

# Using different levels of biological organization as indication of effects on fish fauna caused by pesticides exposure in a rain forest reserve, Brazil

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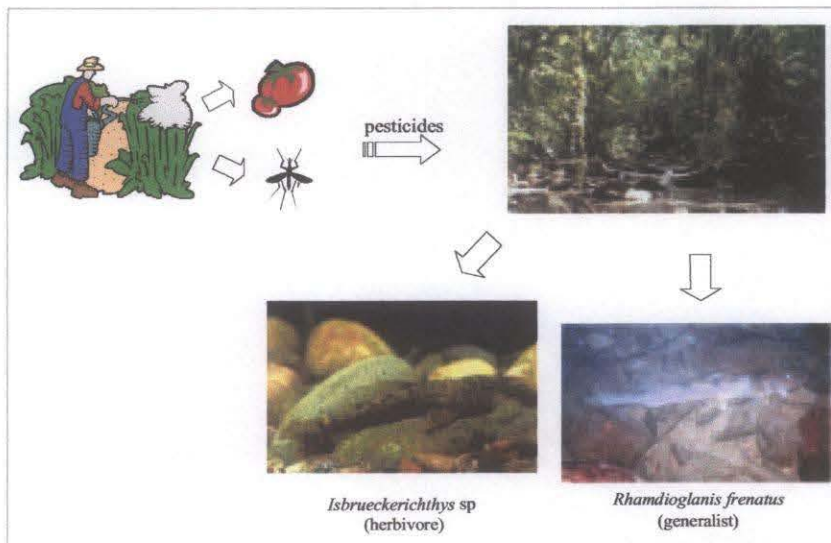
## Abstract

Pesticides are applied inside and in the vicinity of a rain forest reserve in Brazil to control agricultural pests and disease vectors. The objective of this study was to identify possible effects on fish fauna due to exposure to pesticides using enzymatic, organismic and community indicators of effects. The three main rivers that cross the park and some of their tributaries were surveyed. Pesticides and metabolites were detected at all sites either in water, sediment or fish tissue samples. Several of the measured values were higher than their threshold in some of the streams. The preliminary results show detectable changes in condition factor, fish biomass and fish community trophic structure at some sites that may be related to pesticide exposure.

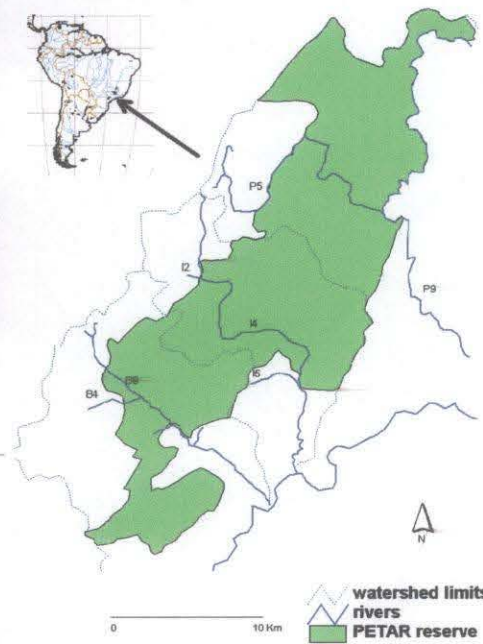
## Introduction

The *Parque Estadual Turístico do Alto Ribeira* (PETAR) is one of the preserved areas of Atlantic rain forest in Brazil. Most of the families in the area survive on subsistence agriculture and some cultivate, among other crops, tomato, which requires high amounts of pesticides. Insecticides are also periodically applied near settlements by the health authorities to control populations of disease vectors.

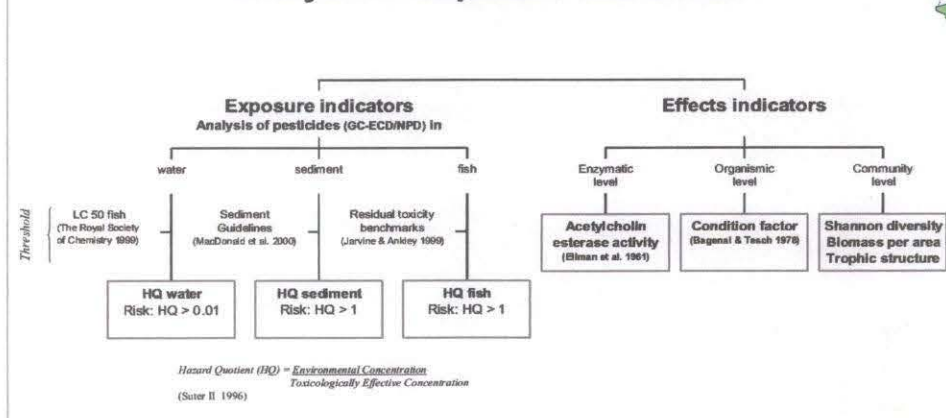
The **objective** of this study was to identify possible effects on fish fauna due to exposure to pesticides using different levels of biological organization. The **assessment endpoint** was the fish community with focus on two species of benthic catfishes (Fam Siluriforms).



## Study area and sample sites



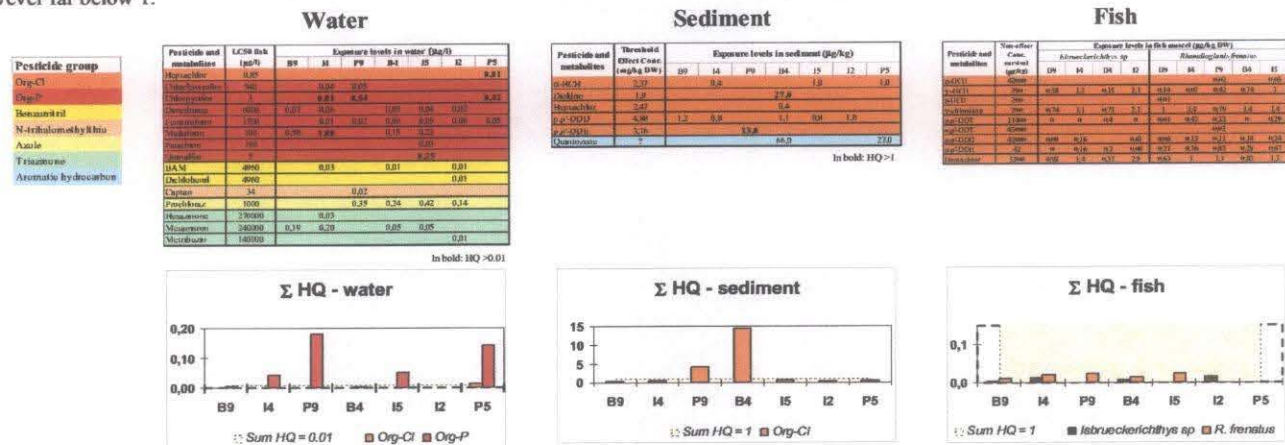
## Analysis of exposure and effects



# Results and discussion

## Exposure levels and hazard quotient

Pesticides and degradation products were detected in samples from all examined sites. Cumulative hazard quotient higher than 0.01 were found in water samples from P9, P5, and I5 (organophosphate, Org-Ps) and higher than 1 for sediment samples from B4 and P9 (organochlorine, org-Cls). Org-Ps pesticides and metabolites were found in fish muscles from all survey sites. Sum of fish burdens hazard quotient for both species were however far below 1.



## Effects on enzymatic level

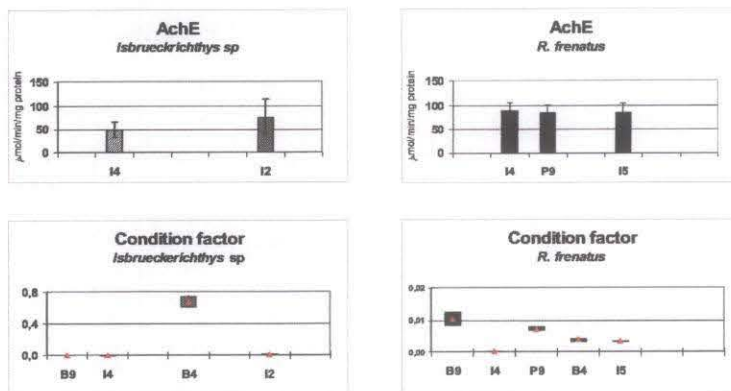
There was no significant depletion of AchE activity among samples of the same species.

## Effects on organismic level

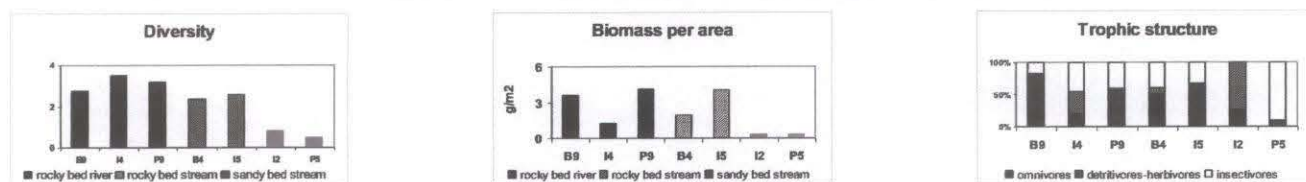
Condition factor of *Isbrueckerichthys sp* from B4 and *R. frenatus* from B9 were significantly higher than the values calculated for the same species from other sites ( $P > 0.01$ ).

## Effects on community level

A lower percentage of detritivorous-omnivorous and a higher percentage of omnivores were observed in B4 when compared to another similar stream (I5).



Sampled fish biomass was lower in I4 and B4 when compared to similar streams (respectively B9 and P9; and I5). Fish diversity was alike among comparable streams which can be a result of pesticide contamination, but can also be due to lead, cadmium and zinc exposure which is known to be of concern at least for the site B4. Lower diversity and fish biomass observed in I2 and P5 are probably due to riverbed conditions.



Limitations on the analysis methods (low recoveries in the samples in GC), and sampling procedures (reduced temporal and spatial coverage for both exposure and effects characterization) must be taken into consideration and measured values should be considered only as indications of pesticide contamination and effects in PETAR streams.

## Conclusion

- ✓ Pesticides were found in all surveyed streams, even in sites previously considered non-exposed by the park administration and local community.
- ✓ Some of the measured values were higher than their threshold concentration, which may cause reduction on fish survival and growth. Preliminary results show detectable changes in condition factor and community biomass at some sites that may be influenced by pesticide exposure. Further analyses are needed to corroborate the cause-effect relationship.

## References

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