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PRELIMINARY POND CULTURE TEST OF PIRAPITINGA (*Mylossoma bidens*) AND TAMBAQUI (*Colossoma bidens*) FROM THE AMAZON RIVER BASIN*

by

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Abstract

Tambaqui (Colossoma bidens) and pirapitinga (Mylossoma bidens) from the Amazon River were stocked in earthen ponds at the Pentecoste Fish Culture Research Station in the State of Ceará, Brazil. Tambaqui were stocked at 2 077/ha with an average weight of 6 g. Pirapitinga were stocked at 2 632/ha with an average weight of 9 g. Both ponds received cow manure and triple superphosphate during the experiment. Both species were fed a pelleted ration 6 days a week and, after 405 days, 2 509 kg/ha and 2 472 kg/ha of tambaqui and pirapitinga respectively, were harvested. The average weight of tambaqui was 1 245 g and 992 g for pirapitinga. Both species were resistant to low levels of dissolved oxygen and to handling and were easily captured with a seine. Attempts to artificially spawn these species with injections of curimatã comum (Prochilodus cearensis) pituitaries were unsuccessful.

Extracto

Ejemplares de tambaqui (Colossoma bidens) y pirapitinga (Mylossoma bidens) del Río Amazonas, fueron introducidos en estanques de tierra de la Estación Experimental de Piscicultura de Pentecoste, Estado de Ceará, Brasil. La densidad de población de los tambaqui fue de 2 077/ha, con un peso promedio de 6 g. Para pirapitinga la densidad fue 2 632/ha con un peso de 9 g. Ambos estanques fueron fertilizados con estiércol de vaca y triple superfosfato durante el experimento, y las dos especies fueron alimentadas con "pellets" seis veces por semana. Tras 405 días se cosecharon 2 509 kg/ha de tambaqui y 2 472 kg/ha de pirapitinga siendo los pesos promedio 1 245 g y 992 g respectivamente. Las dos especies se mostraron resistentes a bajas concentraciones de oxígeno y al manejo y fueron fácilmente capturadas con chinchorros. Intentos de madurar artificialmente a ambas especies con inyecciones de pituitarias de curimatã comum (Prochilodus cearensis) no tuvieron éxito.

1. INTRODUCTION

Pirapitinga (Mylossoma bidens), often called the white tambaqui, is a close relative of the tambaqui (Colossoma bidens) and the two species are often confused when they are young. However, they can easily be separated by examination of the adipose fin. The pirapitinga has a fleshy adipose fin while the tambaqui has a bony adipose fin containing small fin rays. The adult fish are also coloured differently; the pirapitinga is silver with orange laterally and ventrally, while the tambaqui is grey, bronze, or black dorsally, fading to white ventrally and often has a patch of black in the area of the anal and caudal fins. Surprisingly, little is known of the life history of these two characins. Both species are known to occur throughout most of the Amazon River Basin.

The centre of the commercial fishery appears to be located around the city of Manaus, State of Amazonas, where the tambaqui is pursued by local fishermen on a year-round basis because of its high commercial value. Pirapitinga is fished on a more seasonal basis, appearing in the Manaus Fish Market from January through July. Both species spawn during December and January in the Manaus area in response to the rising waters of the Amazon and Negro Rivers. The authors were unable to find any information on the actual spawning behaviour of either fish.

Some information is available concerning the food habits of the tambaqui in its native habitat[1]. Major food items included phytoplankton, zooplankton, larval shrimps, terrestrial fruits and aquatic insects. A few adult shrimps have been found in the stomachs of large tambaqui, but never any fish. It is a well known fact that the tambaqui invades inland areas during times of high water to feed on fruits that fall into the water or are made available when fruit-bearing bushes are inundated by flood waters. Tambaqui appear to feed almost exclusively on fruits when they are available. However, during periods of low water when access to backwaters is limited, the tambaqui appears to be principally a filter feeder. The pirapitinga is also known to eat regional fruits made available by flood waters. When fruits are not available, it is not known what pirapitinga eat. The maximum size of tambaqui and pirapitinga seen by the authors in the Manaus area were fish of 890 mm weighing 13.2 kg, and 790 mm with a weight of 11.2 kg respectively. Local fishermen report that both species reach weights in excess of 20 kg.

These preliminary pond experiments were undertaken to determine the suitability of tambaqui and pirapitinga as culture fish. With the limited number of individuals available, an attempt was made to obtain information on the growth, production, acceptance of feed, hardiness, critical water quality levels, and general behaviour of tambaqui and pirapitinga in a confined environment (Figure 1).

2. METHODS

Shipments of 74 tambaqui and 94 pirapitinga from waters of the Amazon Basin near Iquitos, Peru, were stocked into 355 m^2 earthen ponds at the Intensive Fish Culture Research Station located in Pentecoste, State of Ceará, Brasil. Tambaqui were stocked at 2 077/ha with an average weight of 6 g and pirapitinga were stocked at 2 632/ha with an average weight of 9 g. Both ponds were fertilized twice within the first six months with 16 kg of cow manure, 448 kg/ha, and four times within the same time period with 600 g of triple superphosphate, 16.8 kg/ha. Fertilization was discontinued when pond fertilities reached high levels that could be maintained by feeding alone.

Both species were fed a pelleted ration 6 days a week at 3 percent of the standing crop of fish in the pond until poor water qualities necessitated a reduction in the feeding rate. Tambaqui and pirapitinga were fed half the allotted daily ration in the early morning while the remaining half was fed in the late afternoon. The ration contained 29.1 percent protein of which 8 percent consisted of animal protein. The feeding rate was adjusted monthly on the basis of growth as indicated by monthly seine samples. Total lengths and weights of at least 20 percent of the fish in the ponds were recorded during sampling. Analysis of dissolved oxygen, pH, and water temperature were made at least once a week. Determinations were made in the early morning and late afternoon of the same day. Oxygen was taken with a YSI portable oxygen meter, and the pH was determined colorimetrically. The experiments were terminated after 405 days.

3. RESULTS

3.1 Production

Table I gives a summary of experimental results for tambaqui and pirapitinga. Total production for tambaqui and pirapitinga was 2 509 kg/ha and 2 472 kg/ha respectively for the experimental period.

1/ Unpublished data collected by Mrs. Elizabeth Honda, Fishery Biologist with Instituto Nacional de Pesquisas do Amazonia

3.2 Growth

In 405 days, tambaqui grew from an average of 6 g to an average of 1 245 g and pirapitinga grew from an average of 9 g to an average of 992 g. The average weight gain per day was 3 g and 2.4 g for tambaqui and pirapitinga respectively. Maximum calculated average growth was 284 g for tambaqui and 248 g for pirapitinga over a 35-day period. Figure 2 shows the growth of tambaqui and pirapitinga between sampling periods over the 405-day experimental period.

3.3 Feeding

Both species of fish readily accepted a pelleted ration. Both tambaqui and pirapitinga were observed feeding on the pellets as they sank to the bottom. Conversion of food to fish flesh was 3.07:1 and 3.38:1 for tambaqui and pirapitinga respectively. Maximum feeding rate was 56.6 kg/ha/day for tambaqui and 63.7 kg/ha/day for pirapitinga. These feeding rates were held for 7 days and 25 days for tambaqui and pirapitinga respectively before poor water quality forced a suspension of feeding. When water quality permitted the resumption of feeding, both species were fed at the rate of 42 kg/ha/day for 11 weeks without further water quality problems.

Some interesting observations on the feeding habits of tambaqui and pirapitinga were made. Pirapitinga readily fed on a large variety of fruits and vegetables thrown into the pond. Pirapitinga consumed bananas, pieces of watermelon, pieces of watermelon rind, guavas, cucumbers, fresh corn cut from the cob, fresh beans, bean shells, as well as a number of local fruits. Even fruits with a large seed or pith had the edible portion removed before the seed was rejected. Stomachs taken from several pirapitinga that were in a fertilized, unfed pond were found to contain remains of shrimp, seeds from land plants bordering the pond, and plant detritus. Tambaqui was observed eating several kinds of fruits, but to a much lesser extent than pirapitinga. Stomachs of tambaqui from a fertilized, unfed pond were found to contain zooplankton and larval shrimps almost exclusively.

3.4 Water quality

Both species of fish are resistant to poor water quality. Dissolved oxygen levels of surface waters between 1 and 2 ppm had no adverse effects on tambaqui and pirapitinga as both species continued to feed normally. When dissolved oxygen dropped below 1 ppm, tambaqui and pirapitinga were able to survive by gulping air at the water surface until corrective measures could be taken. No mortalities were recorded due to low levels of dissolved oxygen.

Both species can also withstand wide ranges in pH. In the Manaus area, tambaqui and pirapitinga are found in the River Negro, which has a pH ranging from 3.5 to 6.0 depending on the season. Water entering the Pentecoste Research Station has a pH of 7.8 to 8.3 and a total alkalinity of 140 to 150 ppm. Neither fish had any problems adjusting to environmental conditions in Pentecoste ponds. Several times, in the late afternoon, and in the presence of a heavy concentration of blue-green algae, pH readings of over 10 were recorded. While no mortalities resulted, a pH of this level restricted normal feeding by pirapitinga and tambaqui as uneaten food was found in the feeding area. With a reduction of the phytoplankton bloom and a subsequent lowering of pH, both species resumed normal feeding. Surface water temperature ranged from 25°C in the morning to 35°C in the afternoon.

3.5 Reproduction

Very little is known of the reproductive habits of tambaqui or pirapitinga in their natural habitat and it is not known if tambaqui or pirapitinga will spawn in a captive environment. To better understand the reproductive potential of these two species, 13 tambaqui and 22 pirapitinga were placed in a 0.1 ha earthen pond. Over a two-year period, these fish were fed a pelleted ration containing 34 percent protein of which 15 percent was composed of fish meal. The fish were fed approximately 3 percent of their body weight per day and during the rainy season, the suspected spawning, the fish were fed at 5 percent of

their body weight. In December 1973, several individual pirapitinga and tambaqui were observed to be entering a state of sexual maturity. At this time, the tambaqui and pirapitinga were approximately 4½ and 3 years old respectively. All individuals of both species were captured and moved to a 0.3 ha pond that had been freshly filled and had a flow of fresh water entering constantly. It is felt that the introduction of fresh water helped stimulate sexual development.

On 18 February 1974 examples of sexually mature pirapitinga and tambaqui were selected for artificial spawning with pituitary injections. When not in spawning conditions, no method has been found to separate males and females of either species. When in spawning conditions, males of both species release sperm when pressure is applied along the abdomen. Females of both species were distinguished by their swollen abdomens and swollen, reddish genital papilla. The authors found only 1 female and 2 male tambaqui that were ready for spawning. A larger number of pirapitinga were ready for spawning so 2 females and 4 males were selected. The ripe fish were removed from the holding pond and placed in 4-m^2 concrete tanks with constantly flowing water. The fish were separated by species and sex.

The fish were injected with pituitaries collected from the characin curimatã comum (Prochilodus cearensis) having an average weight of 450 g. Pituitaries were collected from ripe curimata two weeks prior to the attempted spawning of tambaqui and pirapitinga. The fresh pituitaries were preserved in absolute alcohol. The pituitary solution for injection was prepared by grinding the pituitaries in a mortar and pestle, adding physiological saline, and centrifuging the mixture to remove solid particles. Injections were made with a Luer glass syringe using a number 20 needle.

Pirapitinga and tambaqui were given intramuscular injections below the dorsal fin every 6 hours over a 24-hour period. Generally, males of both species received half the dosage of pituitary solution received by the females. Tables II and III summarize injection procedures. After the third injection, males and females of both species were placed together, 2 males and 1 female in each tank. Twenty-five hours after the first injection a female pirapitinga began releasing eggs. As the female gave no indication of spawning naturally with the males in the holding tank, the female pirapitinga was taken from the holding tank and her eggs stripped into a dry porcelain pan. The eggs were easily stripped with slight pressure on the abdomen. A small quantity of sperm was stripped from two males and mixed with the eggs. After five minutes, water was added to the eggs and the eggs were allowed to water harden for twenty minutes. As this one female gave a large quantity of eggs, the spawn was placed into three incubators. After water hardening, the eggs are about 2 mm in size and are semi-buoyant. Only partial fertilization was achieved and those eggs that were fertilized developed to the 32 cell stage after which complete mortality was observed. The reason for the failure of the fertilized eggs to develop past the 32 cell stage is not known. A female pirapitinga weighing 3.5 kg with a total length of 493 mm was sacrificed and the ovaries removed. The ovaries weighed 419 g and were calculated to contain 348 308 eggs.

Thirty hours after the initial injection, the tambaqui female began releasing eggs but no sperm could be obtained from the males so the eggs were not fertilized. Average water temperature was 30.7°C and ranged from 28.0°C to 33.0°C during the spawning attempt.

3.6 Capture

One primary advantage of tambaqui and pirapitinga as culture species is their ease of capture. A single seine haul in a full pond captured 100 percent and 96 percent of pirapitinga and tambaqui respectively when the experiment was terminated. Bag seine hauls in full ponds by two or three workers consistantly yielded better than 90 percent capture of all fish in the ponds. Neither species jumps or lies in the bottom mud to escape the seine but remains in a closely grouped school in midwater.

3.7 Resistance to handling

Both species are resistant to handling and seining. Tambaqui and pirapitinga were held in crowded conditions with little water while they were being weighed and measured during sampling. No mortalities were recorded due to sampling. Tambaqui and pirapitinga are easily handled as these fish lack spines or bony fin rays that can injure hands. The lack of spines also allows for easy removal from nets and seines.

3.8 Commercial value

The authors ate several tambaqui and pirapitinga and found the flesh to be firm and of good quality. Both species contain a small number of forked, intramuscular bones which are easily removed but may limit the fishes market value in some areas.

4. DISCUSSION

Pirapitinga and tambaqui demonstrated excellent potential as pond culture fish. The total productions of 2 509 kg/ha and 2 472 kg/ha for tambaqui and pirapitinga respectively, over the 13½-month experimental period, are good considering the low stocking rate and small initial average weight of fish stocked. The authors feel that the total production can be increased by stocking a larger number of fish per hectare with a higher initial average weight and raising the fish to a suitable market size of 500 g.

The fact that both species are known to eat fruits presents an interesting culture possibility in tropical areas where fruits are cheap and normally available on a year-round basis. The ease with which tambaqui and pirapitinga are captured with a seine can also be taken advantage of in dry tropical areas. In areas where water conservation or the conservation of fertile pond waters is of primary concern, fish crops could be harvested without draining the ponds. Being able to utilize zooplankton as food, tambaqui may yield high productions when raised in fertilized ponds without feeding or when cultured in association with other species of fish. The above ideas will have to be tested in the future when more small fish are available for experimental purposes. At the present time, the major disadvantage of tambaqui and pirapitinga as culture fish is their inability to reproduce in a captive environment. It is felt that both species can be spawned artificially using pituitary injections but, until the techniques for artificially spawning tambaqui and pirapitinga are perfected and a supply of fingerling fish becomes available, the true culture potential of tambaqui and pirapitinga will remain in doubt.

TABLE I

Summary of experimental results for tambaqui (Colossoma bidens) and pirapitinga (Mylossoma bidens) raised in earthen ponds

	Tambaqui	Pirapitinga
Total weight at harvest (kg)	89.6	88.3
Total weight at stocking (g)	443	884
Net production (kg)	89.2	87.4
Average weight of fish at stocking (g)	6	9
Average weight of fish at harvest (g)	1 245	992
Weight of ration fed (kg)	274.2	295.7
Feed conversion	3.07	3.38
Survival[a/] (%)	97	97

a/ Two fish of each species were removed for display purposes after 9 months and were not replaced

TABLE II

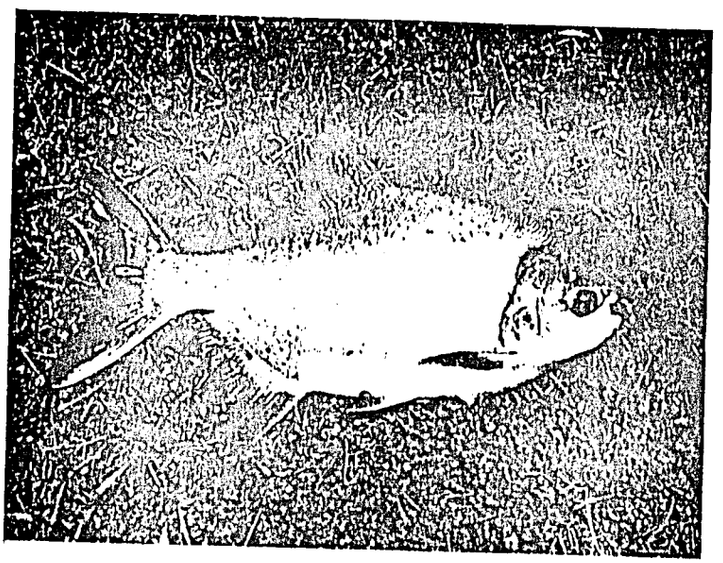
Summary of the data relating to the artificial spawning of pirapitinga (Mylossoma bidens) with injections of curimatã comum (Prochilodus cearensis) pituitaries

Injections			1	2	3	4
Date			18 February 1974	18 February 1974	19 February 1974	19 February 1974
Hour			15.40 h	21.35 h	04.10 h	10.20 h
Pituitary solution			3 pituitaries in 3 cm^3	6 pituitaries in 3 cm^3	8.5 pituitaries in 3 cm^3	24 pituitaries in 3 cm^3
Dosage per fish	Sex	Weight (kg)				
	♂	2.6 3.1 3.0 3.4	0.5 cm^3	0.5 cm^3	0.5 cm^3	0.25 cm^3
	♀	3.5 4.8	0.5 cm^3	0.5 cm^3	0.5 cm^3	1.00 cm^3

TABLE III

Summary of the data relating to the artificial spawning of tambaqui (Colossoma bidens) with injections of curimatã comum (Prochilodus cearensis) pituitaries

Injections			1	2	3	4
Date			18 February 1974	18 February 1974	19 February 1974	19 February 1974
Hour			15.30 h	21.20 h	04.00 h	10.10 h
Pituitary solution			2 pituitaries in 2 cm^3	4 pituitaries in 2 cm^3	6.5 pituitaries in 2 cm^3	16 pituitaries in 2 cm^3
Dosage per fish	Sex	Weight (kg)				
	♂	7.5 7.0	0.5 cm^3	0.5 cm^3	0.5 cm^3	0.5 cm^3
	♀	11.0	1.0 cm^3	1.0 cm^3	1.0 cm^3	1.0 cm^3



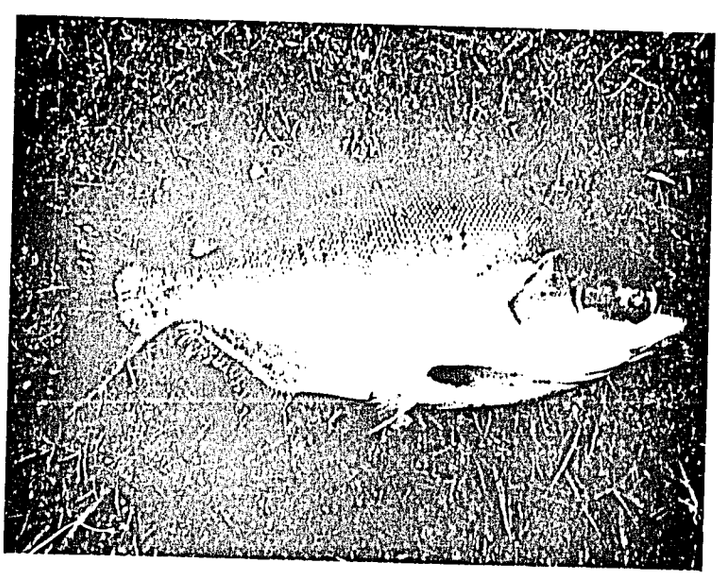


Figure 1 From top to bottom: Pirapitinga (Mylossoma bidens) and tambaqui (Colossoma bidens)

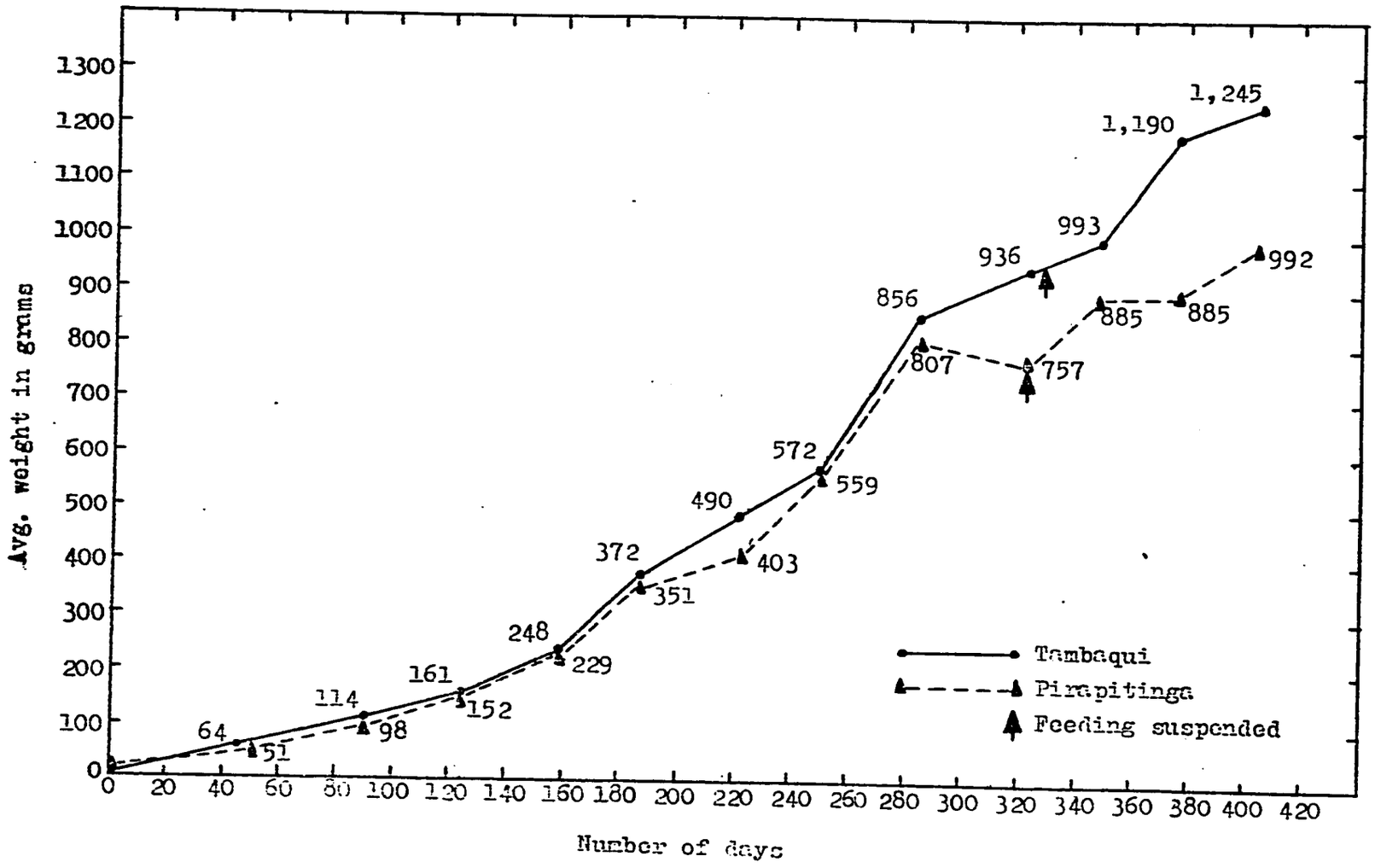


Figure 2 Average growth in grams of tambaqui (Colossoma bidens) and pirapitinga (Mylossoma bidens) between samples over 405 day experimental period