

Final Research Report to Rufford Small Grant

for Nature Conservation Project # 17.05.06

Ecology and Conservation Status of the Giant Fish *Arapaima gigas* in the Rupununi Wetlands of Guyana

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INTRODUCTION

The overall aim of this project was to begin collecting essential data on the biology and ecology of the *Arapaima* population in the Essequibo Basin (Guyana) in order to develop an effective management and conservation plan.

The *Arapaima* is one of the most important subsistence and commercial freshwater fishes in the Essequibo region and intense unmanaged exploitation has led to the near collapse of the population. *Arapaima* possesses several qualities that make it an excellent commercial species for Amazonian fishermen. They can grow up to 3 m in length and 200 kg in weight (they are the largest scaled freshwater fish species in South America); they can be easily captured by harpooning when they surface to breathe (they are obligate air-breathers); and the meat is boneless and constitutes up to fifty percent of the total body weight of the fish. These characteristics all contribute to over-exploitation and an ever increasing likelihood of regional extirpations.

The study is being conducted in south-western Guyana and encompasses the upper and middle reaches of the Essequibo River, and its tributaries the Rupununi and Rewa Rivers (approximately 3° N, 58° W). Within this system, *Arapaima* is known to occur in about 200 lakes and ponds.

OBJECTIVES OF RESEARCH

The specific objectives of this project was to: (i) determine the relative abundance of the *Arapaima* population in Guyana; (ii) determine the current age structure of the population using scales to estimate the age of individuals belonging to various size classes and then estimate growth and mortality; (iii) determine the extent of genetic and morphological variation between the Guyana and central Amazonian populations by analyzing DNA material and morphometric data and; (iv) build capacity in local fishing communities to assist with, and then take over, the *Arapaima* management activities.

FIELD AND LABORATORY ACTIVITIES

Estimating Population Abundance:

Arapaima is an obligate air-breather and it must surface every 15-20 minutes to breathe. Such physiological constraint offers a unique opportunity to obtain reliable counts of individuals. Ten of the most experienced fishermen from local communities who were previously trained by the Mamirauá Institute (Brazil) were selected for this project. Counting was conducted during the dry season (Jan-Feb) when *Arapaima* were concentrated in lakes following the method of Castello (2004): (1) each fisherman counted the number of individuals in an area of up to two hectares during a 20-minute period; (2) only *Arapaima* measuring more than 1 m were counted (size is estimated by looking at the dorsal region and/or by listening to distinctive sounds that they make when breathing); (3) counted individuals were classified as either juveniles (between 1 and 1.5 m total length), or adults (larger than 1.5 m total length). Several such counts were made in a lake to estimate total abundance and most of the lakes known to have *Arapaima* were surveyed. We counted a total of approximately 2600 individuals in the Essequibo Basin.

Determination of Age and Growth using Scales:

Arapaima individuals were captured with a seine (150 m x 5 m, 17 cm mesh size) pulled in lakes known to harbor *Arapaima*. Individuals were removed as soon as they became entangled in the seine, restrained, and measured for total length (± 5 cm). After measuring a sample of approximately 4-6 scales was taken from the scale row just above the pectoral fin base, cleaned and placed in a labelled Ziploc bag. Each fish was then released at the point of capture. To date we have collected scales samples from a total of 109 individuals which are currently being analysed in the Laboratory at SUNY-ESF to estimate age structure, growth rates and survivorship of the population. I hope to complete the scale analyses by the end of 2008.

Determining the extent of morphological and genetic differentiation between Guyana and central Amazonian *Arapaima* populations

To analyze possible differentiation between the Guyanese and central Amazonian *Arapaima* populations we are examining two lines of evidence – molecular and morphological. For morphological analyses, we took a standard set of morphometric measurements and meristic counts from 25 individuals belonging to several size classes. It is important to include several size classes in the sample to evaluate allometric changes with increasing body size. Digital photos were also taken for each collected specimen to record colour patterns and external morphology. We have completed preliminary statistical analyses of

the morphometric and meristic data from both the Guyanese and Brazilian populations. The results for these analyses indicate that *Arapaima* in the Essequibo Basin differs morphologically from *Arapaima* in the central Amazon. It does not belong to the species *Arapaima gigas*. This new finding prompted a re-examination of the species-level taxonomy of *Arapaima*. Since 1868, the genus *Arapaima* has been considered to have only one species, *A. gigas* (Schinz, in Cuvier 1822). In 1847, the French biologist Valenciennes recognized four species of *Arapaima*, but in 1868, the British ichthyologist Günther merged three of those species (*A. mapae*, *A. arapaima*, *A. agassizi*) with *A. gigas*. Günther (1868) did not provide any data to support the merging of these species but yet no one questioned his actions. A review of relevant literature from the early 1800's and examination of all existing type specimens for *Arapaima* revealed that all four of the species recognized by Valenciennes (in Cuvier and Valenciennes 1847) are valid.

For the molecular analyses we have collected DNA materials (muscle tissues and fin clippings) from a total of 51 individuals. We have so far sequenced Mitochondrial DNA for 14 individuals. We hope to complete sequencing the remaining samples by the end of the year.

Building Capacity in Local fishing Communities for *Arapaima* Management

All of the fishermen that were on the team were trained to take length and weight data, collect scale samples for age determination and preserve DNA materials. Meetings were held with local communities to inform them about the project and to discuss how the management process should proceed. At the end of our field work (Dec 2008) we will have a training session to train at least one representative from each village to analyse scales for age determination.

**L. CYNTHIA WATSON EXPENSE REPORT
RUFFORD SMALL GRANT FOR NATURE CONSERVATION
PROJECT NO: 17.05.06**

ITEM	DESCRIPTION	TOTAL-£Sterling
Subsistence	£5/da for 14 persons x35 da	2,450.00
Stipend-fishermen and boat captain	£5/da for 11 personsx35 da	1,925.00
Stipend-Research Assistant	£5/da for 1 personx35 da	175.00
Boat and engine rental and gasoline for boat	£325 for boat and £150 for gas	475.00
Misc research equipment/materials	ziploc bags, lab supplies for DNA analyses, vials, fishing hook and lines, batteries, waterproof notebooks,flashlights,etc	120.00
DNA analyses	DNA sequencing	112.00
TOTAL		5,257.00