Ann. Naturhist. Mus. Wien	97 B	439 - 449	Wien, November 1995

Current knowledge on the European mudminnow, *Umbra krameri* WALBAUM, 1792

(Pisces: Umbridae)

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Abstract

The present paper summarizes the current knowledge on the European mudminnow (*Umbra krameri* WALBAUM, 1792) with respect to systematics, taxonomy, and ecology.

Key words: Umbridae, *Umbra krameri*, systematics, taxonomy, ecology.

Zusammenfassung

Die vorliegende Arbeit faßt den derzeitigen Wissensstand über den Europäischen Hundsfisch (*Umbra krameri* WALBAUM, 1792) unter Berücksichtigung systematischer, taxonomischer und ökologischer Aspekte zusammen.

Names, taxonomy, and systematics

Scientific name: *Umbra krameri* WALBAUM, 1792

Common names:

Based on BLANC & al. (1971) and LINDBERG & HEARD (1972). Names suggested by the author are given at first, those marked with an asterix (*) are given in BLANC & al. (1971).

German:	Europäischer Hundsfisch, Hundsfisch*, Ungarischer Hundsfisch
Hungarian:	Lápi póc*
Czech:	Tmavec hnědý*, Blatňák tmavý
Slovak:	Blatniak*
Russian:	Evdoshka, Umbra*
Ukrainian:	Boboshka (Dniestr), Evdoshka, Lezheboka (Danube), Petsek, Sobacha ryba (Zakarpatie), Umbra
Romanian:	Ţigănuş*
Slovenian:	Velika sencica
Croatian:	Crnka*
Serbian:	Rapa
English:	European mudminnow

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Systematics (after NELSON 1984):

Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Neopterygii
Division: Halecostomi
Subdivision: Teleostei
Infradivision: Euteleostei
Superorder: Protacanthopterygii
Order: Salmoniformes
Suborder: Esocoidei (Haplomi)
Family: Umbridae

Synonyms (based on HOLLY 1941, ANTIPA 1909):

Gobius caninus MARSILI, 1726
Umbra Kramer GRONOVIUS, 1763
Umbra Krameri WALBAUM, 1792
Aphyra lacustris GROSSINGER, 1794
Cyprinodon umbra CUVIER, 1829
Umbra Crameri MÜLLER, 1844
Umbla (pro *Umbra*) *Krameri* BONAPARTE, 1846
Umbra Nattereri (in. lit.) + *U. Krameri* CUVIER & VALENCIENNES, 1846
Umbrina Krameri STEINDACHNER, 1870
Umbra canina KAROLI & HERMANN, 1882
Umbra umbra BERG, 1916
Umbra lacustris HANKÓ, 1923
Umbra krameri krameri KUX & LIBOSVÁRSKÝ, 1957
Umbra krameri pavlovi KUX & LIBOSVÁRSKÝ, 1957

Comments on nomenclature (after HANKÓ 1923, HOLLY 1941, KUX & LIBOSVÁRSKÝ 1957):

The European mudminnow was first mentioned under the name *Gobius caninus* by MARSILI (1726). He gave full details about this fish, added an illustration and information about the spawning time. He mentioned that it cannot be eaten and its habitats are swamps and floodplains along the river Danube. However he did not state any exact localities. KRAMER (1756) designated the genus name *Umbra* to this fish. He collected fishes from the Leitha river in Lower Austria and from Neusiedler See. Also GRONOVIUS (1763) writes about this fish. Despite early descriptions the mudminnow was not mentioned in the famous textbooks of LINNÉ (1758), BLOCH (1782), LACÉPÈDE (1798), and the first edition of CUVIER (1817).

WALBAUM (1792) used the currently valid name for the first time. He stated that the fish lives in the Danube river. GROSSINGER (1794) wrote about the mudminnow from Hungarian swamps using the name *Aphyra lacustris*. In 1825 Temminck, the director of the museum in Leyden, collected specimens from Neusiedler See and sent some to Cuvier in Paris, who mentioned them as *Cyprinodon umbra* in the second edition of his Règne animal (CUVIER 1829). Zoologists like Natterer collected specimens from Neusiedler See and donated some to the museum in Paris where they were referred to as

Umbra nattereri. However, this name was never published. FITZINGER (1832) used the name *Umbra Krameri*, and MÜLLER (1844) called it *Umbra Crameri*. VALENCIENNES (in CUVIER & VALENCIENNES 1846) used the previous name and placed it into the new family Umbridae for the first time. After HECKEL & KNER (1858), who reported the occurrence of the fish (*Umbra Krameri* FITZINGER) from several Hungarian localities, most authors took over their description. Nevertheless, GÜNTHER (1866) also used *Umbra crameri*. KÁROLI & HERMANN (1882) used *Umbra canina* (MARSILI) and BERG (1916) called it *Umbra umbra* (CUVIER), which was copied by VLADYKOV (1931). HANKÓ (1923) was convinced that the fish should be called *Umbra lacustris* (GROSSINGER) and his opinion was accepted by GEYER & MANN (1939), GEYER (1940), and MOHR (1940). After the work of HOLLY (1941) the currently valid name was commonly accepted.

Etymology:

Umbra (latin) = shadow; *krameri* - in honour of Wilhelm Heinrich Kramer, who described the fish as *Umbra* even before Linné.

Morphology

Description:

D II-III 12-16; A I-II 5-7; V I 5; P I 9-14.

The European mudminnow is a small fish with a total length of 5 to 9 cm, sometimes reaching 11.5 cm (PAVLETIĆ 1954 noticed even 15 cm for females). The body mass is 5 to 8 g, 27 g at most (BERG 1948). It has an elongated, cylindrical bodyshape which is slightly compressed laterally. The males are usually smaller and more slender than the females. The head is large and makes up a third of the standard length. The mouth is relatively large and slightly directed upwards. The upper jaw is shorter than the lower one and extends to the middle of the eye. The upper jaw and the tongue are without teeth. Fine, villiform teeth can be found on the lower maxillary, premaxillary, vomer, and palatines. The whole body and the head except the snout and chin are covered by large cycloid scales. They are spherical, smooth, and detach easily. They have no radial lines but fine concentric circles (circuli). The lateral line is missing, along the side 31 - 36 scales are found, above and below there are 5 - 7 rows of scales. Cephalic sensory canals and pitlines are described in NELSON (1972). The colour of the mudminnow is usually dark brown on the back and lightgrey, almost white on the belly. Differently shaped black spots are distributed irregularly over the body. A light stripe extends laterally from just behind the opercles to the caudal peduncle. Black bands of elongated, regularly positioned spots are found in the dorsal and caudal fin. The dorsal fin is situated in the second half of the body, originates directly above the origin of the pelvics (MOHR 1941), and extends to the origin of the anal fin. Its rays are equally long so that the fin appears almost rectangular. The unpaired fins, especially the caudal fin, are rounded.

Anatomical characteristics:

The blood circulation system of the mudminnow is special because the blood flows from the swimbladder directly to the sinus venosus and not to a vena portae like in other teleosts. This emphasizes the respiratory function of the swimbladder. The bladder is

covered by a respiratory epithel which is full of capillaries ensuring accessory air breathing (RAUTHER 1914, GEYER & MANN 1939a, b, JASIŃSKI 1965, MEŞTER & BABEŞ 1975).

Osteology:

WILSON & VEILLEUX (1982) compared the osteology in the family Umbridae. Relevant papers dealing with fossil records are CAVENDER (1969), WEILER (1973), SYTCHEVSKAYA (1976), and OBRHELOVÁ (1978).

Karyotype:

According to RÁB (1981) and BĂNĂRESCU & al. (1983) the number of chromosomes is 2n = 44. There are exclusively acrocentric chromosomes. Four pairs are large and easy to identify, the rest gets continuously smaller, eight pairs are regarded as mid-sized and ten as small. Nucleolar-organizing-regions (NORs) are relatively small and located near the centromeres of a mid-sized pair of chromosomes (RÁB & MAYER 1987). These results were compared to fish from the Danube delta by SUCIU (1993), who could however find no apparent differences.

Protein specificity:

Not published yet.

Sexual dimorphism:

Besides the statement that males appear more slender than females and besides differences in growth, morphometric differences have been reported by KUX & LIBOSVÁRSKÝ (1957). They found that males have longer pelvic fins and a shorter distance between pelvics and anal fin. However, they also reported differences between populations in the same study, which were revised later in a more extensive study (BARUS & LIBOSVÁRSKÝ 1983). Therefore, their sexual differentiation should be viewed with caution.

Variations:

No valid subspecies are currently known. KUX & LIBOSVÁRSKÝ (1957) described a subspecies (*Umbra krameri pavlovi*) from the delta of the River Danube, but this was revised later (BARUS & LIBOSVÁRSKÝ 1983).

Age and size variability:

See the chapter about growth below.

Hybrids:

No hybrids between the mudminnow and any other species have been reported.

Distribution

In general its original distribution area comprises the lowlands of the Danube watershed from Vienna to the delta and the lower reaches of the Prut and Dniester (LELEK 1987). More detailed informations on certain local occurrences are found in the compilation of

GEYER (1940). Detailed distributions in certain countries are only available from Slovakia (KUX & WEISZ 1961, MIŠÍK 1965) and Slovenia (POVŽ 1984). Today's general distribution area is similar to that mentioned above and the species can be found in Austria (thought to be extinct since 1976 but rediscovered by WANZENBÖCK in 1992), Slovakia, Hungary, Slovenia, Croatia, Serbia, Romania, Moldova and the Ukraine. It is regarded to be absent from Bulgarian waters (KUX & LIBOSVÁRSKY 1957) but this needs further verification.

Ecology

Habitat:

In general the areas where the species can be found are described as marsh land and swamp regions (GEYER 1940). It can be found in densely overgrown parts of larger waters (e.g. in Neusiedler See it was found in the reedbelt) but mostly in smaller, highly structured waters like abandoned oxbow lakes (POVŽ 1984), ditches, and ponds (KUX & WEISZ 1961, BOHLEN 1991). An obvious similarity of all habitats described is the rich structure provided by plants (e.g. fallen trees, macrophytes, water mosses) characteristic for marsh and swamp areas (GEYER 1940, KUX & LIBOSVÁRSKÝ 1957, KUX & WEISZ 1961, GUTI & al. 1991, BOHLEN 1991).

Migrations: Not known.

Hardiness:

It can survive very low oxygen conditions due to accessory air breathing capabilities (GEYER & MANN 1939a, b). BERG (1948) states that this fish is very hardy and can survive without water for more than two days in winter.

Feeding habits:

Informations on food composition are given in GEYER (1940), BERG (1948), LIBOSVÁRSKÝ & KUX (1958), BĂNĂRESCU (1964), and GUTI & al. (1991). Young mudminnows feed mainly on small crustaceans like ostracods and cyclopoids, and chironomid larvae. At the end of the first summer they switch to larger food items. Mostly benthic food, e.g. gammarids, isopods, and snails, is found in their guts. But also food from the surface and mid-water like water-beetles and other insects is taken. GUTI & al. (1991) reported also vegetational food (*Lemna* sp.). Fish fry of other species are described as food by BERG (1948).

Longevity:

For some time the maximum age of the mudminnow was thought to be only two years in the western part of its distribution area according to scale readings and discernible size classes, which were believed to represent age classes (GEYER 1940, KUX & LIBOSVÁRSKÝ 1957). The mudminnows of the Danube delta and the Dniester can reach five years of age according to PAVLOV (1936) and MAKAROV (1936). This apparent difference was a strong argument for KUX & LIBOSVÁRSKÝ (1957) to discern a separate subspecies (see above).

Concerns on this opinion were raised by MIŠÍK (1966). In the revision of BARUŠ & LIBOSVÁRSKÝ (1983) the problems of defining the right age from scale readings are described. After detailed studies with electromicroscopical methods they concluded that mudminnows from the western part of the distribution area can also reach more than two years. WILHELM (1984) reports an age of six years for mudminnows measuring 10 cm. Therefore, the maximum age has to be assumed to be five to six years.

Growth:

According to identical informations provided by GEYER (1940), LIBOSVÁRSKÝ & KUX (1958), MIŠÍK (1966), MAKARA & STRÁŇAI (1980), and WILHELM (1984) mudminnows reach 30 - 50 mm total length in the first year (0+). In the second year (1+) all authors, except WILHELM (1984), reported 60 - 80 mm for males and 70 - 85 mm for females. MAKARA & STRÁŇAI (1980) gave 96 mm for females in the third year of life (2+). WILHELM (1984) reported 50 - 60 mm for 1+ fish, 53 - 70 mm for 2+ fish, 65 - 75 mm for 3+ fish, 72 - 89 mm for 4+ fish, 90 - 96 mm for 5+ fish, and 97 - 107 mm for 6+ fish, females being always slightly larger. Length-weight relationships differ extensively between authors. For a fish length of e.g. 6 cm, GEYER (1940) states 2.5 g, WILHELM (1984) 3.3 g , LIBOSVÁRSKÝ & KUX (1958) 4.5 g, and MIŠÍK (1966) 5 g. These differences can partly be explained by different length measurements used. In the latter two papers body length (= standard length) was used whereas the former authors did not state which length measurement they used, presumably total length.

Population dynamics:

Detailed investigations on population dynamics of the mudminnow are still missing. GEYER (1940) reports possible high population growth rates with 38 % of juvenile fish entering the adult phase. Also POVŽ (1990) mentions high population growth after artificial propagation by means of excavating a shallow oxbow. Information on the standing stock of mudminnows in the canal system of the great Danube island in Slovakia is given in MIŠÍK (1964). He found 11 - 12000 individuals ha^{-1} corresponding to 25.5 - 27.5 kg ha^{-1}.

Reproductive Biology

Sexual maturity:

According to GEYER (1940) and LIBOSVÁRSKÝ & KUX (1958) mudminnow males and females reproduce as 1+ fish for the first time. In aquaria the youngest reproducing individuals have been found to be ten month of age (Bohlen, pers. communication).

Sex ratio:

The above mentioned authors found slightly more males in most populations (54 - 63 %).

Fecundity:

In BERG (1948) a range of 1580 - 2710 eggs per female (82 - 104 mm total length, n = 25) is given. GEYER (1940) counted 214 eggs in one female of 8 cm length. Only 100 -

200 eggs per female are supposed by BALON (1967). MAKARA & STRÁŇAI (1980) counted between 241 and 2528 eggs per female, average 1626 (n = 12). KOVÁČ (1995) found that egg numbers can exceed 1000 per female.

Gonads:

GEYER (1940) reported that testes and ovaries are pigmented in different ways: testes are pigmented by small spots all over whereas ovaries are spotted with larger pigment cells only on the side facing the gut.

Spawning period:

Commonly the early spring between March and April is regarded as spawning time when waterbodies reach 12.5 to 16.5 °C.

Spawning sites:

See spawning behaviour.

Spawning behaviour:

GEYER (1940), BOHLEN (1991), and KOVÁČ (1995) describe the spawning behaviour based on aquarium observations. Females choose a nest site which can be just a certain spot over roots or watermoss or a real nest made of plant material in a previously made and cleaned depression of the bottom. During nest guarding the female exhibits territorial behaviour. The actual spawning act is preceded by a chase of several males following one female. Spawning takes place above the nest site and the female releases 6 - 8 eggs accompanied by trembling of the whole body. One or several males take part and fertilize the eggs. The chase and subsequent spawning is repeated several times. After spawning the female is very aggressive and guards the eggs until hatching, sometimes even longer. Fanning of the eggs can be observed by the female and feeding is unrestricted during that time.

Early ontogeny:

According to GEYER (1940) and KOVÁČ (1995) egg diameter of fully swollen eggs is 1.8 - 2.0 mm, average 1.9 mm (n = 16). Their colour is yellow to orange and they are sticky. Numerous oil globulae of different dimensions are found in every egg at the prospective animal pole.

Development of eggs until hatching lasts ten days at approximately 13 °C and seven days at 16 °C. At hatching the eyes of the larvae are unpigmented and body pigmentation is weak, larvae measure 6 mm. The hatched larvae rest motionless at the bottom or attached to various structures. They show vigorous movements of their pectorals probably for oxygen provision. About ten days after hatching the yolk sac has disappeared, the pigmentation is largely developed, and the larvae start to feed exogenously. Their body length is 8 - 10 mm and the upside directed urostyle becomes very distinctive. About three weeks after hatching the larvae are 10 - 12 mm long (depending on temperature), fins are largely developed, and scales and fin rays are visible. The finfold dissappears at a length of 14 mm, approximately four weeks after hatching.

Important parasites and diseases

A specific parasite of the European mudminnow, *Gyrodactylus slovacicus* ERGENS, 1963 (Monogenea) has been described by ERGENS (1963). Predators of mudminnows are reported to be large water insects, predatory fish, and fish feeding birds (BOHLEN 1991).

Economic importance

The European mudminnow is economically not important. In older times it was indirectly used as food for pigs and ducks or as manure when caught in high numbers (ARNOLD 1990).

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