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Article Review

Striped catfish (*Pangasianodon hypophthalmus*) with special emphasis on its suitability to the Egyptian aquaculture: An overview

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ABSTRACT

Striped catfish (*Pangasianodon hypophthalmus*) is one of the cultured finfish species in a variety of Asian countries, particularly India, Bangladesh, Thailand, and Malaysia. It is characterized by high growth rates, and the relatively acceptable and delicious taste of its fillets. It is an omnivorous fish as it can feed on algae, higher plants, herbal supplements, zooplankton, and insects. It also accepts formulated feeds. This fish can tolerate various environmental conditions and also grow well in high stocking densities. The above characteristics make this fish a valuable species to be imported by several countries. It has been recently introduced in Egypt as an exotic ornamental fish species. However, its farming and economic impacts on Egyptian aquaculture have not yet been satisfactorily explained. Pangasius culture in Egypt may increase the diversity of cultured finfish species. It will also improve the economic and social status and conditions of various stakeholders in the Egyptian communities. This article provides a synopsis of the biological features, global producers, habitats, reported diseases, and market trade of the pangasius fish. It will also spotlight the characteristics and suitability of pangasius culture in Egypt. This will pave the way for further future research studies to stand solid ground on the culture of this valuable fish species.

INTRODUCTION

Aquaculture has grown quickly in recent years to cover the continuously rising requirements and needs of the increased human population. Still, the predicted increase in the population by 2050 will lead the aquaculture industry to be more intensified in several intensive culture systems. Pangasiid catfish is an important finfish species of the family Pangasiidae. It has several names, such as *Pangasius sutchii*, *Pangasius hypophthalmus*, or *Pangasianodon hypophthalmus*. This fish is widely farmed in several Asian countries such as Malaysia, Bangladesh, Vietnam, and others **(Jahan et al. 2019; Abdel-Latif et al. 2023a).**

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This fish species also has a variety of common English names, including Sutchi catfish, iridescent shark catfish, and striped catfish.

Several reasons have led to the import of this fish in several countries worldwide, such as a) its high growth rates, b) white flesh, c) low lipid content, d) better taste, e) reduced operating costs and f) relatively high economic returns (**Ali et al. 2013**). This is beside its physiological characteristics as enduring low oxygen concentrations, high temperatures, elevated ammonia concentrations and high salinity degrees. However, introducing these fish into a new cultural environment may increase their vulnerability to various emerging diseases resulting from changing their environment (**Abd-Elaziz et al. 2023**). According to its feeding habits, *P. hypophthalmus* is considered an omnivorous fish species as it can feed on various feeds of either plant or animal origins. This fish can feed on algae, zooplankton, higher plants, and insects, although its larger size can feed on shrimps and small fishes (**Ali et al. 2005; Phumee et al. 2009**).

Newly, this fish species has been imported to be cultured in several countries, such as Egypt; thus, it is considered an exotic fish in our aquaculture industry. Moreover, several laboratory-based experiments have been conducted to evaluate this fish species' growth performance, physiological characteristics, disease resistance, antioxidant capacity, and immune responses (**Abdel-Latif et al. 2023a; Abdel-Latif et al. 2023b; Abd-Elaziz et al. 2023; Zaki et al. 2023**).

However, the suitability of this fish species to be farmed on large scales in the Egyptian culture fields has not been fully confirmed and warrants additional research studies. This review article provides a synopsis of the biological features, main global producers, habitat, diseases, and market trade of the pangasius fish. Moreover, it will spotlight the characteristics and suitability of pangasius aquaculture in Egypt. This will pave the way for further future research studies to stand solid ground on the culture of this valuable fish species.

2. Historical background

Striped catfish is considered a foremost fish species in the Mekong River fishery, one of the world's largest and most important inland fisheries. The traditional development of capture-based aquaculture for this species probably began particularly in Viet Nam, Malaysia, Bangladesh, and to a lesser extent in Thailand and Cambodia. This is because it is a prolific spawner, producing relatively large numbers of larvae easily harvested from the flowing river (**Ali et al. 2013**).

3. Main producers throughout the world

The main producers of *P. hypophthalmus* include several countries worldwide, such as Indonesia, Bangladesh, Malaysia, Viet Nam, India, Cambodia, Thailand, and China (**Ali et al. 2005**). This fish species has been recently imported to be cultured in several countries, such as Egypt, as exotic ornamental fish (**Abdel-Latif et al. 2023b**). This will lead to an increase in their production rates throughout the world.

4. Biological and structural features

The body shape of this fish is long and flattened, with no scales over its skin. These fish have relatively small heads and broad mouths with small sharp teeth on their jaw and palatal bones. These fish have relatively large eyes and two pairs of barbels, dark grey or black fins. Of interest, the young fish have a black stripe along the lateral line and another long black stripe below the lateral line; this has led to their name “stripped catfish” (**Rainboth, 1996**). Large adult fish are uniformly grey but have greenish tints and silvery sides (**Kottelat, 2001**). In spite of the fact that they can use gills for breathing, this fish species is an obligatory air-breathing fish inhabiting large rivers (**Rainboth, 1996**) and can be farmed in rice fields (**Halwart and Gupta, 2004**). According to its feeding habits, *P. hypophthalmus* is omnivorous, feeding on algae, higher plants, zooplankton, and insects, while larger specimens also take fruit, crustaceans, and fish. It is a migratory fish species as it can move upstream of the Mekong River to spawn in different areas (**Van Zalinge et al. 2002**) and then return to

the mainstream when the river waters fall with the need to seek their habitats (**Hill and Hill, 1994**).

5. Habitats and life cycle

Originally, the habitats of this freshwater species are limited to the Mekong River, Chaopraya River, and the Mekong basins in Cambodia, Lao People's Democratic Republic, Thailand, and Viet Nam (**Trong et al. 2002**).

Like all Pangasiid species, *P. hypophthalmus* is a highly migratory riverine fish species that make long-distance migrations over several hundred kilometers between the upstream refuge and spawning habitats and downstream feeding and nursery habitats (**Suntornratana et al. 2004**). Mature fish can reach a maximum standard total length of 130 cm and weigh up to 44 kg. This species typically lives within pH 6.5-7.5 and temperatures of 22-26 °C. Although its freshwater fish can endure up to 18 ppt salinity. This fish never spawns naturally in captivity. Females take at least three years to reach sexual maturity in captivity (over 3 kg in weight), while males often mature in their second year, probably taking about the same time in the wild. A mature 10 kg female can spawn over one million eggs. Wild broodstock typically spawns twice annually, but in cages, it has been recorded as spawning a second time 6 to 17 weeks after the first spawning. The life cycle of *P. hypophthalmus* is intimately tied to the annual monsoon flood cycle, spawning in May - June at the start of the monsoon season (**Phuong, 1998; Phu et al. 2003**).

6. Market and trade of this valuable fish species

The exports of this fish species from Vit Nam to over eighty countries worldwide, including several in Europe (particularly Poland and Spain), Asian countries, Mexico, Australia, the USA, and the Middle East (**Lazard and Cacot, 1997**). New markets have been established in several other countries, such as Russia. The European Union remains the most significant market (35 % by volume, 40 % by value). Viet Nam can process 3500 MT of fish products daily with continuously increasing capacity. There are 405 industrial-scale processing plants in Viet Nam, of which 301 are certified for export to Europe, and 30 are certified to export to the Russian Federation. The farming of this fish has emerged as a commercially valuable freshwater species that has now become a significant component of world whitefish supplies. Trades of the frozen products manufactured have generally stagnated in 2007 and 2008, except for this fish species, with trade increasing primarily as frozen fillets. This fish species has become a highly competitive, highly valued white fish product on many global markets.

7. Diseases and control measures

Disease problems in striped catfish aquaculture have been considered one of the major obstacles and difficulties that can negatively affect the sustainable development and growth of this fish species (**Phuong and Oanh, 2010**). The intensification of this fish in intensive culture systems has resulted in the emergence of disease outbreaks due to several pathogens, particularly during the last few years. Several pathogens have been reported to be linked with diseases in striped catfish aquaculture, including fungi, ectoparasites, endoparasites, viruses, and bacteria (**Phuong and Oanh, 2010**). Among the infectious diseases, bacterial agents have been responsible for the major epizootics affecting striped catfish farming. Several bacterial diseases have been reported in striped catfish farming. These cause signs such as white nodules on the internal organs caused by *Edwardsiella ictaluri* and hemorrhagic septicemia signs caused by pathogenic *Aeromonas hydrophila* (**Dong et al. 2015**). Moreover, *Aeromonas veronii* has also been isolated from striped catfish mortalities (**Hoai et al. 2019**). The bacterial pathogen, E. ictaluri, has been described as to cause of "Bacillary necrosis of Pangasianodon (BNP)," which is one of the most serious bacterial diseases of striped catfish in Vietnam (**Ngoc Phuoc et al. 2020**). Furthermore, *Flavobacterium columnare* has been reported to cause freshwater columnaris infection in farmed *P. hypophthalmus* fingerlings (**Tien et al. 2012**). Besides, *A. hydrophila* has been recently implicated in striped catfish kills (**Chen et al. 2022**). These diseases induce

losses estimated to be as high as 50% compared to other infectious agents (**Thinh et al. 2004; Phuong et al. 2007**). Stress-induced factors have primarily caused the outbreak of diseases. Studies have revealed that stress factors, including localized environmental degradation, wastes from agricultural activities, improper caring, high stocking density, and low stocked seed, make the stock susceptible to infectious pathogens (**Phuong et al. 2007**).

8. Suitability for farming in Egypt

Striped catfish possess a high resistance to several environmental conditions and high stocking densities, this makes it suitable for rearing in Egyptian farming conditions. Lately, this fish species has been imported to Egypt; thus, it is considered an exotic fish in our aquaculture industry. Moreover, several laboratory-based experiments have been conducted to evaluate this fish species' growth performance, physiological characteristics, disease resistance, antioxidant capacity, and immune responses (**Zaki et al. 2023**). However, the suitability of this fish species to be farmed on large scales in the Egyptian culture fields has not been fully confirmed and warrants additional research studies. This is because of several reasons, including a) seasonal changes, b) different environmental characters, c) various physicochemical criteria of the water quality, and d) different fish culture systems and culture facilities. Hence, the suitability of the culture of this fish to Egyptian aquaculture warrants additional research studies.

9. Conclusion and Prospectives

The following key factors should be considered for promoting and enhancing striped catfish aquaculture in Egypt and also for improving its market share: -

Promotion of using the fillets and fish products obtained from *P. hypophthalmus* in the Egyptian markets to increase the consumer purchase of the products obtained from this fish species.

Effective implementation of striped catfish broodstock in well-prepared hatcheries to increase their local production in Egypt.

Establishment of cost-effective production systems throughout the production chain and cost-effective group marketing initiatives.

Development of cost-effective environmental management and biosecurity measures to enhance the culture systems of this fish species.

Sharing and disseminating market price information on input costs and the end products.

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