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First Sighting of Exotic Alligator gar, *Atractosteus spatula* (Actinopterygii: Lepisosteidae), from Diu, India- an Ecological Risk to Fish Diversity

Rath Shibananda[1], Bungdon Shangningam[1]* and Mishra Subhrendu Sekhar[2]
[1]Freshwater Fish Section, Zoological Survey of India, 27, J.L. Nehru road, (Kolkata), India.
[2]Estuarine Biological Research Centre, ZSI, Gopalpur (Odisha), India.

(Corresponding author: Bungdon Shangningam)*
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ABSTRACT: An exotic alligator gar, *Atractosteus spatula* (Lacepède, 1803), is reported from a confined pond inside the campus of Fishery Department, Diu, India. The discovery of an exotic alligator gar has prompted discussions about potential ecological risks to the local fish diversity. In light of concerns regarding the potential invasiveness of this voracious fish species and its potential to disrupt the existing fish populations, various strategies to mitigate these risks have been deliberated in the present paper.

Keywords: Alligator Gar, Aquarium Fish, Diu.

INTRODUCTION

Atractosteus spatula, commonly referred to as the Alligator Gar and scientifically classified by Lacepede in 1803, is a euryhaline ray-finned fish of notable significance. This species, the largest within the Lepisosteidae family, holds a prominent place among North America's primary freshwater fish. Its unique status as a "living fossil" is attributed to the retention of ancestral morphological characteristics. Indigenous to North America, particularly within the Mississippi River basin, this species has gained international recognition in the ornamental fish trade (Raz-Guzmán *et al*., 2018; Salnikov, 2010).

A notable aspect of Atractosteus spatula is its remarkable adaptability, with recent sightings recorded in various Indian states, including Assam (Anonymous, 2020), West Bengal (Thakur 2016), Odisha (Anonymous, 2017), Andhra Pradesh (Vadlamudi, 2021), Kerala (Kumar *et al.*, 2019); Maharashtra (Ghai, 2018; Patil *et al*., 2019). It is capable of thriving in both freshwater and marine environments (Goodyear, 1967), and reports from Indonesia (Hasan *et al.*, 2020) and Texas (Buckmeier, 2008) have demonstrated its ability to tolerate fluctuations in salinity levels, further enhancing its adaptability and potential distribution.

This paper reports a noteworthy observation of the Alligator Gar within the confines of a freshwater pond situated on the premises of the Fishery Department in Diu, which operates under the administration of Daman and Diu. It is noteworthy that there are no previously published records of Gar species in Diu, making this sighting a significant addition to the region's ichthyological knowledge.

MATERIAL AND METHODS

Two large-sized specimens of *Atractosteus spatula* were sighted freely swimming in the confined pond found inside the campus of Fishery department in Diu, India 20˚42′48″ N 70˚58′22″ E (Fig. 1). A single specimen was collected by using a catch net on 20-11-2019. Identification of the species follows Bigelow *et al.* (1963). The collected gar was free back in the live form into the pond after the study. Specimens of the long whiskers catfish *Mystus gulio* (Hamilton, 1822) were also collected along with the alligator gar.

Within the confines of the Fishery Department's campus in Diu, India, at coordinates 20°42'48" N and 70°58'22" E (as illustrated in Fig. 1), two substantial specimens of *Atractosteus spatula*, commonly known as the Alligator Gar, were observed swimming freely in a restricted pond. On the date of November 20, 2019, one of these specimens was captured using a catch net. The identification process adhered to the guidelines presented by Bigelow *et al*. (1963). Following the completion of the study, the collected gar specimen was released back into the pond, allowing it to continue its existence in its natural habitat.

Additionally, during the collection process, specimens of the long whiskers catfish *Mystus gulio* (Hamilton, 1822) were also gathered from the same pond, further contributing to the research and documentation of the aquatic life in this unique environment.

Fig. 1. Collection of alligator Gar from freshwater Pond in Fishery office campus, Diu, India.

RESULTS

The body of the *Atractosteus spatula* was covered with large, tough, diamond-shaped ganoid scales. These scales did not overlap with one another, giving the fish a unique appearance. However, it's important to note that the head and snout of the gar were devoid of scales. The upper jaw of the gar featured two rows of piercing teeth, with a second row of teeth positioned inside the mouth. This internal arrangement of teeth differed from the externally visible teeth. Both the dorsal and anal fins of the fish were comprised of 7 rays each. The pectoral fin displayed 14 rays and was situated near the gill opening.

In terms of coloration, the dorsal surface of the gar's body exhibited a dark olivaceous hue, while the lower abdomen was characterized by a creamy white coloration. This distinctive color pattern added to the overall uniqueness of the *Atractosteus spatula* specimen.

Fig. 2. Freshly caught *Atractosteus spatula.*

DISCUSSION

The release of large alligator gar specimens into the pond is suspected to be the result of actions taken by certain aquarium hobbyists. Unfortunately, the risky climatic conditions in the region have further facilitated the entry of exotic fishes into Indian inland waters and their ecosystems, as noted in studies by Raj *et al.* (2021); Manna *et al.* (2021). Currently, the global aquarium trade industry has had a detrimental impact on the presence of non-native fish species, with over 5000 different species being exported worldwide, as reported by Chan *et al.* (2020). The Alligator gar has been illegally introduced into Indian fisheries, as highlighted in the study by Kumar *et al.* (2019). The unauthorized introduction and proliferation of numerous exotic species have had adverse effects on indigenous fishes, impacting almost all riverine systems in India. This situation has been documented in studies by Knight (2010); Sandilyan (2016).

The *Atractosteus spatula* specimens were collected from a freshwater pond situated within the Diu Fishery Office, which operates under the administration of the Union Territory (UT) of Daman & Diu. Interestingly, this particular site appears to have an underground connection with nearby backwaters. Upon conducting inquiries, it was discovered that the Fishery Office was originally constructed by a private resort known as the "Krishna Restaurant & Entertainment Centre" back in the year 2000. Additionally, during the investigation, it was observed that there were notably large aquariums, measuring approximately 4 feet by 1 ½ feet by 3 feet in size, within the building. It is surmised that prior to transferring ownership of the building to the Government, the private resort chose to release all the fish that were originally housed in these aquariums into the adjacent pond. This action likely accounts for the presence of the *Atractosteus spatula* specimens in the pond and sheds light on the origin of these exotic fish in this particular aquatic ecosystem.

The observation of only a few long whisker catfish *Mystus gulio* in the same water body alongside the alligator gar is indicative of a challenging coexistence scenario. It suggests that native fishes, aside from catfishes, may struggle to survive in the presence of the gar. This discrepancy in survival rates may be due to the predatory nature of the alligator gar, which could be particularly impactful on other native fish species. The observation of two specimens of the alligator gar, although their sexes were not examined, raises the possibility that the present water body or climatic conditions may not be suitable for reproduction. Alternatively, it's plausible that both observed specimens belong to the same sex, which would restrict breeding opportunities. This absence of successful reproduction can have implications for the long-term sustainability of the alligator gar population in the pond. In any case, the introduction of the alligator gar into this pond is likely to lead to a significant disruption of the ecosystem. Given its predatory behavior and potential reproductive limitations, this exotic species can potentially alter the balance of species interactions

and impact the overall biodiversity and dynamics within the pond's ecosystem.

The presence of the exotic gar species in the pond raises concerns about its potential accidental entry into the river ecosystem. It is unclear whether this introduction was accidental or intentional, but the consequences of introduced species becoming invasive can be highly impactful, leading to significant ecological changes. To address this issue, it is crucial to implement proper monitoring programs to track the population of the gar species in the wild. Simultaneously, outreach initiatives should be launched to educate the local community about the risks associated with invasive species. Government agencies, Fishery Departments, environmentalists, and relevant ministries should collaborate to take appropriate measures to manage and potentially eradicate the invasive gar species. In light of these considerations, it is advisable to take action to remove the invasive gar species from the aquatic ecological body. This intervention is essential to protect and promote the growth of native species, ensuring the overall health and stability of the ecosystem.

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