

Contribution to the knowledge of the Snakeheads of Iran (Family Channidae)

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Abstract: The systematics, morphology, distribution, biology, economic importance and conservation of the snakehead (*Channa gachua*) of Iran are described, the species is illustrated, and a bibliography on this fish is provided. The single species is distributed in southeastern Iran.

Keywords: Biology, Morphology, *Channa*, Makran, Mashkid.

Introduction

The freshwater ichthyofauna of Iran comprises a diverse set of families and species. These form important elements of the aquatic ecosystem and a number of species are of commercial or other significance. The literature on these fishes is widely scattered, both in time and place. Summaries of the morphology and biology of these species were given in a website (www.briancoad.com) which is updated here, while the relevant section of that website is now closed down.

Family Channidae

This family is known as the snakeheads or serpent-heads because of the characteristic broad head with large scales and a large oblique mouth. They are found from Africa to eastern Siberia and Southeast Asia and comprise about two genera with 32 species (Eschmeyer & Fong 2011) but the family is need of a revision. The phylogeny of the family, calibrated with fossil evidence, is given by Adamson et al. (2010). Their biodiversity and zoogeography in relation to other Iranian fishes is summarised in and Coad (1987, 1998) and Coad & Abdoli (1996). Maximum size is about 1.2m.

Snakeheads are characterised by paired accessory organs or suprabranchial organs in the upper gill chamber (above and behind the gills)

which enable these fishes to breathe air, survive low oxygen conditions and even reputedly travel overland, by an elongate rounded body becoming compressed posteriorly, the dorsal and anal fins are long, of even height and spineless, pelvic fins are present or absent, the mouth is large and the lower jaw protrudes, there are teeth on the jaws, vomer and palatines, gill openings are wide and the gill membranes are united but free from the isthmus, branchiostegal rays number 5, the caudal fin is rounded, scales are small and cycloid or ctenoid, and colour is highly variable, rapidly changing to suit the surroundings.

Snakeheads are ambush predators, living in still waters although some inhabit the larger rivers. Most species build a bubble nest in vegetation, laying and fertilising the eggs below it so that they float up into the bubbles. Others are mouth brooders. One or both adults guard the nest and young and will attack intruders savagely, including humans according to folklore. Many species are known to aestivate in summer when the habitat dries. They can be carried alive wrapped in wet cloths or vegetation and may be introduced into areas outside their natural distribution.

A number of species grow large enough to be an important food in Southeast Asia but are also pests, eating more valuable species. Some species are

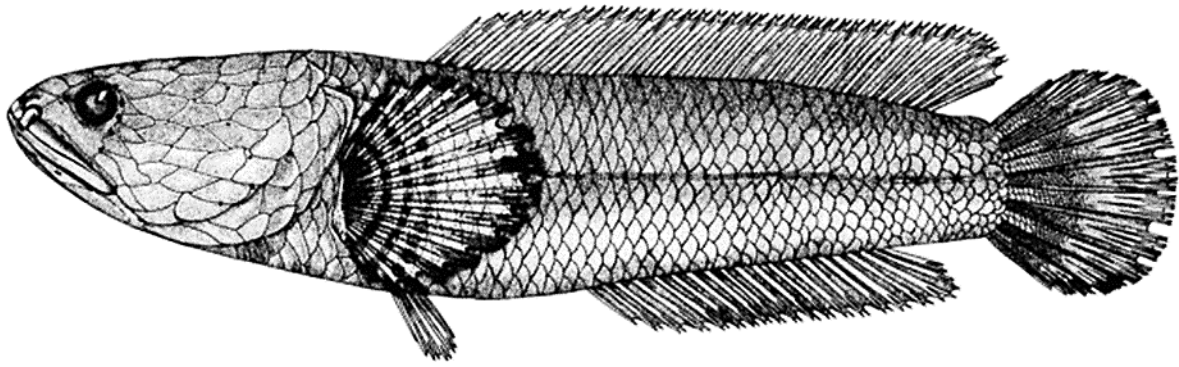


Fig.1. Line drawing of *Channa gachua* by S. Laurie-Bourque.

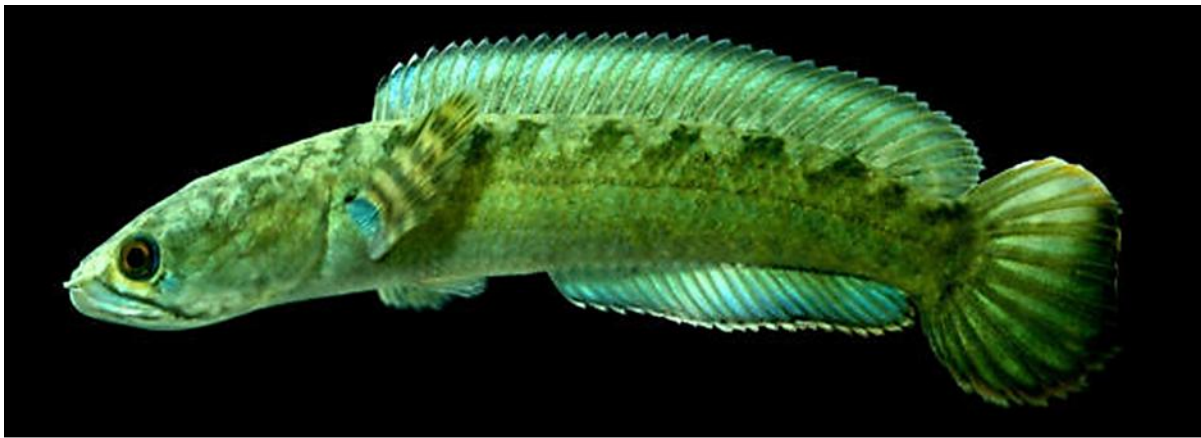


Fig.2. *Channa gachua* from the Mashkid River basin, courtesy H. R. Esmaili.

popular in the aquarium trade. Juveniles may be called, incorrectly, "larvae" in the aquarium trade and are brighter in colour than adults.

Genus *Channa* Scopoli, 1777

Channa Scopoli, 1777 has priority over *Ophicephalus* Bloch, 1793 (Eschmeyer 1990). *Ophicephalus* is an incorrect emendation. See also Myers & Shapovalov (1931-1932), DeWitt (1960), Etrich & Schmidt (1989) and Pethiyagoda (1991) for discussions on the taxonomy of this genus and species.

The characters listed under the family above obtain for the genus which has only one confirmed Iranian species.

Channa gachua (Hamilton, 1822)

(Figs. 1-2)

Common names: mahi-ye sarmari (= snakeheaded fish). [tond, dolli or dauli in Pakistan; dwarf snakehead, frog snakehead, brown snakehead, oriental snakehead, smooth-breasted snakehead,

gachua].

Systematics: *Ophicephalus gachua* was originally described from Bengal, India. Possible syntypes are in the Natural History Museum, London under BM(NH) 1858.8.15.54 (1) and BM(NH) 1858.8.15.144 (1) (Eschmeyer's "Catalog of Fishes", accessed 29 August 2007). It has been considered a synonym of *Channa orientalis* Bloch & Schneider, 1801 and some literature occurs under that name.

Key characters: The large head scales and elongate dorsal and anal fins are distinctive.

Morphology: Dorsal fin rays 30-37 (the last 2 rays counted as 1 where close together at base), anal fin rays 20-27, pectoral rays 13-17, and lateral line scales 39-48. Pelvic fins may be present or absent. The lateral line is displaced down one row under, or just beyond, the posterior end of the pectoral fin. Scales have a vertical anterior margin, parallel dorsal and ventral margins and a rounded posterior margin. The anterior dorsal and ventral corners are square cut,

rounded to sharp. Circuli are fine and numerous on the anterior field but on the posterior field become coarser and are parallel to the horizontal axis. Radii are numerous in the anterior field and radiate from a central focus. Gill rakers are minute. The gut is short and s-shaped. The anterior nostril is tube-shaped and hangs over the upper lip to the mouth. The chromosome number is $2n=78$ (Banerjee et al. 1988; Klinkhardt et al. 1995).

Meristic values for Iranian specimens are: dorsal fin rays 33(1), 34(3) or 35(1) (the last 2 rays counted as 1 where close together at base), anal fin rays 22(5), pectoral rays 14(3), 15(1) or 16(1), and lateral line scales 41(2), 43(2) or 44(1).

Sexual dimorphism: Females have a dark eye-spot at the posterior part of the dorsal fin (Pethiyagoda 1991).

Colour: Colour varies with the habitat. The back is usually greenish-grey to brownish with bluish tints and the flank is crossed by irregular oblique bars, less obvious in adults than young. The background colour of the flank is dove-grey with a violet sheen in males. The dorsal, anal and caudal fins are slate-coloured and have characteristic, narrow and strong orange margins (white in preservative). The membranes of these fins may be an iridescent green. The dorsal fin may have a blue or bluish-green stripe with a vertical extent from the fin mid-point distally about half-way to the fin margin on the membranes. The caudal fin has blue and green rays. Females have a dark eye-spot at the end of the dorsal fin. The pectoral fin base is dark blue and there are 4-5 orange and blue bands on the fin, with the margin orange. Bars on the pectoral fin are very distinctive in preservative, alternating dark and light. The iris is reddish. The peritoneum is silvery.

Size: Attains 33.0cm (Day, 1875-1878) although Courtenay & Williams (2004) give 17.0cm, probably more accurate given taxonomic confusion in the past.

Distribution: This species is reported from Iran east to China and Indonesia. It is reported from Afghanistan (Coad 2014) and the Dasht and Rakshan rivers, the Makran coast and the Mashkel (=

Mashkid) River basin in Pakistan (Zugmayer 1913). Iranian records were limited to four specimens collected by N.A. Zarudnyi in the Bampur river (upper or middle course) during 15-23 July 1898 (27 June-4 July in Berg (1949)) until one specimen was found in the Halil River basin near Sabzeveran at 28°39'N, 57°45'E, over 300km northwest of the Bampur River at Bampur (Coad 1979). Abdoli (2000) reports this species from the Halil and questionably from the Iranian Makran. Ebrahimi (2001) maps two localities in the Halil River as does Mahtab (2002), and it has been collected in the Mashkid River at Esfandak (27.133°N, 62.666°E) and at Koshk (27.283°N, 61.983°E). Esmaeili et al. (2015) reported it from Mashkid and Makran basins. The map in Berra (2001) has this species too close to the Straits of Hormuz and the map in Courtenay & Williams (2004) does not extend far enough into Iran. **Zoogeography:** The distribution of this species in southeastern Iran was confirmed in Coad (1979), a record not noted by Bănărescu (1992). It is the westernmost occurrence of the species in Asia. It is found eastwards to Indonesia (Ettrich & Schmidt 1989, Esmaeili et al. 2015). This large range is probably the result of range expansion beginning during the late Miocene-early Pliocene and may conceal cryptic species (Adamson et al. 2010).

Habitat: This species can survive in turbid and poorly oxygenated water because of its ability to breathe air. Air breathing is so well developed that this snakehead can travel overland between water bodies, using a hopping motion. Two pharyngeal suprabranchial cavities extend along the body to the caudal peduncle and are lined with vascularized mucous membranes. Mountain streams, large rivers, lakes, reservoirs, ponds, canals, rice paddies and even hot springs are recorded as habitats for this species in South Asia. Clear water in shallow streams and swamps in forested areas are preferred (Courtenay & Williams 2004) while Pethiyagoda (1991) states that flowing water is preferred. It is found in mud among emergent vegetation in Sri Lanka (De Silva 1991). It may be largely nocturnal. This species can survive



Fig.3. Habitat of *Channa gachua*, irrigation ditch 2km south of Jiroft, Kerman, 6 May 1977, Brian W. Coad.

temperatures as low as 13°C, a pH range of 3.1-9.6, brackish water, and waters low in calcium, low in mineral content and pronounced anion excess (Lee & Ng 1994). Low temperatures may be a limiting factor in its distribution in Iran (Fig. 3).

Age and growth: Some populations in mountain streams are mature at about 13cm while in lower areas maturity is reached at about 10.2cm at 20 months. The population examined in Sri Lanka has 90% of the individuals less than 24 months old and 99% less than 38 months. Longevity is about 6 years (De Silva 1991).

Food: This species is recorded as a nocturnal predator on other fishes and on frogs but most diet studies indicate that insects and crustaceans are the main foods (De Silva 1991; Pethiyagoda 1991). Young fish feed on unfertilised eggs from the mother for about 4 weeks. These eggs are released and fall in the water (while those which hatch float). The young stimulate egg release through close body contact with the mother, who swims in a circle while releasing the eggs. In aquaria, a female will take *Artemia* nauplii

into its mouth and swim over to the male which releases the young to feed on the nauplii as they are emitted from behind the gill cover (Ettrich & Schmidt 1989). An Iranian specimen had only sand grains in its gut.

Reproduction: Spawning takes place over silt or gravel bottoms or in areas of cleared vegetation forming a "nest". Vegetation is cleared by fin movements and can be 15cm across (Ettrich & Schmidt 1989). Some reports have the female swimming belly up and the male then fertilises the eggs as they are released by swimming diagonally over the female's vent. Ettrich & Schmidt (1989) state that the male forms a loop around the belly region of the female, an intensive and long-lasting process. This occurs after pair-bonding lasting several weeks which serves to synchronise reproduction, necessary since all the eggs are released at once. The male picks up the eggs in his mouth and keeps them there for 4-5 days until hatching (Ettrich 1989; Pethiyagoda 1991), as the eggs are oily and slowly float to the surface. The fry may also be protected in the male's

mouth for up to three days before releasing them, but the fry are retained behind the gill cover when danger threatens or night descends (Ettrich & Schmidt 1989). Egg numbers vary between 20 and 200 per spawning (Lee and Ng 1994). Fecundity ranges from 389 and 7194 (De Silva 1991; Courtenay & Williams 2004). Brood size (97-343 larvae) is smaller than the number of mature eggs reported for females according to De Silva (1991) and many eggs either fail to develop or are lost to predators despite parental care. An Iranian fish caught on 6 May contained small and possibly atretic eggs. Egg diameter is 2.6mm and the eggs are a golden yellow.

Ettrich & Schmidt (1989) report that 6 days after being released from the mouth, the fry ascend to the water surface and draw air. A foam nest is produced under which the young fish hide.

De Silva (1991) found breeding to take place throughout the year in Sri Lanka, with enhanced breeding in May to July and October to December. In the Karnataka State, India this species breeds from May to August. Individuals appear to spawn once in each rainy season in Sri Lanka.

Parasites and predators: None reported from Iran.

Economic importance: This species is too rare in Iran to be of any economic importance but in Sri Lanka it consumes pests in rice paddies (De Silva 1991) and in Singapore in 1990 sold for up to Singaporean \$60 (Courtenay & Williams 2004). It is kept in aquaria because of its small size and colour but is an aggressive species that should not be kept with smaller species. It prefers a temperature of 22-28°C and a pH of 6.0-8.5. Outside Iran, this fish has been widely used in toxicological, physiological, parasitological and ecological studies.

Conservation: This species would be difficult to conserve in Iran as it is rare and at its extreme westernmost distribution. Survivability may be marginal and numbers low. It is listed as Least Concern by the IUCN (2014).

Sources: Some counts were taken from Vishwanath & Geetakumari (2009). Further details on collections examined can be found in the museum catalogues.

Iranian material: ZISP 11714, 4, 42.9-70.2mm standard length, Baluchestan, Bampur River (no other locality data); CMNFI 1979-0220, 1, 110.9mm standard length, Kerman, irrigation ditch, 2km south of Jiroft (=Sabzeveran) (28°39'N, 57°45'E).

Comparative material: BC 66-32, 2, 63.8-71.5mm standard length, East Pakistan, Chittagong Hill Tracts, Karnaphuli Reservoir tributary (no other locality data); BC 66-38, 23, 79.5-124.9mm standard length, East Pakistan, Dacca, Bellabor Fish Market (no other locality data); BC 66-44, 2, 109.6-122.3mm standard length, East Pakistan, Tipperali, Chandpur (no other locality data); BM(NH) 1843.2.25:59, stuffed syntype of *Ophicephalus montanus*, 1, 81.7mm standard length, Afghanistan, Baissoat (locality uncertain but it appears to be in the Koh-i Baba range in the Kabul River basin); CMNFI 2008-0045, 1, 98.8mm standard length, Afghanistan, near Jalalabad (34°25'N, 70°27'E); HUJM F-5098, 1, 82.2mm standard length, Afghanistan (no other locality data); ZMH 4397, 1, 97.6mm standard length, Afghanistan, Jalalabad (34°26'N, 70°28'E).

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ماهیان سرماری ایران (خانواده ماهیان سرماری)

برایان کد

موزه تاریخ طبیعی کانادا، اتاوا، انتاریو، KIP 6P4، کانادا.

چکیده: در این مقاله، سیستماتیک، ریخت‌شناسی، پراکنش، زیست‌شناسی، اهمیت اقتصادی و حفاظت تنها گونه ماهی سرماری ایران *Channa gachua* شرح داده شده، تصاویری از آن ارائه گردیده و فهرستی از منابع موجود درباره این گونه لیست شده است. ماهی سرماری در جنوب شرقی ایران پراکنش دارد.
کلمات کلیدی: زیست‌شناسی، ریخت‌شناسی، *Channa*، مکران، مشکید.

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