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**MODDEC 04** International Workshop of Natural Products and Agro-Industrial Processes in Ecuadorian Amazon Region

## INFLUENCE OF WASTEWATER DISCHARGED FROM THE AMAZON STATE UNIVERSITY IN THE ICHTHYOLOGICAL DIVERSITY OF THE PUYO RIVER.

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### Graphical Abstract



### Abstract.

Influence of discharge from the State Amazon University (UEA) on the ichthyological diversity of the river Puyo, since Guevara & Ramos in 2018 stated that there is a 39% efficiency of the Wastewater Treatment Plant (PTAR) therefore several fish species are relegated from their habitat, for the determination of the study area the capture method was used by delimiting the discharge point of waste water as the starting area and the catches 1000 metres upwards, as well as 1000 metres downwards, by marking four sampling points in the above-mentioned areas, 30 minutes per sampling area were used using an atarraya to capture and photograph species within a 30-metre radius at the centre of the sampling points, 24 specimens from six families (*Anostomidae*, *Cichlidae*, *Curimatidae*, *Characidae*, *Heptapteridae* & *Loricaridae*), belonging to three orders (*Characiformes*, *Perciformes* & *Siluriformes*) where the predominant family is Loricariidae with 17 individuals, in the lower part is recorded a higher rate of orders versus the upper part in which two orders of the three obtained in total of the study are recorded.

## Keywords

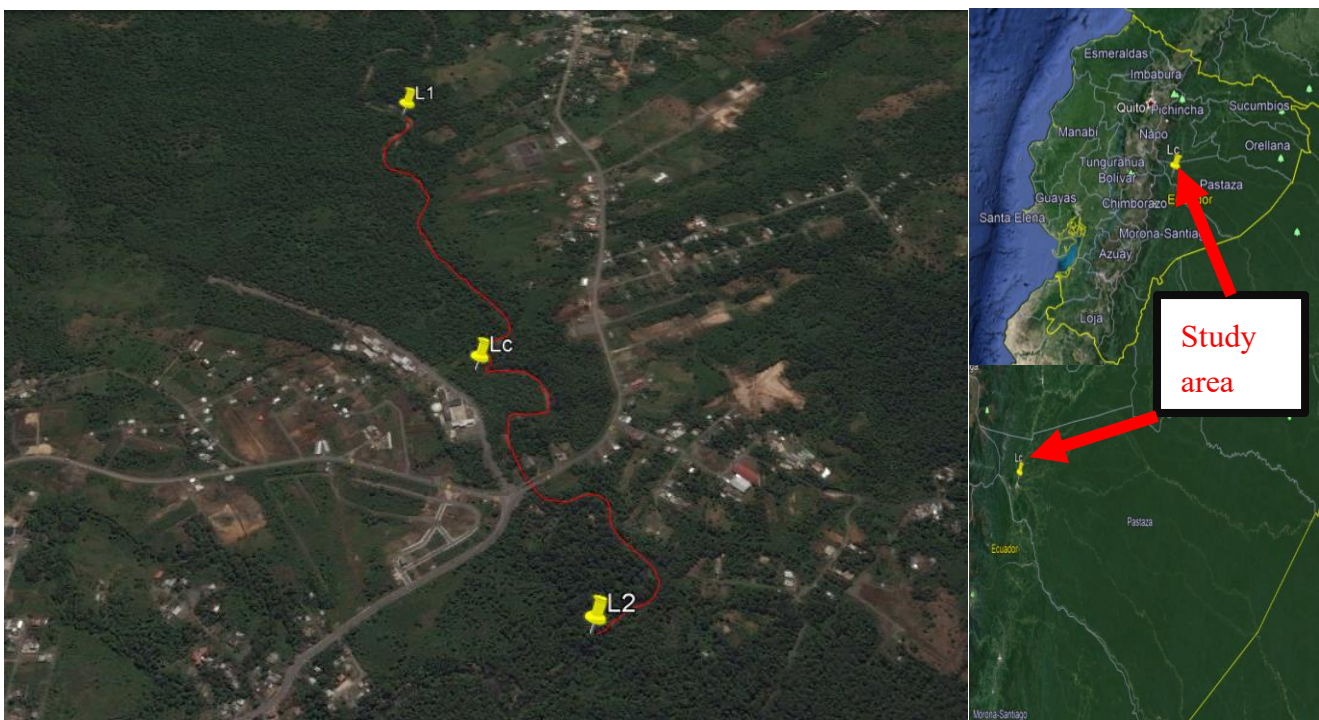
Ichthyology , order, specimens, siluriformes

## Introduction

Wastewater disposed in a surface current without any treatment causes serious inconvenience of pollution that affects the flora and fauna of the ecosystem. This wastewater, before being discharged into the receiving masses, must receive adequate treatment, capable of modifying their physical, chemical and microbiological conditions. The Amazon State University (UEA) has a wastewater treatment plant (PTAR) that is discharging treated water to a receiving body that flows into the Puyo River, which is used recreationally by national and foreign tourists (Guevara & Ramos, 2018). According to Guevara and Ramos, a total efficiency of the WWTP - UEA of 39% of which 69% corresponds to physical parameters and 31% chemical - biological parameters was determined. The Eastern region includes the Upper Amazon, with four zones and 125 species (Barriga, 2012). Within the characteristics of the ichthyographic areas of the high Amazon, Alto Pastaza (AP) limits the north with the Puyo River and the south the Tuna Chiguaza River with a wealth of 35 species (Barriga, 2012). In this area the water temperature varies between 18°C and 22°C.

## Materials and Methods

**Study area.** - The sampling was carried out in the province of Pastaza, Pastaza canton, Puyo parish on the northeast margin of the city, on the Puyo river, in an ecosystem of evergreen Piemontane forest of the Northern Cordillera Oriental of the Andes, in a total length of 2000 meters taking as a central point the downloads made by the UEA, in the following UTM coordinates, L1 thousand meters to the east (18M 166251 9838632 to 947 masl), Lc center of the sampling area (18M 166506 9837708 to 939 masl), L2 one thousand meters to the west (18M 166769 9837036 at 936 meters above sea level).



**Figure 1:** Study area where L1 is the east limit, Lc shows the center limit of the area and the area of wastewater discharges and L2.

**Field work.** - For the sampling, four sampling points were marked in the study area on each side of the discharge at 250, 500, 750 and 1000 meters respectively, 30 minutes of fishing with anchors were estimated within a radius of 30 meters taking as center the marked sampling points, the art of fishing with ataraya consists of a circular net with weights at the banks and a rope to be able to pull it from the center (Lambarri Martinez & Espinoza Perez, 2019), this art is used in shallow waters and visible, this network can be used by a single person and they are thrown with a special technique from the banks of the body of water. The work team was made up of four students of the UEA's biology degree, two people were fishing and the rest of the team was in charge of photographing and taking measurements of the specimens, once the measurement was made, the specimens were returned to the River.



**Figure 2:** Sampling points, Lc: point of discharge of wastewater. P1S: point one on the discharge at 500 meters of Lc. P2S: point two on the discharge at 1000 meters of Lc. P3S: point three on the discharge at 250 meters of Lc. P4S: point four on the discharge at 750 meters of Lc. P1B: Point one under the discharge at 500 meters of Lc. P2B: point two under the discharge at 1000 meters of Lc. P3B: point three under the discharge at 250 meters of Lc. P4B: point four under the discharge at 750 meters of Lc. Green circumference: fishing area with a radius of 30 meters at each sampling point.

**ID.** - For the identification of the specimens, we compare the photographs obtained in the field work with fish guides and work done in rivers and nearby areas with similar characteristics to the study area, in some cases we use dichotomous keys to arrive at the description of the families and minimize identification work. The guides used were: COMMON FISHES OF THE ALTO RIO NAPO, ECUADOR, 2014. Authors: Anaguano Fernando & Cueva Rubén. ICTIOFAUNA DE LOS RÍOS ZUÑAG AND ANZU IN THE ECOLOGICAL CORRIDORS OF LOS LLANGATOS - SANGAY, PROVINCES OF PASTAZA AND TUNGURAHUA, ECUADOR, 2017. Authors: Fidel E. Rodríguez-Galarza, Jonathan Valdiviezo-Rivera, Juan P. Reyes-Puig, Danilo J Yáñez -Cajo. FISH OF CUENCA PASTAZA ECUADOR, 2010. Author: Rivadeneira Juan Francisco. & GUÍA PACES DE LIMONCOCHA, 2012. Authors: Rivera Jonathan, Carrillo Carolina, Madero Roberto, Albarracín Marco.

## Results and Discussion

The fish caught at the end of the estimated time of three days amounted to a total of 24 individuals that in this area are recognized by the following common names; carachamas, catfish, sardines, chutis.

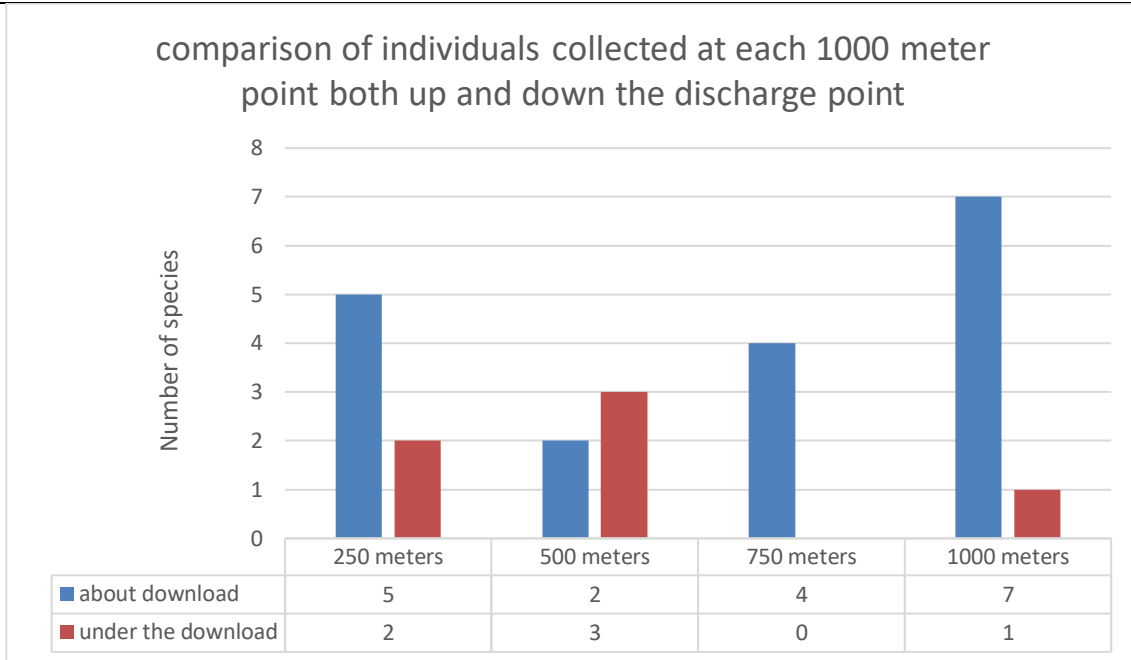
After a meticulous research work with various local fish guides and with third party advice, it was concluded that the total number of fish caught for the study belonged to three different orders. Mostly it was possible to reach the genus and species, but there was a case in which it was only possible to reach the family of the specimen. The collection was carried out 1000 meters up and 1000 meters down from the point of wastewater discharge, of those 1000 were divided into four points; at 250 meters, 500 meters, 750 meters and 1000 meters respectively. At 250 meters above the discharge, 4 *Chaetostoma microps* and a *Curimatide* sp. At 500 meters above the discharge, a *Creagrutus kunturus* and a *Chaetostoma microps* were captured. At 750 meters above the discharge, three *Chaetostoma microps* and one *Pimelodella lateristriga* were captured. At 1000 meters above the discharge we capture 6 *Chaetostoma microps* and a short *Chaetostoma*. As for the 1000 meters down the discharge point; 250 meters below the discharge, a *Chaetostoma microps* and a *Curimatide* sp. At 500 meters below the discharge, a *Pimelodella lateristriga*, a *Phenacogaster pectinatus* and a *Crenicichla anthurus* were captured. At 750 meters the discharge no specimen was obtained and at 1000 meters below the discharge a *Chaetostoma microps* was captured. Two of the three days used to collect the river presented above normal levels in its usual flow due to the constant rains that precipitate over the city of Puyo. In these days of the water flow above normal there was more incidence in the capture of fish both at 1000 meters above the discharge and at 1000 meters below the discharge of the Puyo River. Apart from the university's sewage discharges, another focus of discharge other than that of the research was evidenced but was not taken into account for this study.

**Table 1** Total number of individuals collected and total orders, families, genera and species identified

<b>N° total of individuals</b>	<b>N° total orders</b>	<b>N° total families</b>	<b>N° total gender</b>	<b>N° total species</b>
<b>24</b>	3	6	5	6

**Table 2** Number of families, genera and species for each order

<b>Orders</b>	<b>Families</b>	<b>Genders</b>	<b>Species</b>
<i>Characiformes</i>	3	2	2
<i>Perciformes</i>	1	1	1
<i>Siluriformes</i>	2	2	3



**Grafico 1** Representation of the diversity of species collected on the discharge as well as under the discharge in the Puyo River

	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Characiformes</u>	<u>Anostomidae</u>	<u>Phenacogaster</u>	<u>Pectinatus</u>
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Perciformes</u>	<u>Cichlidae</u>	<u>Crenicichla</u>	<u>anthurus</u>
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Characiformes</u>	<u>Curimatidae</u>		
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Characiformes</u>	<u>Characidae</u>	<u>Creagrutus</u>	<u>kunturus</u>
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Siluriformes</u>	<u>Heptapteridae</u>	<u>pimelodella</u>	<u>lateristriga</u>
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Siluriformes</u>	<u>Loricariidae</u>	<u>chaetostoma</u>	<u>microps</u>
	<u>Order</u>	<u>Family</u>	<u>Gender</u>	<u>Species</u>
	<u>Siluriformes</u>	<u>Loricariidae</u>	<u>chaetostoma</u>	<u>breve</u>

**Image 1** Species identified with the detailed information of order, family, genus and species to which they belong

## Conclusions

- The methodology that the project applied gave very good results because it was a participatory methodology. In a short time, tangible achievements could be obtained.
- In the 750 meters under the discharge, the expected results were not obtained, since the tributary of the river was high due to the heavy rains present in the area.
- An Environmental Management Plan will allow generating an action to at least mitigate and the environmental impacts detected, in this way the river continues to maintain its natural conditions and does not lose its scenario.
- Perform water analysis at least semiannual, since polluting sources (UEA effluent discharges) have been observed with Bioindicators, physical, chemical and microbiological analysis, to keep the Puyo River acceptable for the various species that exist in the River Puyo.
- Control the dumping of solid waste and liquid discharges of the constructions carried out at the university in the riverbed, by means of ordinances that allow mitigating the impacts to such an important tourist sector of the city.
- When efficient wastewater treatment systems are not available, the main factor affected is the water resource, both in its quality and in its use, because the discharges discarded by the university are directly discharged into the Puyo River, when performing this action Other factors such as flora, fauna, soil, downstream of the discharge are affected.

## References

- RodríguezGalarza, F., Valdiviezo, J., Reyes, J., & Yáñez, D. (2017). Ictiofauna de los ríos Zuñag y Anzu en el. *Boletín Técnico 13*, 12-13: 33-52.
- Anaguano, F., & Cueva, R. (2014). *Peces comunes del alto río Napo, Ecuador*. Quito .
- Barriga, R. (2012). LISTA DE PECES DE AGUA DULCE E INTERMAREALES DEL ECUADOR. *Revista politècnica*, 83-119. Obtenido de BIBDIGITAL EPN: <http://bibdigital.epn.edu.ec/handle/15000/5068>
- Carrillo, C., Madero, R., Albarracín, M., & Valdiviezo, J. (2012). *Guía de peces Limoncocha*. Quito : Universidades Internacional SEK.
- Guevara, D., & Ramos, T. (3 de Diciembre de 2018). *EVALUACIÓN DEL FUNCIONAMIENTO DE LA PLANTA DE TRATAMIENTO DE AGUAS RESIDUALES DE LA UNIVERSIDAD ESTATAL AMAZÓNICA*. Obtenido de academia.edu: [https://www.academia.edu/37068170/EVALUACION\\_DEL\\_FUNCIONAMIENTO\\_DE\\_LA\\_PLANTA\\_DE\\_TRATAMIENTO\\_DE\\_AGUAS\\_RESIDUALES\\_DE\\_LA\\_UEA](https://www.academia.edu/37068170/EVALUACION_DEL_FUNCIONAMIENTO_DE_LA_PLANTA_DE_TRATAMIENTO_DE_AGUAS_RESIDUALES_DE_LA_UEA)
- Lambarri Martinez, C., & Espinoza Perez, H. (3 de 11 de 2019). [www.ictiologia.ib.unam.mx](http://www.ictiologia.ib.unam.mx). Obtenido de [www.ictiologia.ib.unam.mx](http://www.ictiologia.ib.unam.mx): <http://www.ictiologia.ib.unam.mx/Manual.pdf>
- Ministerio del Ambiente de Ecuador . (2013). Sistema de Clasificación de los Ecosistemas del. En M. d. Ecuador, *Sistema de Clasificación de los Ecosistemas del* (pág. 108). Quito.
- Rivadeneira, J. (2010). *Peces de la cuenca del Pastaza, Ecuador*. Quito : Publiasesores . Obtenido de [www.academia.edu](http://www.academia.edu).

