



## Pacu farming- a threat to local population in Purba Medinipur

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### ABSTRACT

Recently introduced Pacu fish farming in Purba Medinipur district is picking up fast without envisaging scientific track to promote or regulate it. The unofficially introduced Pacu in India is projected to be *Piaractus brachypomus* relying on the identifying characteristics. However, the species available in aquaculture and that in aquarium trade is yet to be scientifically validated. The identification of juvenile fish available at hatcheries, farms and aquarium shops based on morphological features may not be correct particularly when possibility of existing different species of Pacu and their interspecific hybrids may exist. Monitoring, risk assessment and identification of the individual species should be scientifically conducted. In Purba Medinipur, the farm-raised Pacu grows well but its production differs from farm to farm. The fish can utilize diets high in carbohydrates and plant proteins, tolerates poor water quality conditions, varied environments and culture conditions. Breeding of the fish is now well established for its farm raising and propagation yet ornamental value of the fish has also further fascinated aquarium shopkeepers and hobbyists to keep and propagate it in Purba Medinipur. Farm raising, hatchery production and aquarium trading of Pacu facilitated inadvertent releases of introduced Pacu which has gravitated into several natural water bodies. It is proposed that the available Pacu farms and hatcheries need to be urgently registered in view of proper management and scientific regulations on Pacu farming. Based on the field oriented information presented in this study, there are several adverse ecological concerns and consequences are observed. The issues and concerns of rapid expansion of Pacu in Purba Medinipur draws attention of the policy makers and the scientific community to address them keeping in view of the larger interest of the farmer's community, society and the environment.

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### Keyword:

Pacu,  
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### Introduction

Introduction of exotic fishes in the Indian waters can be traced back more than a century old history. While the country was under the British rule, such fisheries were possibly introduced for recreational fisheries. Sir Francis Day, the author of the classical work on the Fish fauna of Indian

region (Day, 1889), was probably the first person who tried to introduce the brown trout, *Salmo trutta fario* in the Nilgiri waters in the year 1863, but his attempt was unsuccessful (Jhingran, 1975). This was followed by introduction of several exotic fish species from various parts of the world to different regions

of India for augmenting fish production through aquaculture, for sport fishery, for mosquito control, weed control, for ornamental purpose etc with successes and failures. The larvaecidal fishes, such as, *Poecilia reticulata* and *Gambusia affinis* were introduced in the year 1908 and 1928 respectively, to control mosquito larvae in confined waters. But the larvaecidal value of these species is not well established. There are hundreds of ornamental fish species being imported to our country since the aquarium trade is in progressive growth stage but insecticidal value of these species is not well established. The ornamental fishes, although remain confined to aquarium tanks, their release into natural habitats is not uncommon and the impacts in case of escapee were not yet assessed. The so-called fish Pacu, *Piaractus brachipomus* (Cuvier 1818) was unofficially introduced possibly during 2012 via Bangladesh (Chatterjee and Mazumdar, 2009; Singh and Lakra 2011). As per information available in Fishbase, there are 12 species of Pacus (Froese, Rainer and Pauly. 2017). The popular species of Pacu are *Colossomama cropomum* (tambaqui), *Piaractus brachipomus* and *Piaractus mesopotamicus*. Red-bellied Pacu and black Pacu have been reported from India (Singh, Dinesh, and Abubakar, 2012). Nevertheless, *Piaractus brachipomus* (Cuvier 1818) commonly known as Pacu, pirapitinga, roopchand is understood to be available at many of the farms, markets and aquarium shops of Indian states and the fish has got both food and ornamental value. In addition, another Pacu like

species called piranha is also available which belongs to the family Characidae and subfamily Serrasalminidae belonging to the same group (Jegu M. 2003). The morphological information, characteristics and biology of Pacus found in India are yet to be scientifically validated. At the juvenile stage, Pacu resembles piranha (*Pygocentrus nattereri*), but differs greatly in behaviour and feeding habits even though they belong to the same family (Singh and Lakra 2011). Since the boundaries of the country are porous, Pacu piracy and unauthorized introductions have been carried out (Singh and Lakra 2011) and actually needed scientific information are lacking. The unofficial culture and breeding of Pacu in India has been expanding during recent past causing concern of local fish biodiversity management and encouraging aquaculture for food security. As per reports available, a significant subset of alien species can become invasive and have serious adverse impact on biodiversity and related ecosystem services, as well as have other social and economic impact (Singh and Lakra 2011). Internationally, culture and breeding technology of Pacus, *Colossomama cropomum* (tambaqui), *Piaractus brachipomus* and *Piaractus mesopotamicus* is now well established and available (Hashimoto, Senhorini and Foresti, 2012). However, it is also important to mention that in recent years, hybrids of Pacus have also been produced and reported to represent recent advances in aquaculture of Pacu (Hashimoto, Senhorini and Foresti, 2012). Since three species of Pacus *Colossomama macropomum* (tambaqui), *Piaractus brachipomus* and

*Piaractus mesopotamicus* are very common at farms and hatcheries in several countries, morphological distinction of such unintentional or deliberate hybrids production from the parents becomes highly unidentifiable, particularly between interspecific hybrids and pure species individuals. It is thus difficult to generate species specific information of the individuals available at the farms and markets. Hybrids Pacu can be erroneously identified as pure species in breeding facilities, which might reduce production on farms and negatively affect native populations due to escapes or unscientific stock management practices [Hashimoto, Senhorini and Foresti, 2014]. These deliberate or unauthorized activities of hybrid production are considered to be more resistant to varied environmental factors [Moraes, Avilez and Hori, 2006]. Further, mislabelling of the existing species may become a cheat to the market and farmers as the hybrids may not be as productive and remunerative for aquaculture as that of pure species (Hashimoto, Senhorini and Foresti, 2012). Nevertheless, genetic and environmental problems are also foreseen and since different species of Pacu are reproductively compatible (Hashimoto, Senhorini and Foresti, 2012). The propagule pressure on the Pacu fish farming in India is equal for aquaculture as food and also for ornamental keeping (Datta and Nandeesh, 2006; Ghosh, and Datta, 2014). It is quite likely that attempts are in operation or maybe made towards creating fancy appearance of the fish through crossbreeding of different species of Pacu for value addition especially in ornamental trade. It is therefore, imperative to ensure what

species farmers are cultivating and demonstrate authenticity. Absence of monitoring by competent agencies/authorities/scientific organizations, the warnings reported by Hashimoto *et al.* (2012) based on experience elsewhere particularly in the USA and Asia will be needed towards the implementation of regulatory measures and management on Pacu culture. Keeping in view of the above facts, present scenario on the culture and breeding of Pacu in Purba Medinipur has been synthesized and presented in the present paper. Further, various environmental conditions required for the fish to spread has also been generated so as to make out possible invasions. The instances of inadvertent releases of the fish in different natural aquatic bodies are highlighted besides lessons to be learnt from the other countries and even other states of our country to contemplate scientific measures to regulate culture and propagation of Pacu in Purba Medinipur.

### **Materials and Methods**

Present work is mainly based on the field and market survey during March, 2018 to February, 2019. Pacu fish were collected and surveyed in different blocks like Egra-I&II, Contai-I&II, Mahisadal, Moyna, Nandigram I, Panskura, Potaspur-I&II, Bhawanpur-I&II, Tamluk of Purba Medinipur district. Different farm sides were also visited and their culture process was noted. Seeds were collected from fish hatchery of Onda, Bishnupur of Bankura district, reported by fish-farmers on Purba Medinipur.

### **Aquaculture of Pacu in Purba Medinipur**

Both red-bellied Pacu, *Piaractus brachyomus*

and the black Pacu, *Colossomacropomum* have been found to grow well in pond of Purba Medinipur. Pacu exhibit potential characteristics feature for use in aquaculture.

Pacu can:

- reproduce under captive conditions
- thrive low on the food chain
- accept prepared feed
- tolerate hares and hardy environmental conditions
- can easily be handled,
- grow rapidly
- be cultivated in high density
- be marketed and have consumer's acceptability
- fetch good price and
- be preferred as food as well as ornamental fish.

They exhibit fast growth, and are able to utilize diets having high in carbohydrates and plant proteins. They are resistance to poor water quality conditions and diseases having good flesh quality. They have high ornamental value and attractive aquaculture characteristics. Red-bellied Pacu, *Piaractus brachypomus*, is though native of Brazil is now introduced to study area via Bangladesh. It is cultivated in Purba Medinipur, under extensive or semi-intensive type of culture both as monoculture and polyculture system. Pacu in the study area is mostly cultivated in Inland water of Moyna, Tamluk, Panskura, Khajury, Bhawanpur, Egra and Contai block of the district. In most of the areas, Pacu is cultured in combination with

mainly rohu (*Labeo rohita*) or even with catla (*Catla catla*) and mrigal (*Cirrhinus mrigala*) at a stocking density of 7000 and 5000 per hectare respectively with total production levels of 12-15 MT/ha. Although *Piaractus brachypomus* is one of the introduced species being cultured in the district alone in an area of over 1200 hectares, its compatibility with Indian major carps in mixed/poly culture has not been fully understood but still it is cultured. Nevertheless, there is no standard practice of its culture; the farmers are doing it at their own discretions and convenience. The production of the fish varies from farm to farm and overall production in the district is assessed to cross 0.1 million tonnes/ha/year.

#### **Invasion risks of Pacu in natural water bodies**

Introduction of fish species is a globally widespread practice that is now serious consideration as such practices cause losses to native species and homogenization of diversity within and across continents (Singh and Lakra 2011). In Florida, Pacu was first observed in the wild during the 1960's and initially the Pacu population was thought to be non-breeding and existed only as the escapees of residential aquariums and hence non-invasive. However, they later on colonised and today they are everywhere, from South Florida canals, to Lake Okeechobee and through-out most of the continental United States (Howard and Brian, 2012). Invasions of red-bellied Pacu populations have further been reported from many other countries such as Philippines, Iran, and Hungary etc. Pacu being South American native fish

has been reported to occur near Yuma, Arizona in June 2006 and in New Jersey in June 2015 (Howard and Brian, 2012). The occurrence of Pacu has also been reported in Denmark, Michigan and other places. However, invasiveness of the species has yet to be determined. So far as the ecological issues are concerned, there is a report from Papua New Guinea in 2011, where incidence of two human deaths was reported due to Pacu attack by biting off the testicles of fishermen (Rick, 2013). The species possesses a powerful dentition that can also cause serious bites to humans and other aquatic organisms and damage to fishing nets such as gill and cast nets as reported in the reservoir of Pune, India (Singh and Lakra 2011). Some of the reports available from different countries where Pacu were introduced and escaped into natural aquatic bodies are presented here so as to understand possible risks of its culture and propagation keeping in view of the international scenario.

Therefore, Pacu culture in Purba Medinipur is at high risk of escaping from farm to the natural water bodies especially in flood prone blocks like Moyna, Panskura and Tamluk sadar. As like other invasive species Pacu also causes ecological adverse effect on local population.

#### **Adverse effects on local species**

In spite of their significant contributions in aquaculture and ornamental trading, there is debate over the introduction of non-native species. Any new species introduced to an ecosystem has an impact, although in most cases, the effects may remain unnoticed. Non-

native fish species are often considered to pose a threat to biodiversity, and these effects on aquatic biodiversity can result from competition for food and space, habitat destruction, alteration of ecosystems and genetic interaction through hybridization. It is believed that the introduction of farmed non-native species such as Pacu has an adverse impact on small indigenous aquatic species of Purba Medinipur.

Although non-native species were introduced only for aquaculture in India, they are often found in inland rivers, reservoirs, floodplains, canals and wetlands. Purba Medinipur is a flood-prone district of West Bengal, especially Moyna block of the district where non-native species can easily spread from closed culture systems to open water resources during the monsoon season. Scientists have noted that this spread of the fast-growing, non-native fish like Pacu impacts native ecosystems and threatens native aquatic species. Populations of these introduced fish have seen exponential growth and are rapidly extending their range outside the points of introduction.

There is a worrying increase in the number of non-native fish species being detected in rivers, lakes, reservoirs, irrigational tanks and canals in recent years. The non-native fishes moved into open waters inadvertently or due to unawareness or lack of knowledge of the aquaculturists and farmers. The impact of such escapee fishes have been assessed and found to cause ecological problems in several natural aquatic systems. Ecological risks have been mainly caused by non-native species that have

become fully established and acclimatized in natural ecosystems and show naturally reproducing populations. In suitable conditions, such species produce abundant populations and causes a permanent alteration in the local ecosystem.

### **Discussion**

Occurrences of red-bellied Pacu in Purba Medinipur have been recorded from several natural aquatic bodies raising alarms and concerns of scientists. It is recorded to occur in the Moyna, Tamruk and Panskura Block of Purba Medinipur District is the initial alarm to native aqua-fauna of the region. In India, Pacu has already been reported from Pamba River in Kerala, which is known for its inland fishery resources and great biodiversity (Rani, Dharan and Sherly, 2017). Zeena and Beevi (2014) reported captures of Pacu from Muvattupuzha River, Kerala. The occurrence of *Piaractus brachypomus* has also been interestingly reported from the Vembanad Lake. The Vembanad Lake is the largest coastal lagoon on the southwest coast of India with a catchment area of 14500 km<sup>2</sup> drained by seven rivers which are the Chalakudy, Periyar, Muvattupuzha, Meenachil, Manimala, Pamba and Achankovil, along with a large number of canals originating and flowing through Western Ghats. The region is known as one of the 34 global biodiversity hotspots of the world (Srinivas, Revichandran and Maheswaran, 2003). Presence of red-bellied Pacu, *Piaractus brachypomus* has also been reported from Krishna and Godavari rivers of Telangana

(Johnson, Paromita and Sivakumar, 2014; Laxmappa, 2016).

Therefore, like Kerala, Telangana and adjoining regions, West Bengal as well as Purba Medinipur are also infested by the illegally imported cultivable fish, *P. brachypomus*.

### **Conclusion**

Some of the recent reports on the incidents of inadvertent releases of Pacu that gravitated into natural water bodies especially in Purba Medinipur are definitely considered as serious concern and are alarming in response to the heedless interventions of the aquaculturists and emanating environmental changes. The Pacu introduction in India has not been scientifically evaluated and hence its invasiveness still remains a query. A plastic diet, large body size and longevity (up to 70 cm SL and 28 years) (Loubens, Panfili and Biologie, 2001) and the capacity to achieve large local abundances and wide distributions, are some of the characteristics that support the invasive characters of the species (Singh and Lakra 2011). Whatsoever may be the scenario, established self-sustaining populations *P. brachypomus* have not been recorded so far due to the low frequency of individuals occurring in natural aquatic habitats. Nevertheless, there is a great possibility that a gradual release of these long-living fishes provides favourable conditions for growth, spawning, and establishment. The possibilities of adversities on the biodiversity and ecosystem services attract serious attention of the policymakers and the scientific community to address them looking into larger interest of the

farmers community, society and the environment.

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