

## OVERVIEW

# Color Variation, Taxonomic Ambiguity and Synonymous Confusion a hurdle for Snakehead Conservation.

### Dates:

Received: 13 Jun 2012    Accepted: 14 Nov 2012    Published: 23 Feb 2013

### ABSTRACT:

About 28-30 species of murrels belonging to genera *Channa* and *Parachanna* are known in the global scenario but with taxonomic ambiguity/mystery as well as synonymous confusion. Ichthyologists at present agree that *Channa* and *Ophicephalus* are synonymous. Taxonomic ambiguity and confusion persist between species like *Channa diplogramma* and *C. micropeltes* and *C. gachua* and *C. orientalis*. Since snakeheads display the most dramatic color changes during early, late juvenile and adult stages, they have been misidentified by various taxonomists. Along with the conventional morphological studies, geometric studies like Truss Network Analysis and molecular markers can be ideal tools for proper identification of snakehead species and ultimately for their conservation.

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### Keywords:

Snakeheads, Color Variation, Taxonomic ambiguity, Conservation.

### Web Address:

<http://amjbiol.com/AJB0009.pdf>

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### Article Citation:

Haniffa MA, James Milton M, Bilal Ahmad Paray, Ajaz Ali Bhat and Allen Benzigar PS.  
Color Variation, Taxonomic Ambiguity and Synonymous Confusion a hurdle for Snakehead Conservation.  
American Journal of Research in Biology (2013) 1(1): 012-016

**INTRODUCTION**

**Snake and Snakeheads**

Murrels belonging to genus *Channa* and *Parachanna* are a unique group of freshwater air breathing fishes highly preferred due to their taste, less intramuscular spines and medicinal values (Li et al., 2006). They are commonly called snakeheads because of their elongated and cylindrical body but particularly due to presence of large scales on their heads. Another feature similar to snakes is flattened head and eyes being located in the dorsoventral position on the anterior part of the head (Figures 1, 2). They are widely distributed in Iran and southern Asia (Indian subcontinent including Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, and Philippines) and the Far East (China, Taiwan, Korea, and southern Russia) (Musikasinthorn, 1998; Zhang et al., 2002; Courtenay et al., 2004). About 28-30 species of murrels are known in the global scenario but with taxonomic ambiguity/mystery as well as synonymous confusion (Haniffa, 2010). Only three *Parachanna* species viz: *Parachanna africana*, *Parachanna insignis* and *Parachanna obscura* have been reported inhabiting African water bodies. In India 10 species of snakeheads have been reported based on morphometric and meristic characteristics but again with synonymous confusion.

**Taxonomic Ambiguity**

Most of the earlier literature on snakeheads refers to the genus *Ophicephalus* and often it is incorrectly spelled as *Ophiocephalus* (Bloch, 1793). Ichthyologists at present agree that *Channa* and *Ophicephalus* are synonymous. (Myers and Shapovalov, 1932) reviewed the status of the genera *Ophicephalus* and *Channa* and concluded that the separation of the two genera based on presence (*Ophicephalus*) or absence (*Channa*) of pelvic fins was invalid. Hence they placed *Ophicephalus* as a junior synonym of *Channa*. (Vierke, 1991; Musikasinthorn, 2000; Musikasinthorn and Taki, 2001; and Zhang et al., 2002) considered 29 species of Channidae as valid.

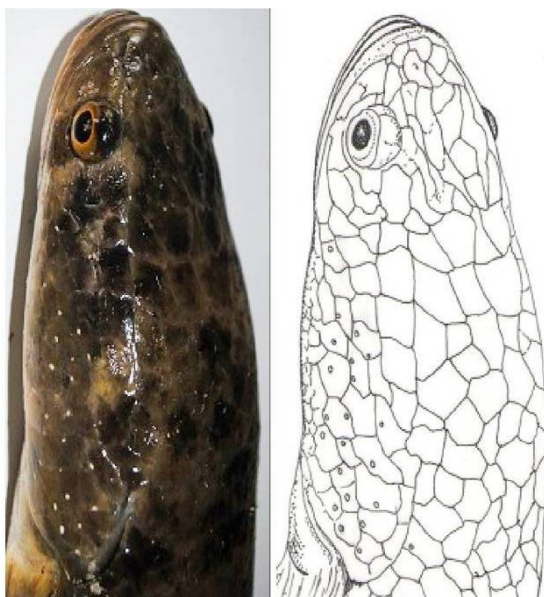


Figure 1 Scales on head of Snakehead *C. marulius*

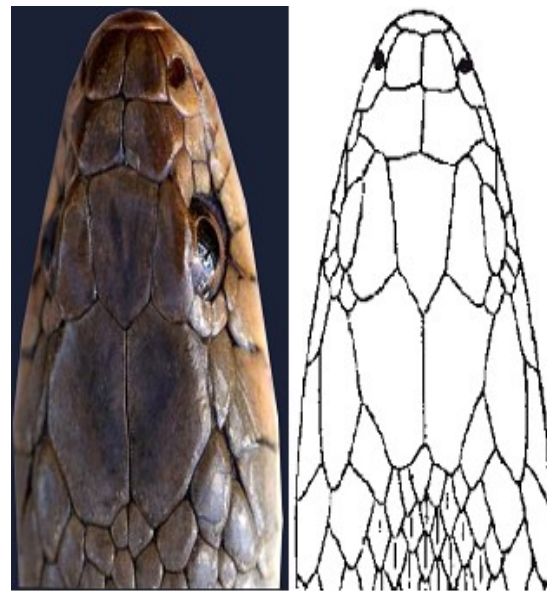


Figure 2 Scales on head of Snake



Plate 1 Color variation in *C. striatus* and *C. punctatus* during various life stages

Table 1 Status of Indian Snakeheads (CAMP, 1997).

S.No	Species Name	Country	Status	Purpose
1*	<i>Channa amphibeus</i> (Chel or Borna snakehead)	McClelland,1845	India	Food /Ornamentaental
2	<i>Channa argus</i> (Northern or Amur snakehead)	Cantor, 1842		
3	<i>Channa asiatica</i> (Chinese or Northern)	Linnaeus, 1758		
4	<i>Channa aurantimaculata</i>	Musikasinthorn, 2000		
5	<i>Channa bankanensis</i> (Bangka snakehead)	Bleeker, 1852		
6	<i>Channa baramensis</i> (Baram snakehead)	Steindachner, 1901		
7*	<i>Channa barca</i> (barca or tiger snakehead)	Hamilton, 1822	India	
8*	<i>Channa bleheri</i> (rainbow or jewel snakehead)	Vierke, 1991	India	Ornamental
9	<i>Channa cyanospilos</i> (Blue spotted snakehead)	Bleeker, 1853		
10*	<i>Channa gachua</i> (dwarf, gacha or frog)	Hamilton, 1822	India	Vulnerable
11	<i>Channa harcourtbutleri</i> (Inle snakehead)	Annandale, 1918		
12	<i>Channa lucius</i> (shiny or splendid snakehead)	Cuvier, 1831		
13	<i>Channa maculata</i> (blotched snakehead)	Lacepede, 1831		
14*	<i>Channa maurulius</i> (bullseye, murrel, snakehead)	Hamilton, 1822	India	Lower Risk-Near Threatened
15	<i>Channa maruloides</i> (emperor snakehead)	Bleeker, 1851		
16	<i>Channa melanoptera</i>	Bleeker, 1855		
17	<i>Channa melasoma</i> (black snakehead)	Bleeker, 1851		
18*	<i>Channa micropeltus</i> (giant or red)	Cuvier, 1831	India	Critically endangered
19	<i>Channa nox</i>			
20	<i>Channa orientalis</i> (Ceylon or ceylones)	Schneider, 1801	India	Vulnerable
21	<i>Channa panaw</i>	Musikasinthorn, 1998		
22	<i>Channa pleurophthalmus</i> (oscillated sp, snakehead)	Bleeker, 1851		
23*	<i>Channa punctata</i> (dotted or spotted snakehead)	Bloch, 1793	India	Lower Risk- Near Threatened
24	<i>Channa stewarti</i> (golden snakehead)	Playfair, 1863	India	Ornamental
25*	<i>Channa striata</i> (chevron or striped snakehead)	Bloch, 1797	India	Lower Risk-Least Concern
26	<i>Parachanna africana</i> (Niger or African snakehead)	Steindachner, 1879		
27	<i>Parachanna insignis</i> (Congo, Square-s, African snakehead)	Sauvage, 1884		
28	<i>Parachanna obscura</i> (dark African, du snakehead)	Gunther, 1861		

\* Reported by Pandian and shanmuga sundaram, (Talwar and Jhingran, 1992) and (Jeyaraman, 1999)

So far there are no authentic IUCN reports available regarding the threatened status of snakeheads however the Workshop on Conservation Assessment Management Plan (CAMP) evaluated the status of freshwater species of India, in 1997 and categorized *Channa* species as " Low risk - near threatened, Low risk-least concerned, Vulnerable, and Critically endangered" (Table 1) due to restricted distribution, loss of habitat, over exploitation, destructive fishing practices and trade (Annon, 1998). Recently (Allen et al., 2011) reported *C. micropeltes* as *C. diplogramma* in India. *Channa striatus* is at lower risk whereas *Channa punctatus* and *Channa marulius* are nearly threatened. *Channa gachua* (Ng and Lim, 1990) and *Channa orientalis* are vulnerable whereas *Channa micropeltes* is critically endangered.

#### Morphological Colour Changes

Earlier taxonomists used color as one of the distinguishing characteristics and hence the plethora of scientific names for snakeheads is in par with dramatic colour

changes that occur between early, late juvenile and adult stages. For instance hatchlings of striped murrel *Channa striatus* are black (Figure 3) followed by a critical red color stage (Figure 4) from post larvae to fry, again black during fingerling stage (Figure 5) and finally the adults show white stripes all over the body (Figure 6). Similarly the spotted murrel *Channa punctatus* displays a yellow colour band on its dorsal side during its earlier life stage (Figure 7) whereas in fingerlings and adults this yellow color band disappears but numerous small dots appear (Figure 8). *Ophiocephalus diplogramma* (Malabar snakehead) now known as *Channa diplogramma* described by (Day, 1865) based on one juvenile specimen from port city of Cochin (Southwestern India) synonymises with *O. micropeltes* described by (Cuvier and Valenciennes, 1831) due to morphological closeness between the Juveniles of the two species. *Channa diplogramma* displays the most dramatic color changes during its life span. In the fingerling stage this snakehead species has an orange color

9. Yellow color band in *C. diplogramma* fingerling

10. Disappearance of yellow color band with growth

11. Numerous dots on *C. diplogramma* adult12. *C. micropeltes*13. *Channa gachua*14. *C. orientalis*

**Plate 2 Color variation in *Channa diplogramma*, morphological closeness between *C.diplogramma* and *C.micropeltes* and *C.gachua* and *C.orientalis***

band, between two black color bands (Figure 9). After six months the orange color band disappears (Figure 10) and numerous prominent dots appear. Again these dots become more prominent and bands disappear completely during the adult stage (Figure 11) and the fish resembles *C. micropeltes* (Figure 12) and the male shows beautiful violet color while in water. Recent researchers (Kottelat, 1998; Adamson *et al.*, 2010) suggested that *C. diplogramma* is distinct from *C. micropeltes* and should be considered as a valid species (Allen *et al.*, 2011). Similarly confusion persists between *Channa gachua* and *Channa orientalis* (Figures 13 and 14). According to (Pethiyagoda, 1991) *Channa orientalis* is endemic to Sri Lanka but it has also been reported in Indian waters (Chandrasekhar, 2004).

Most of the snakehead species are caught from wild and there are almost no reports regarding the captive breeding and culture of these species except *Channa striatus*. Snakeheads are caught from natural water bodies for food as well as ornamental trade. Overfishing and immense exploitation raised an alarm with regard to their scarcity and disappearance. It is very important to have a clear taxonomic status of these snakehead species for their apt and proper management and conservation. There is scarce information available on genetic constitution and phylogenetic aspects of snakeheads (Li *et al.*, 2006; Adamson *et al.*, 2010; Lakra *et al.*, 2010; Jamaluddin *et al.*, 2011). At this juncture along with the conventional morphological studies, geometric studies (Truss Network Analysis) and molecular markers can be ideal tools for proper identification of snakehead species. The studies on mitochondrial DNA by us have already been used to overcome taxonomic mystery between *Channa diplogramma* and *Channa micropeltes* (Ng and Lim, 1990). These molecular

markers are very much promising to solve the taxonomic ambiguity and synonymous confusion in snakeheads and ultimately for their conservation.

#### ACKNOWLEDGEMENTS

The work was supported by CSIR Emeritus Research Grant (No.21 00670/07/EMR-II) sanctioned to Dr. M. A. Haniffa. We are grateful to Rev. Dr. Alphonse Manickam S.J., Principal, St. Xavier's College, Palayamkottai for providing necessary facilities.

#### REFERENCES

- Adamson Eleanor AS, David A, Hurwood Peter B and Mather. 2010.** A reappraisal of the evolution of Asian snakehead fishes (Pisces, *Chaannidae*) using molecular data from multiple genes and fossil calibration. *Molecular Phylogenetics and Evolution*, 56:707-717.
- Allen PS, Philip S, Raghavan R, Anvar Ali PH, Sukumaran M. 2011.** Unraveling a 146 Years Old Taxonomic Puzzle: Validation of Malabar Snakehead, Species-Status and Its Relevance for Channid Systematics and Evolution. *PLoS ONE* 6 (6): e21272. doi:10.1371/journal.pone.0021272.
- Annon. 1998.** Annual Report 1997-1998. National Research Centre on Coldwater Fisheries. Bhimtal, Uttaranchal, India, 68.

- Bloch ME. 1793.** Naturgeschichte der Ausländischen fische, 7: Berlin, Germany, Morino and Co., 144.
- Chandrasekhar SVA. 2004.** Fish fauna of hyderabad and its environs. Zoos' Print Journal 19(7):1530-1533.
- Courtenay WR Jr, Williams JD. 2004.** Snakeheads (Pisces: Channidae) A biological synopsis and risk assessment. U.S. Department of the Interior, U.S. Geological Survey Circular 1251, 143.
- Cuvier G and Valenciennes A. 1831.** Histoire naturelle des poissons, Vol.7. Levrault, Paris-Strasbourg.
- Day F. 1865.** On the fishes of Cochin, on the Malabar coast of India. Part I. Acanthopterygii. Proceedings of the General Meetings for Scientific Business of the Zoological Society of London 1865(pt 1): 2-40. Continues as Part II, 286-318.
- Haniffa MA. 2010.** Indian Snakehead, Fishing chimes. 30(1):34-36.
- Jamaluddin Jamsari, Amirul Firdaus, Tan Min Pau, Mohd Nor Siti-Azizah. 2011.** Genetic structure of the snakehead murrel, *Channa striata* (channidae) based on the cytochrome c oxidase subunit I gene: Influence of historical and geomorphological factors. Genet Mol Biol., 34(1):152-160.
- Kottelat M. 1998.** Fishes of the Nam Theun and Xe Bangfai basins, Laos, with diagnoses of twenty-two new species (Teleostei: Cyprinidae, Balitoridae, Cobitidae, Cobiidae and Odontobutidae). Ichthyol. Explor. Freshwaters, 9:1-128.
- Lakra WS, Goswami M, Gopalakrishnan A, Singh DP, Singh NS. 2010.** Genetic relatedness among fish species of Genus *Channa* using mitochondrial DNA genes. Biochemical Systematics and Ecology 38:1212-1219.
- Li X, Prachya Musikasinthorn, Yoshinori Kumazawa. 2006.** Molecular phylogenetic analyses of snakeheads Perciformes:Channidae) using mitochondrial DNA sequences. Ichthyol Res., 53:148-159.
- Musikasinthorn P and Taki Y. 2001.** *Channa siamensis* (Günther, 1861), a junior synonym of *Channa lucius* (Cuvier in Cuvier and Valenciennes, 1831). Ichthyol Res., 48:319-324.
- Musikasinthorn P. 2000.** *Channa aurantimaculata*, a new channid fish from Assam (Brahmaputra River basin), India, with designation of a neotype for *C. amphibeus* (McClelland, 1845): Ichthyological Research 47(1)27-37.
- Musikasinthorn P. 1998.** *Channa panaw*, a new channid fish from the Irrawaddy and Sittang River basins, Myanmar. Ichthyol Res., 45:355-362.
- Myers G and Shapovalov L. 1932.** On the identity of *Ophicephalus* and *Channa*, two genera of labyrinth fishes: Peking Natural History Bulletin 6:33-37.
- Ng PKL and Lim KKP. 1990.** Snakeheads (Pisces: Channidae): Natural, history, biology and economic importance: Essays in Zoology, Papers Commemorating the 40<sup>th</sup> Anniversary of the Department of Zoology, National University of Singapore 127-152.
- Pethiyagoda R. 1991.** Freshwater fishes of Sri Lanka: Colombo, Wildlife Heritage Trust of Sri Lanka 362.
- Vierke J. 1991.** Ein farbenfroher neuer Schlangenkopffisch aus Assam *Channa bleheri* spec. nov. . Das Aquarium. 259:20-24.
- Zhang, Chun-Guang, Musikasinthorn P, Watanabe K. 2002.** *Channa nox*, a new channid fish lacking a pelvic fin from Guangxi, China: Ichthyological Research 49:140-146.

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