2·6-3·6 | 3·1 | 0·1 | 3·0-3·2 |
| Postorbital length in HL | 2·4 | 0·1 | 2·2-2·6 | 2·5 | 0·2 | 2·3-2·7 |
| Interorbital distance in HL | 4·7 | 0·5 | 3·7-5·6 | 4·3 | 0·1 | 4·2-4·4 |
| Length longest dorsal fin soft ray in HL | 2·5 | 0·1 | 2·3-2·8 | 2·4 | 0·1 | 2·2-2·5 |
| Length longest anal fin soft ray in HL | 2·5 | 0·2 | 2·4-2·8 | 2·5 | 0·1 | 2·4-2·7 |
| Pectoral fin length in HL | 2·0 | 0·1 | 1·8-2·2 | 1·8 | 0·1 | 1·7-1·9 |
| Pelvic spine length in HL | 3·1 | 0·6 | 2·4-4·5 | 3·3 | 0·3 | 2·9-3·6 |
| Length first dorsal spine in HL | 4·5 | 0·5 | 3·6-5·2 | 4·9 | 0·5 | 4·3-5·4 |
| Length second dorsal spine in HL | 3·9 | 0·4 | 3·2-4·3 | 4·7 | 0·4 | 4·2-5·2 |
| Pelvis width in pelvis length | 2·2 | 0·1 | 2·0-2·5 | 2·2 | 0·2 | 1·8-2·5 |
| Caudal peduncle depth in caudal peduncle length | 2·3 | 0·2 | 2·0-2·6 | 2·3 | 0·2 | 2·1-2·5 |

Tab. 2. Meristic counts of *Gasterosteus aculeatus* from Syria and Turkey.

| | Nahr Sūrit | Akçapınar and Marmaris |
|---|---|---|
| Dorsal fin spines | III (15) | III (3), IV (3) |
| Dorsal fin soft rays | 11 (1), 12 (12), 13 (2) | 12 (4), 13 (2) |
| Anal fin spines | I (15) | I (6) |
| Anal fin soft ras | 9 (6), 10 (9) | 9 (2), 10 (4) |
| Pectoral fin rays | 9 (2), 10 (13) | 10 (6) |
| Left lateral plates | 2 (2), 3 (5), 4 (7), 6 (1) | 3 (3), 4 (2), 5 (1) |
| Right lateral plates | 2 (1), 3 (5), 4 (7), 5 (2) | 0 (1), 4 (4), 5 (1) |
| Total gill rakers | 17 (2), 18 (13) | 17 (2), 18 (2), 19 (1), 20 (1) |
| Total vertebrae | 30 (2), 31 (3) | 31 (6) |

spine when depressed. The ventral spines vary considerably in length, being proportionately smaller in the largest fish. The ventral spines, and to a lesser extend the dorsal and anal spines, bear large denticulations especially proximally.

A female of 45·0 mm SL contained large (1·5 mm diameter) eggs numbering 56 totally for both ovaries. Attempts to maintain specimens in aquaria were unsuccessful and this population may have been at the end of its spawning season (on 12. VIII.) and the larger specimens in the last year of life.

Meristic, morphometric and other characters agree with descriptions of the low-plated or *leiurus* morph from other localities in the Mediterranean (Gross 1977, Wootton 1976; comparative material listed above) except that vertebral counts are lower. Gross (1977) cited mean values ranging from 31·8 to 32·7 for 10 Mediterranean samples. The low values recorded here appear to be rare in this species (Hagen & Gilbertson 1972, Coad 1974).

Habitat: The headwaters of Nahr Sūrit form a small lake which collects the waters of several karst springs and drains through a short water course into the Mediterranean Sea. They are located immediately south of Nahr Sana (Map 1b). The headwaters of both water courses are within 200 m distance from each other. Their discharge amounts to 14 m$^3$/sec (Weulersse 1940). The water of the lake is clear and relatively cold. The sticklebacks were caught in almost stagnant water near the shore, mainly at a depth of 0·3-0·5 m, where they were hidden in a lush vegetation composed of *Fontinalis* and *Jussieuia*. The density of the population was quite low. On the other hand the North American mosquito fish, *Gambusia affinis* (Baird & Girard 1854), was very abundant but it cannot yet be decided whether it has any negative influence on the *Gasterosteus* population.

## Zusammenfassung.

Der Fund des Dreistachligen Stichlings, *Gasterosteus aculeatus*, aus dem Nahr Sūrit in NW-Syrien wird mitgeteilt. Es handelt sich hierbei um das südlichste rezente Vorkommen der Art in W-Eurasien. Basierend auf 20 Exemplaren wird eine kurze morphologische Beschreibung gegeben. Die syrische Population zeichnet sich durch eine niedrige Zahl lateraler Knochenplatten und grob gezähnte Flossenstacheln aus.

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# *Cobitis elazigensis*, a New Species of Cobitidid Fish from Anatolia, Turkey

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# *Cobitis elazigensis*, a New Species of Cobitidid Fish from Anatolia, Turkey

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(Received December 9, 1986)

**Abstract** A new cobitidid, *Cobitis elazigensis*, is described from Anatolian Turkey in the province of Elaziğ. The new species differs from all other members of the genus by having the following combination of characters: two Canestrini's scales on the pectoral fin, a suborbital spine with a dorso-lateral branch (rarely simple and unbranched), large size, over 180 mm total length, total vertebrae 47–49, lateral spots reduced or absent, a spot at the upper caudal fin base, scales longer than wide with a small focus, dorsal fin rays III, 5–6, usually 6, ventral fin rays III, 6–7, usually 6, and pectoral fin rays I, 7–9.

The Cobitididae or loaches are small fishes having a Eurasian distribution with the genus *Cobitis* found from Morocco and Spain to Japan and China. Six nominal species are recorded from central Anatolian Turkey, namely *C. battalgili* Bacescu, 1962 from Gölhisar (Aegean Sea basin), *C. bilseli* Battalgil, 1942 from Beyşehir Gölü, *C. phrygica* Battalgazi, 1944 from Aci Göl and *C. turcica* Hanko, 1924 from Eregli (internal basins), *C. simplicispina* Hanko, 1924 from Kötschke-Kissik on the Porsuk Çayi (Black Sea basin), and probably the widespread *C. taenia* Linnaeus, 1758 which may occur in the Tigris-Euphrates basin as well as other parts of Anatolia. We follow Pellegrin (1928) and Berg (1949) in regarding *Cobitinula anatoliae* Hanko, 1924 from Ak Göl with only four barbels as an abnormal *C. taenia*.

One of us (M. S.) made collections in the Euphrates River basin near Elaziğ in central Anatolia which include a new species of *Cobitis* as described below. Counts and measurements follow Hubbs and Lagler (1958).

Type specimens are deposited at the National Museum of Natural Sciences, Ottawa (NMC).

## ***Cobitis elazigensis*** sp. nov.

(Figs. 1, 2)

**Holotype.** NMC85-0679A, 149.4 mm SL, female, Turkey, Elaziğ Province, a creek at Cip, 15 km west of Elaziğ, in the drainage of the Murat Nehri a tributary of the Euphrates River, 38°42′N, 39°05′E, in mud, creek 2 m wide and 30–50 cm deep, by hand and scoop net, Mustafa Sarıeyyüpoğlu, September 1983.

**Paratypes.** NMC85-0679, 4, 120.2–163.1 mm SL, same locality data as holotype; NMC85-0680, 4, 99.0–160.2 mm SL, same locality data as holotype, collected in 1985.

**Diagnosis.** A species of *Cobitis* with the following characters: dorsal fin rays III, 5–6, usually 6; ventral fin rays III, 6–7, usually 6; pectoral fin rays I, 7–9; total vertebrae 47–49; males with two Canestrini's scales on the pectoral fin; scales longer than wide with a small focus; suborbital spine with a dorso-lateral branch (rarely simple and unbranched); large size, over 180 mm total length; lateral spots reduced or absent; and a spot at the upper caudal fin base.

**Description.** Meristic data are as follows with values for the holotype underlined: Dorsal fin rays III, 5(1), III, 6(8); anal fin rays III, 5(9); ventral fin rays I, 6(8), I, 7(1); pectoral fin rays I, 7(1), I, 8(4), I, 9(4); branched caudal fin rays 13(1), 14(8); total vertebrae 47(1), 48(6), 49(2).

Morphometric data are summarised in Table 1. The head and body are compressed. The anterior nasal opening is tubular. There are three pairs of barbels, the mouth is arched and subterminal, and the lower lip is split into two fleshy masses which are thick and folded with well-developed posterior elongations. The head, lips and barbels are all covered with minute papillae. The suborbital spine (Fig. 2) is well-developed with a sharp posterior point and a short, pointed dorso-lateral branch. One specimen, a male 99.0 mm SL, has a simple spine without a branch. The dorsal origin is a little ahead of the ventral fin origin. The first branched pectoral fin ray is broader than other rays in this fin in males. The

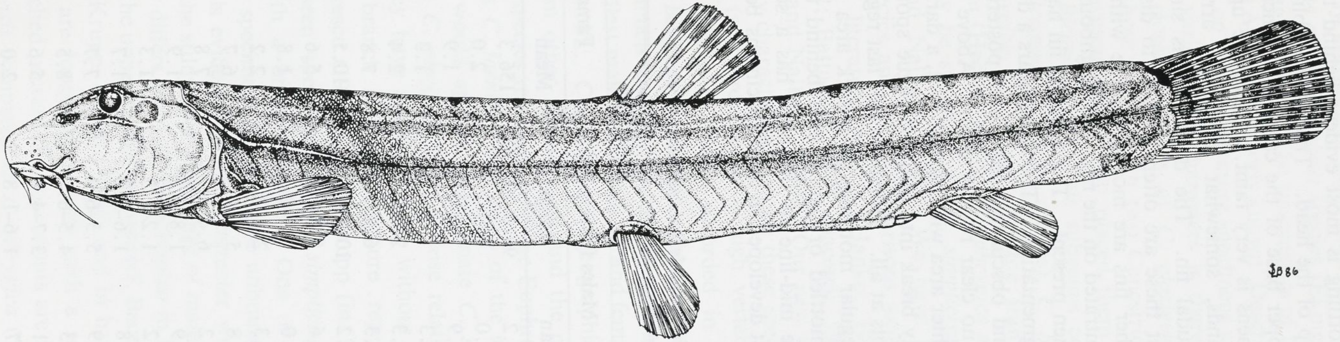

Fig. 1. Holotype of *Cobitis elazigensis* sp nov., NMC85-0679A, female, 149.4 mm SL.

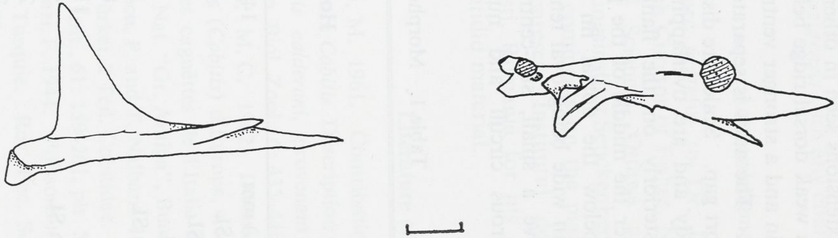

Fig. 2. Left lateral (on left) and dorsal (on right) views of suborbital spine of 160.2 mm SL female *Cobitis elazigensis* sp. nov. (NMC85-0680). Scale=1 mm.

pectoral fin base bears two Canestrini's scales on its inner side. The first Canestrini's scale lies over the first unbranched ray, with some overlap to the first branched ray. The second Canestrini's scale is attached to the first branched ray and overlaps the bases of rays 2 to 5. Both scales are enclosed in a common sac formed from the pectoral fin membrane. These exact arrangements are difficult to determine as the membrane is opaque and pigmented and scales appear to be an irregular bony mass, essentially round in outline without the marked distal extensions seen in other *Cobitis* species. There is a weak dorsal ridge before and behind the dorsal fin and a stronger ventral ridge behind the anal fin. The anus is separated from the anal fin by a short gap. Scales are distributed over the whole body and are overlapping both anteriorly and posteriorly on the flank. The lateral line ends over the middle of the pectoral fin. Scales from below the dorsal fin on the flank are longer than wide being oval tending to sub-rectangular, have a small, sub-central, anterior focus, numerous circuli and numerous radii both primary and secondary on all fields.

The head is dorsally mottled although this may fade into the dark background pigmentation. The mottling is most evident behind the eyes on the top of the head. There is an oblique spot at the upper base of the caudal fin which in some specimens is very faint. There are up to 6 vertical bands, somewhat irregularly arranged on the caudal fin. The dorsal fin is similarly banded but these are often difficult to distinguish. The other fins are mostly hyaline with pigment concentrated on the rays and neighbouring membrane when present. The pectoral fin has the strongest pigmentation. The flank bears a dark mid-lateral band obscuring some spots posteriorly but there is no clear row of spots. Above this band is a lighter area with, dorsal to it, a darker area which may break into clear or vague spots or show no spots at all. Dorsal to this last region there is an irregular mottling, or a dark area anteriorly and a mottled or lighter area behind the dorsal fin. The mid-line of the back has a series of spots, best developed in most specimens behind the dor-

Table 1. Morphometrics of *Cobitis elazigensis* sp. nov.

| Character | Holotype | Paratypes | | | |
|---|---|---|---|---|---|
| | | Males (3) | | Females (5) | |
| | | Mean | Range | Mean | Range |
| Standard length (SL) mm | 149.4 | 114.2 | 99.0–123.4 | 156.3 | 149.0–163.1 |
| Predorsal length in SL | 2.0 | 2.0 | 1.9–2.0 | 2.0 | 1.9–2.1 |
| Prepelvic length in SL | 1.8 | 1.9 | 1.9–2.0 | 1.9 | 1.8–1.9 |
| Preanal length in SL | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Postdorsal length in SL | 2.4 | 2.3 | 2.2–2.4 | 2.4 | 2.3–2.4 |
| Body depth in SL | 8.2 | 7.3 | 6.9–7.5 | 7.8 | 6.3–8.4 |
| Body width in SL | 11.2 | 11.2 | 10.9–11.3 | 10.5 | 8.2–11.5 |
| Head length (HL) in SL | 5.7 | 5.6 | 5.4–5.9 | 5.6 | 5.4–5.8 |
| Head width in HL | 2.0 | 2.0 | 1.9–2.0 | 1.8 | 1.5–2.0 |
| Snout length in HL | 2.2 | 2.3 | 2.2–2.4 | 2.2 | 2.1–2.3 |
| Orbit diameter in HL | 6.9 | 5.8 | 5.2–6.4 | 6.7 | 6.2–7.1 |
| Interorbital width in HL | 6.9 | 7.2 | 6.4–8.8 | 7.8 | 7.1–9.0 |
| Postorbital length in HL | 1.9 | 1.9 | 1.8–2.0 | 1.9 | 1.8–1.9 |
| Longest dorsal fin ray length in HL | 1.4 | 1.2 | 1.2–1.3 | 1.3 | 1.3–1.4 |
| Longest anal fin ray length in HL | 1.9 | 1.8 | 1.6–2.0 | 1.7 | 1.6–1.9 |
| First barbel length in HL | 6.7 | 5.9 | 5.3–6.4 | 7.7 | 5.9–9.1 |
| Second barbel length in HL | 7.7 | 5.3 | 4.5–6.1 | 8.5 | 5.9–16.0 |
| Third barbel length in HL | 5.4 | 4.1 | 3.7–4.4 | 5.6 | 4.8–6.6 |
| Caudal peduncle depth in length | 2.0 | 1.7 | 1.6–1.8 | 2.0 | 1.8–2.1 |
| Pectoral fin length in pectoral-ventral distance | 3.1 | 2.1 | 1.9–2.4 | 2.8 | 2.7–3.1 |
| Ventral fin length in ventral-anal distance | 2.2 | 2.1 | 2.0–2.2 | 2.2 | 2.0–2.4 |

sal fin, sometimes obscured by background pigmentation in front of the dorsal fin or even absent.

**Remarks.** The ichthyofauna of this part of Turkey is poorly known and there have been no previous reports of large *Cobitis* species (Ekingen and Sarıeyyüpoğlu, 1981). The systematics of the genus *Cobitis* in Anatolia is poorly known. Descriptions are based on few or immature specimens and assessment of variation in characters is thereby limited. The closest relatives of *C. elazigensis* appear to be those species with two Canestrini's scales after Bacescu (1961) who placed them in the subgenus *Bicanestrinia*. This subgenus contains *C. simplicispina* (the type species), *C. battalgili*, *C. phrygica*, *C. turcica* and the Iranian species *C. linea* (Heckel, 1849). *C. phrygica* and *C. turcica* may be synonyms of *C. simplicispina* (Banarescu and Nalbant, 1964). We have not seen these species and base comparisons among characters on literature reports (Hanko, 1924; Battalgil, 1942; Battalgazi, 1944; Bacescu, 1961, 1962; Bianco and Nalbant, 1980). Our new species is uniquely characterised among these species by large size (and presumably a high vertebral count). The maximum length recorded in the literature for *Bicanestrinia* species appears to be 95.0 mm SL, much less than for *C. elazigensis* in which the smallest male is 99.0 mm SL and females attain 160.2 mm SL. *C. elazigensis* is geographically remote from other *Bicanestrinia* and the only other *Cobitis* species reported from the Euphrates River basin is *C. taenia*. The shape of the suborbital spine would appear to eliminate *C. simplicispina* and *C. phrygica* from a close relationship since they have a simple spine without the dorso-lateral branch in some literature reports. However, Bacescu (1961) and F. Krupp (in. litt., 1986) have seen specimens of *C. simplicispina* specimens with a branched spine. One of the *C. elazigensis* specimens has a simple unbranched spine and it is evident that this character would benefit from the study of a wide range of material. *C. elazigensis* differs from *C. simplicispina* in having a spot at the upper caudal fin base (cf. Bacescu, 1961 and F. Krupp, in. litt., 1986) and in having scales which are longer than wide with a small focus. Branched pectoral fin ray counts are high in *C. elazigensis* compared to *C. phrygica* (5–6), *C. turcica* (7) and *C. simplicispina* (7) and branched ventral fin ray counts are higher than in *C. phrygica* (5) but some counts may merely reflect specimen size. Morphometry is also a dubious means of comparison. Males are smaller than females in many *Cobitis* species (and judging from our limited sample also in *C. elazigensis*). Some literature data do not take this factor into account and in addition sample sizes are too small for statistical treatment. However, there appear to be differences between the sexes in third barbel length, caudal peduncle shape and pectoral fin length (Table 1). Until the Anatolian *Cobitis* are revised in some detail and these problems are addressed, we are unable to define the sister group of *C. elazigensis* with any confidence.

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## アナトリアから得られたドジョウ科の1新種 *Cobitis elazigensis*

**Brian W. Coad・Mustafa Sarieyyüpoğlu**

トルコのアナトリア地方からドジョウ科の1新種 *Cobitis elazigensis* が得られた．この新種は同属のすべての他種から次の形質を併せ持つことによって区別される．すなわち胸鰭に2枚の Canestrini 鱗を持つこと，眼下棘には通常背側方に向かう1枚があること，全長180 mm をこえる大型種であること，全脊椎骨数 47–49 であること，体側の斑点は不明瞭またはないこと，尾鰭基底上部に1個の斑点があること，鱗は縦に長く，小さな focus を持つこと，背鰭条 III, 5–6 (通常 6)，腹鰭条 III, 6–7 (通常 6)，胸鰭条 I, 7–9 であることなどである．

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