



## Invasion Stages of *Pterygoplichthys* spp. (Pisces: Loricariidae) in the Luzon Island, Philippines

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**Abstract:** Species invasion was identified as one of the main factors in biodiversity loss and it has been the subject of multilateral agreements among countries under the Convention of Biological Diversity to protect the natural environment. One of the more cryptic but potentially devastating invasion events of recent times in the Philippines is the one caused by species of *Pterygoplichthys* or locally known as janitor fish. In this paper, we provide an appraisal of this invasion event in several areas we surveyed where *Pterygoplichthys* spp. has been introduced. We performed: 1) a taxonomic survey of collected *Pterygoplichthys* specimens in localities in the Luzon Island; 2) an ecological survey of waterways in the localities; and 3) field interviews of people during the visits. Our results show that the eight sites visited have been invaded by *Pterygoplichthys* spp. Invasion stages range from Stage II to Stage V. The invasion situation at each site is discussed. In this paper, we also offer insights on a multiple founding event for *Pterygoplichthys* spp., as well as its implications to local policies on management and mitigation on species invasions.

**Key words:** *Pterygoplichthys*, janitor fish, invasion, invasion level, invasion pathway, management

### 1. INTRODUCTION

The introduction of species into new habitats is a highly anthropogenic event associated with activities such as trading, travel and leisure, among others. Introduction of species can be benign events, i.e. when a species population fails to propagate or expand from its new range, or it can be serious and dramatic episode wherein a population is able to establish itself and dominate the habitat. This latter situation leads to a status of “invasive” for the introduced species, a status identified by the Convention on Biological Diversity of the World Conservation Union (IUCN) as the second most common cause of loss or extinction of species next to habitat destruction. There are cases where the invasive effects of introduced species are readily apparent as exemplified by the 100 sensational cases documented by the Invasive Species Specialist Group of IUCN (ISSG 2004).

But there are cases of species invasions where the effects are vague and these event types proceed unattended until critical economic or ecological consequences take place—a case in point is the invasion of Laguna de Bay by the suckermouth armoured catfishes (SAC) or locally known as “janitor fish.” The economic implications of this fish invasion became obvious only in 2003 or 18 years after the documented escape of this fish from breeding ponds in the lake. Fishermen have since complained that marketable fishes such as tilapia and hito have been replaced by SACs by as much as 30%. Though the economic effects have been seen, the ecological side of the problem is still to be investigated. Displacement of native species and a disruption of the normal ecosystem function are likely because of SAC characteristics as a low trophic level consumer (detritivore), a habitat modifier (nest-building burrower) and a low oxygen tolerant fish; characteristics that can enable SACs



to alter and dominate its new environment and the existing community structure in the area.

In this study we initiated a biogeographic survey of areas where SACs have been sighted. We reported previously (Chavez et al. 2006) that there were unconfirmed SAC sightings in rivers in Aparri, Cagayan and Zamboanga City. Since then SACs have been documented in Agusan Marsh (Hubilla et al 2007) and Lake Paitan in Nueva Ecija (Cagauan, 2007). SACs are very popular in the ornamental fish trade and its introduction into a number of natural waterways in the country via this route is not a remote possibility.

Our aim here is to document suckermouth armored catfishes (SACs) within the Luzon Island, Philippines that are outside the Laguna de Bay (LDB) basin. The specific objectives are: 1) collect biogeographic information on SACs; 2) collect information relative to SAC introduction in the area; 3) assess the invasion level of SACs in inspected areas.

## 2. METHODOLOGY

This research is an investigation of leads on the biogeographic distribution SACs in Luzon Island outside the Laguna de Bay basin. Specific activities done were inspection of areas where SACs were sighted, and interviews of local residents and officials of pertinent government offices. The bearings of specific sites where SACs were reported were determined using a Garmin GPS

To determine the invasion level of SACs in the areas visited, the suggested framework by Coluatti and MacIsaac (2004) in Table 1 were used as a guide.

Table 1. Invasion stages suggested by Coluatti and MacIsaac (2004).

Stage 0	–	propagule in donor region
Stage I	–	survives transport and released in new environment
Stage II	–	introduced

Stage III	–	established, reproducing
Stage IVA	–	widespread but rare
Stage IVB	–	localized but dominant
Stage V	–	widespread and dominant

When samples were available, a digital photo catalogue was made showing the dorsal, lateral and ventral sides of the fish.

## 3. RESULTS AND DISCUSSION

The summary of results in the study is shown in Table 2. The accounts of the investigation of SAC invasion in some of the areas visited outside of the Laguna de Bay are given in the following sections.

### 3.1 Taal Lake, Batangas

As early as 2008, information of SACs in Taal Lake was already received. In 2010, the brochure “Taal Lake Profile” published by the Bureau of Fisheries and Aquatic Resources (BFAR) Regional Office 4-A (BFAR-4A, 2006) bolstered that SACs were indeed present in Taal Lake. The National Fisheries Biological Center (NFBC) of the Department of Environment and Natural Resources in Taal, Batangas through its head Ms. Ma. Theresa Mutia verified SAC presence and showed photos of a specimen delivered to their office. She mentioned that SACs in Taal Lake comprise a less than 1% of landed fish catch from the lake and there have been sporadic reports coming from the towns of Laurel, Agoncillo and Talisay. She opined that SACs would be most likely to be found in the Pansipit River. Figure 1 shows the general area of the Pansipit River where a SAC was also reportedly speared by a fisherman, which was interviewed during a separate visit..

This particular invasion event is significant because SACs could imperil anew the endemic and already overburdened population of *Sardinella tawilis* in Taal Lake. We assess this invasion at Stage II at most but the discovery of breeding burrows along the Pasipit River could mean that this is a Stage III invasion. While in its early stages

of invasion, mitigation or even eradication plans on the SAC in Taal Lake can easily succeed and be more cost effective at this immediate time.

Fig.1. Vicinity of Pansipit River (A) and Taal Lake (B).



Table 1. Summary results of surveyed areas for SACs in Luzon Island.

Locality	Drainage	Year(s) surveyed	Coordinates	Species	Invasion Stage	Other Findings
Marikina Cities	Marikina River	2004-2011	N 14° 34.500' E 121° 4.568'	<i>P. disjunctivus</i> , <i>P. pardalis</i>	V	• Breeding burrows present in area
Pasig City	Marikina River	2004-2006	N 14° 34.500' E 121° 4.568'	<i>P. disjunctivus</i> , <i>P. pardalis</i>	II	• No breeding burrows were seen in the area
Cardona, Rizal	Laguna Lake	2004; 2006-2011	N 14° 29.714' E 121° 9.285'	<i>P. disjunctivus</i> , <i>P. pardalis</i>	II	• Being harvested for food by some locals
Talisay, Batangas Agoncillo, San Nicolas and Taal Batangas	Taal Lake; Pansipit River	2010-2011 2010	N14° 15'21" E121° 1'17" N13° 55' 35.8" E120° 56' 45.8"	unverified <i>P. disjunctivus</i>	O II	• Only 1 specimen documented • No breeding burrows located in area
San Juan, Batangas	Malaquing Ilog	2010-2012	N13° 50' 41.9" E121° 25' 09.2"	Positive sighting but unverified SAC	II	Considered dirty by some locals due to belief that it eats dirt



Sariaya, Quezon	Maasin River	2010-2012	N13° 50' 41.9" E121° 25' 09.2"	<i>P. disjunctivus</i>	II	<ul style="list-style-type: none"> <li>• 1 juvenile specimen captured</li> <li>• Being harvested for food by some locals</li> </ul>
Sta. Maria, Bulacan	Sta. Maria River	2010-2013	N14° 49' 02.9" E120° 58' 31.3"	<i>P. pardalis</i> <i>P. disjunctivus</i>	V	<ul style="list-style-type: none"> <li>• Dominant catch using lift nets.</li> <li>• Being harvested for food by some locals</li> </ul>
Angat, Bulacan	Angat River	2010	N14° 57' 3.7" E121° 1' 01.1"	<i>P. disjunctivus</i>	II	<ul style="list-style-type: none"> <li>• Only 2 specimens documented</li> <li>• No breeding burrows were seen in the area</li> </ul>
Valenzuela City	Marilao- Meycauayan River system	2012-2013	N14° 43' 39.7" E120° 56' 40.5"	<i>P. disjunctivus</i>	II	<ul style="list-style-type: none"> <li>• Dead specimens were sighted along the river</li> <li>• No breeding burrows were seen in the area</li> </ul>

### 3.2 Sta. Maria, Bulacan

Upstream of the Sta. Maria River (N14° 49' 02.9" E120° 58' 31.3") (Figure 2A) in Barangay Tumana, SACs were observed along the Poblacion-Tumana Bridge. SACs were also seen along the river bank (Figure 2C and D) and were positively identified as juvenile *Pterygoplichthys pardalis* and *Pterygoplichthys disjunctivus* (Figure 2B). The fishermen said that SACs were first observed at Sta. Maria River in 2003 and the SAC catch has since been increasing.

A lift operator in the vicinity of Barangay Poblacion (Figure 3C, D and E) mentioned that in half a day of fishing they are able to catch and sell about 15 kilos of tilapia. Along with that 7 out of 10 (70%) fish they catch in the lift net are SACs (which was also observed by JMC during the interview). He also confirmed that some people collect the SACs apparently for food.



Fig. 2. Vicinity of Sta Maria River at Barangaya Tumana (A). Images of SACs along the river (B) and road side (C and D).

The suspicions on SAC introduction in the Bulacan Province arise out of information from petshops in Metro Manila; it was mentioned that SACs are brought in by suppliers from Bulacan. In our initial assessment of the status of the SAC introduction in Sta. Maria River, this event should be considered as a full blown invasion, Stage V, and that necessary plans to mitigate its impact should be drawn up by the municipality. It is evident from

the widespread and dominant nature of this event that species of SACs have been introduced multiple times into Sta. Maria River rather than a single founding event.

It should also be noted that Sta. Maria River drains westward into the towns of Maycauyan, Marilao and Guiguinto in Bulacan Province. It is likely that SACs are also in these areas.

### 3.3. San Juan, Batangas and Sariaya, Quezon

The area of Malaquing Ilog River in the vicinity of the Malaquing Ilog Bridge (Figure 3A) was visited several times. Fishermen were interviewed and mentioned that SACs were being caught in nets in the river. Upstream of the river at (N13° 50' 08.1" E121° 25' 40" (Figure 3B), residents said that SACs have been in the river since 2003 and that they are unsure how the fish got introduced into the river. However, some residents mentioned that SAC were sighted after the municipal government initiated seeding projects for tilapia. In the vicinity of the Maasin River, Sariaya, Quezon at N13° 50' 41.9" E121° 25' 09.2" two SACs were spotted perched on the cement footing of the Maasin River Bridge (Figure 3C, D and E). One of the residents near the Maasin River claimed they regularly catch SACs from the river and serve these as "pulutan." He also pointed out that the habit of the fish is to stay under rocks and crevices due to the strong river current (Figure 3E). No breeding burrows were observed in the areas visited. No petshops were also observed to be sources of propagules.

The rivers of San Juan and Sariaya drain the areas of San Pablo, Laguna and Tayabas, Quezon. With no likely source for propagules to directly come from San Juan town, it is possible that the SACs here are introduced thus a Stage II invasion is assumed in the area. The interview finding in these areas is akin to those from Valenzuela City.





Figure 3. Vicinity of San Juan, Batangas (A and B) and Sariaya, Quezon (C, D and E)

### 3.4 Angat, Bulacan

The proximity of Angat River to Sta. Maria River led to suspicions that SACs have been introduced into Angat River as well. The area in Barangay Marungko at N14° 57' 3.7" E121° 01' 01.1" (Figure 4B and C) were visited and we found SACs stuffed and hung in a fisherman's hut along the river bank (Figure 4A and B). The samples were identified as *Pterygoplichthys disjunctivus*. The samples were caught by net in the area about a month prior to our visit. The fish were gutted and the flesh was scraped off, which was then cooked and eaten by the fishermen. From our interviews, we found out that SACs were seldom caught along this part of the Angat River, i.e. less than ten samples in a month. But they have noted that SACs have since been caught in that area since 2005. No breeding burrows were apparent along the banks but the fishermen said they have seen large holes along the riverbank.

The Angat River system is a vital source of freshwater. It is the main supply of potable water for Metro Manila and irrigation water for the provinces of Bulacan, Pampanga and Nueva Ecija. This invasion event could have damaging impacts on river use thus further investigation is warranted. A Stage II invasion is believed to be in

effect in this area of Angat Province unless breeding burrows are discovered. It is possible that SACs caught are travelling along the river system, either downstream from the Sierra Madres in Quezon Province or upstream from the swamps of Candaba, Pampanga.

### 3.5 Coloong, Valenzuela City

The Meycauyan River is connected via a complex river system with the Sta Maria River. This connection was hypothesized for presence of SACs in the area. Barangay Coloong II of Valenzuela City (N14° 43' 39.7" E120° 56' 40.5") was surveyed and carcasses of SACs were found along the dikes in the area. The area of Coloong is known for its recreational fishing and fish farming industries. A fish pen owner said that the SACs were sighted initially in 2004 but has not observed possible sources of the fish. One resident in the area opined that the SACs were apparently coming from the upstream of Meycauyan River. He mentioned that sometime in 2004, he witnessed the seeding of tilapia fingerlings into the Angat River and a few months thereafter SACs have been fished out of the river.

### 3.6 On the Sources of Introductions

In the Marikina River, eyewitnesses recounted that the SACs were introduced intentionally to clean up the river. In the area of San Juan, Batangas and Valenzuela City, a new invasion origin has been presented and could be the subject of verification in future. Interviewees have mentioned the possible mixing of SAC fingerlings with tilapia fingerlings that were seeded into the rivers. This mix could have indeed inadvertently introduced the SACs into these areas—an unintentional act that has lead to a problematic event. Perhaps this is indeed a problem but it is apparent that after several years that SACs have been present in these drainages locals have come to accept the fish and consider it as a potential source of food.

## 4. CONCLUSION



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The areas we visited have turned up positively members of Genus *Pterygoplichthys* as invasive species. Except for the Taal Lake in Talisay Batangas, SACS are apparently introduced and established in the other areas visited. Invasion levels are highest at Stage V in Marikina and Sta. Maria River, and vary from Stage 0 to possibly Stage III in the other areas. The exact mechanisms by which introductions occurred in the areas we visited are unknown.

ISSG (2004) *100 of the World's Worst Invasive Alien Species: A Selection from the Global Invasive Species Database*. Invasive Species Specialist Group. 11pp.

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