

# First successful long-distance transport of adult *Arapaima gigas* (Schinz, 1882) within Europe

## Erster erfolgreicher Langstreckentransport von ausgewachsenen *Arapaima gigas* (Schinz, 1882) in Europa

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### Abstract

As adult arapaimas are obligate air-breathers, they are prone to drowning. Therefore, transporting adult specimen has been avoided, since no successful transport was recorded before. When construction on the tropical hall became necessary the move of four arapaimas from Rotterdam was unavoidable, a transport method was developed that enabled safe catching and the transport to Duisburg (220 km) and Paris (530 km). Factors of success were elevating the head immediately while catching, the width of the TAP, a water filled hammock and the direction of travel.

**Keywords:** *Arapaima gigas*, transportation, safety, welfare

### Introduction

The husbandry of one of the biggest freshwater fishes in existence comes with its own challenges. Juvenile arapaima are acquired easily through the pet trade with a total length (TL) of less than 30 cm. These animals grow out quickly, reaching over 100 cm TL within a year (Nuñez, 2024). While the gills are the primary organ of gas exchange in juvenile fish, adult arapaima are obligate air breathers (Farrell, 1987). They use a specialized respiratory gas bladder (Brauner, 2004). It is placed dorsally along the whole length of the coelomic cavity and is connected to the esophagus cranially by a disk-like sphincter. The opening of the sphincter is slit-like and opens

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only 24 mm (Scadeng M. 2020). Arapaimas will glide towards the surface and expel air through the gills before lifting their mouth above the surface to take in air (pers. observ.).

This rare adaptation is proving to be especially challenging during arapaima transport. For a long time it was thought to be impossible to transport fully grown arapaima over long distances due to their size, explosive strength, and possibility of drowning. Common practice was to introduce juvenile animals into aquariums where they grow out to full size and live until the end of their life.

Due to urgent construction needs, this became impossible for five arapaimas (TL 240-260 cm) living in Diergaarde Blijdorp in 2023. The animals needed to be moved out urgently and a suitable new housing for two of them was found in the tropical hall of Zoo Duisburg, for the other two at the Zoological Garden of Paris.

As far as the authors are aware, there has not been any successful long-distance transport of animals this size in Europe and after a transport of one arapaima within the Netherlands ended with the animal drowning, it became clear that a different approach was needed.

A Brazilian arapaima farmer was contacted, who provided a manual on the husbandry and breeding, which also contained a chapter on transporting (Halverson, 2013). This chapter was used as a guide and through extensive correspondence with Halverson, the transport was adapted to the conditions present in Rotterdam Zoo. The following transport description first gives a summary of the factors of success, then describes the transports in detail and finally discusses safety concerns and air intake management.

## **Factors of success**

### **Pectoral fins**

The pectoral fins are the arapaima's most important fins during transport. They are used for balance and needed for an upwards motion of the body, the arapaima is not able to breathe if the pectoral fins are too constricted. Therefore, the transport tank needs to be wide enough for the animal to spread its pectoral fins. If the pectoral fins are constricted in water, the animal might roll to side or on its back with no way to right itself. It is therefore necessary for someone to hold the head of the arapaima above water, in the case of constriction of the pectoral fins, for example in the tube net.

### **Orientation during transport**

Transport bags need to be perpendicular to the direction of travel. This way, the water and animal move together and fewer waves can threaten to crash over the arapaima's mouth.

### **Moment of breath intake**

While moving the transport bag or moving the animal into water, waiting for a breath decreases the chance that it tries to take in air while in unfavorable circumstances (pectoral fins constricted, waves overhead, etc.)

## **Catching and loading**

The arapaimas were fasted for 5-7 days before the transport. On the day of loading, the water of the pool was lowered to about 60 cm water column. Six people in safety gear (as described

in section Safety Concerns) walked in a line toward an arapaima without startling it until the arapaima was parallel to a wall and fairly closed in. Two of these people managed the “puca”, a tube-like net with 70 cm diameter and an open backside, that is knotted with a rope. One was holding the net’s opening in a standard net holder, the other had the closed end to avoid entangling the net. When the animal’s direction became obvious, the puca was aimed in front of the arapaima and the puca’s end was thrown into the water to form a straight line in front of the arapaima. The moment the animal was in the puca, a designated person’s job was to grab the closed end and lift the head of the arapaima over water (Fig. 1).



**Fig. 1:** Arapaima caught in puca. Note: head is held above water at all times. Photo: T. Faust.

Afterwards, the fish in the puca was then moved into a stretcher with two poles left and right. It was then lifted above the water line and walked to the exit (Fig. 2).



**Fig. 2:** The arapaima is transferred into a stretcher while in the puca. The head is still held above water. Photo: T. Faust.

The catching team handed over the stretcher at the exit to the land team. The land team took over and placed the arapaima on a thick mattress with the stretcher being taut. At this stage, the knot closing the puca was opened. Then the whole stretcher was lifted into the TAP that was already filled with 45 cm of water. A TAP is a soft walled watertight transport tank made of reinforced PVC (Genatex 1100, Genap B. V.) and suspended in a metal frame (Fig. 3).



**Fig. 3:** The TAP is mounted in a metal frame. It is pre-filled to 45 cm of water. Measurements of the TAP are a length of 245 cm on the top, 200 cm at the bottom. Width and height of the Tap are 80 cm. The metal frame is 245 cm long and 90 cm high, with a width of 80 cm on the top and 120 cm at the bottom. Photo: R. Bernhard.



**Fig. 4:** The telehandler load lugger picks up the whole transport frame and moves it into the truck (middle of the picture). Photo: T. Faust.

When the arapaima was already in the water in the TAP, the puca was pulled out first. Then the bar on one side of the stretcher was pulled out and the stretcher was slowly pulled out from under the animal on the opposite side. From here a designated person's job was to observe the breathing of the arapaima. As soon as possible the transport frame was covered by a safety net and then by bubble foil while outside to protect from cold air. Through the net, more water was filled into the transport frame, while also taking out some, as arapaimas produce excessive mucus under stress, until the animal was able to fully submerge itself (between 50-62 cm). Water monitoring of the water before and after transport was attempted but came back mostly inconclusive as the mucus interfered with analysis techniques.

After the animal had taken a breath, the whole transport frame was moved outside via forklift and then moved by a telehandler load lugger into the truck (Fig. 4). Orientation of the TAP and arapaima needs to be perpendicular to the direction of travel; a limitation of arapaima transport is therefore the truck width (Fig. 5). The temperature-controlled truck was fully heated to 26°C. During the transport, a camera observed the arapaima.



**Fig. 5:** The transport frame is loaded perpendicular to the direction of travel to avoid waves crashing over the arapaima's head while taking in air. The truck's doors are opened as late as possible, as the truck was heated. Photo: T. Faust.

## Unloading

### At Duisburg

At Duisburg, the whole frame was moved out of the truck and into the tropical hall via pallet truck. Due to cold temperatures in April, we only waited for the arapaima to take in air after moving inside the tropical hall.

There the whole frame was lifted by a pre-installed crane above the water surface and continuously lowered. Lowering only started after the arapaima took in air. While lowering it into

the water it was filled by pump and hose from the top. It was important to keep the water level inside the bag higher than the outside level to keep the bag from collapsing inwards and constricting the fish (Fig. 6).



**Fig. 6:** The whole transport frame is lowered into the water. The green hose on the left fills the bag, so that the water level in the bag is higher than in the surrounding to keep the walls of the TAP from collapsing. Photo: Christian Schreiner, Zoo Duisburg.

From the moment the frame was fully submerged, we lowered it fast to allow the animal to get out of the bag towards the top. The arapaimas swam out and sank to the bottom where they rested. As long as the gills were moving and the eyes follow movement, there is no reason to worry or intervene. The arapaimas took the first breath after 26 and 36 minutes.

## At Paris

It was not possible to move the whole transport frame into the building or water. Therefore, the arapaima had to be taken out of the transport bag and returned into the stretcher. For this only one bar was kept in the stretcher and the side without the bar pushed under one side of the arapaima and pulled out on the other. Afterwards the bar was inserted in the bag's second side (Fig. 7). All people working on the transport bag wore safety gear (as mentioned in the section Safety concerns – Catching). The arapaima reacted with extreme thrashing but did not jump.

While carrying the arapaima in the stretcher through the building, a foam mattress was carried along in the event of an emergency where the stretcher had to be put on the ground (Fig. 8).

The stretcher had to be lowered in the pool by hand. A bridge in the middle of the manatee pool (submerged ca. 1,5 m) allowed people in safety gear to stand in the water and the stretcher with the arapaima was handed over from the land to six people in the water. Until in position, it was lowered as little as possible to keep the head above water and minimize thrashing around by the arapaima (Fig. 9). The stretcher was then moved to the middle of the pool and submerged quickly, while opening the front of the bag (Fig. 10).



**Fig. 7:** The arapaima had to be moved back into the stretcher. Staff in protective gear moved the one side of the stretcher under the fish and pulled it out on the other side. The bar to carry the stretcher with is already prepared. Note the arapaima's head bulging out the TAP. Photo: T. Faust.



**Fig. 8:** The arapaima is carried through the tropical hall in the stretcher. Staff close to the head is wearing protective gear. In the background a foam mattress is carried along. In case of emergency, the stretcher could theoretically be laid on the mattress. Photo: T. Faust.



**Fig. 9:** A submerged walkway approximately 1,5 m under the surface allowed staff to stand in the manatee pool. The group in protective gear was in the water and got handed the stretcher then. The edge of the pool is covered with a foam mattress to protect the underside of the arapaima. Photo: T. Faust.



**Fig. 10:** The stretcher was walked along the submerged walkway and then dropped under water and opened at the front. The arapaima swims out and sinks to the bottom. Photo: T. Faust.

The arapaimas also sank to the bottom of the pool, just as in Duisburg but showed gill movement and the eyes followed movement around. The arapaimas came up for the first breath at 6 and 10 minutes.

## Safety concerns

Safety of the staff involved needs to be taken seriously. Arapaimas of this size weigh up to 200kg and can move with explosive speed. If they are feeling threatened, they may jump considerable heights and distances. Therefore, they can cause severe injuries to the staff and to themselves. Staff involved in critical operations was wearing full sleeve neoprene suits, shoes and gloves. In addition to that they were fitted with protective gear borrowed from a hockey team, including helmets with visors, breastplate, lower body coverings and shin protectors as well as a neck brace. On top of that a padded life vest was worn and a first aid kit for diving emergencies was kept on hand as it was the most extensive kit available.

When unloading in Duisburg there were divers in the water in the event of the arapaima struggling to reach the surface. We would highly advise against that. Even an animal that unloaded calmly got startled suddenly and moved with immense speed but lacking orientation in the new surroundings. The chance of an unresponsive arapaima is low with this method, but the chances of a diver being hurt is disproportionately high.

## Air intake

The arapaimas always started moving around and getting restless about 30-60s before taking a breath. Do not disturb them after they have shown signs of restlessness. It is possible for an arapaima to expel air several times before taking new air in. Air intake has a distinct sound to it. Be sure that air was taken in before moving on to the next point of action. If air was only expelled the risk of an intake attempt while being submerged increases. The breathing frequency is very variable. After introduction in the tank the arapaimas took between 6 and 35 minutes until taking the first breath.

## Conclusion

With careful preparation and the right equipment, the transport of these animals is feasible.

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## Zusammenfassung

Da adulte *Arapaima* obligat Luft holen, können sie leicht ertrinken. Daher wurde bisher davon abgesehen ausgewachsene Tiere zu transportieren, es waren vor den hier beschriebenen keine erfolgreichen Transporte bekannt. Durch notwendige Baumaßnahmen wurde die Umsiedlung von vier *Arapaimas* notwendig. Hierfür wurde eine Transportmethode entwickelt, welche das sichere Fangen und den Transport nach Duisburg (220 km) und Paris (530 km) ermöglichte. Erfolg bringend waren vor allem das sofortige Anheben des Kopfes beim Fang, die Weite der Transporttasche und die Ausrichtung des Fisches während des Transports.

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