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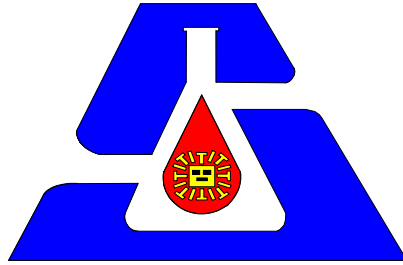
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# Mercury exposure and lifestyle of native Amerindian communities living along the Beni River

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*ICMGP 2009, Guizhou, Guiyang China June 7<sup>th</sup> to June 12<sup>th</sup> 1*

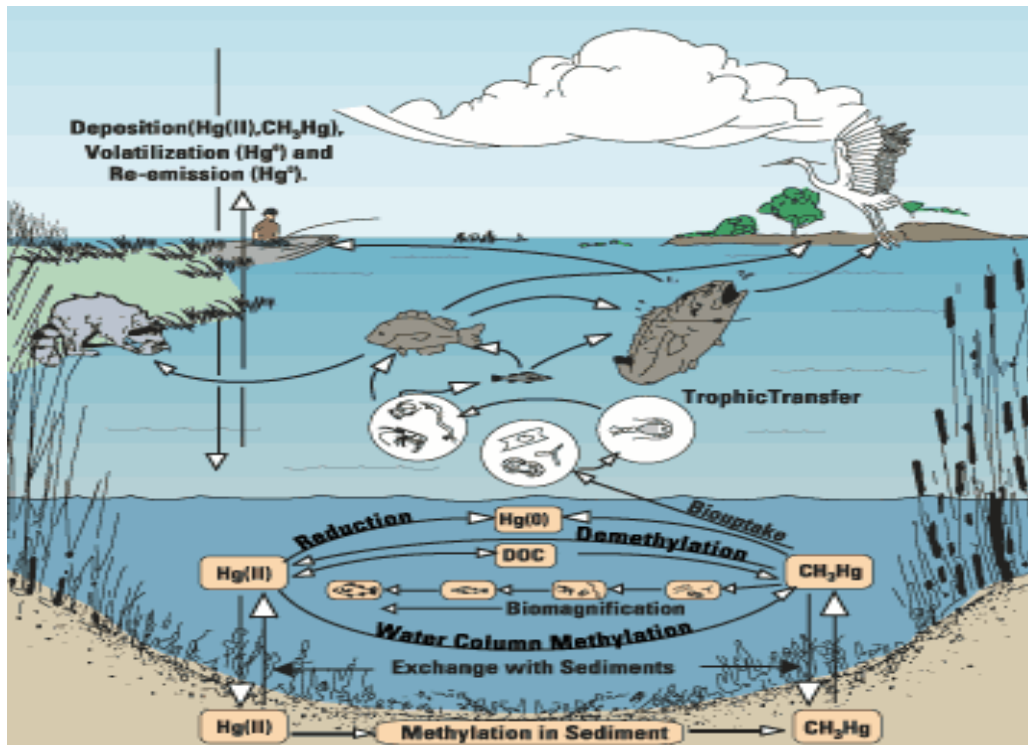
# Context: Gold mining activity in the foot hill of the Andes

According to L Maurice Bourgoïn (2000):

- Extraction of 5 ~10 kg gold/month
  - Use of 250 ~ 500 kg / year of mercury
  - 50 ~ 70 % released into the environment



# Background: communities contaminated through fish ingestion



Bio concentration along the aquatic food chain

# Objectives of the study

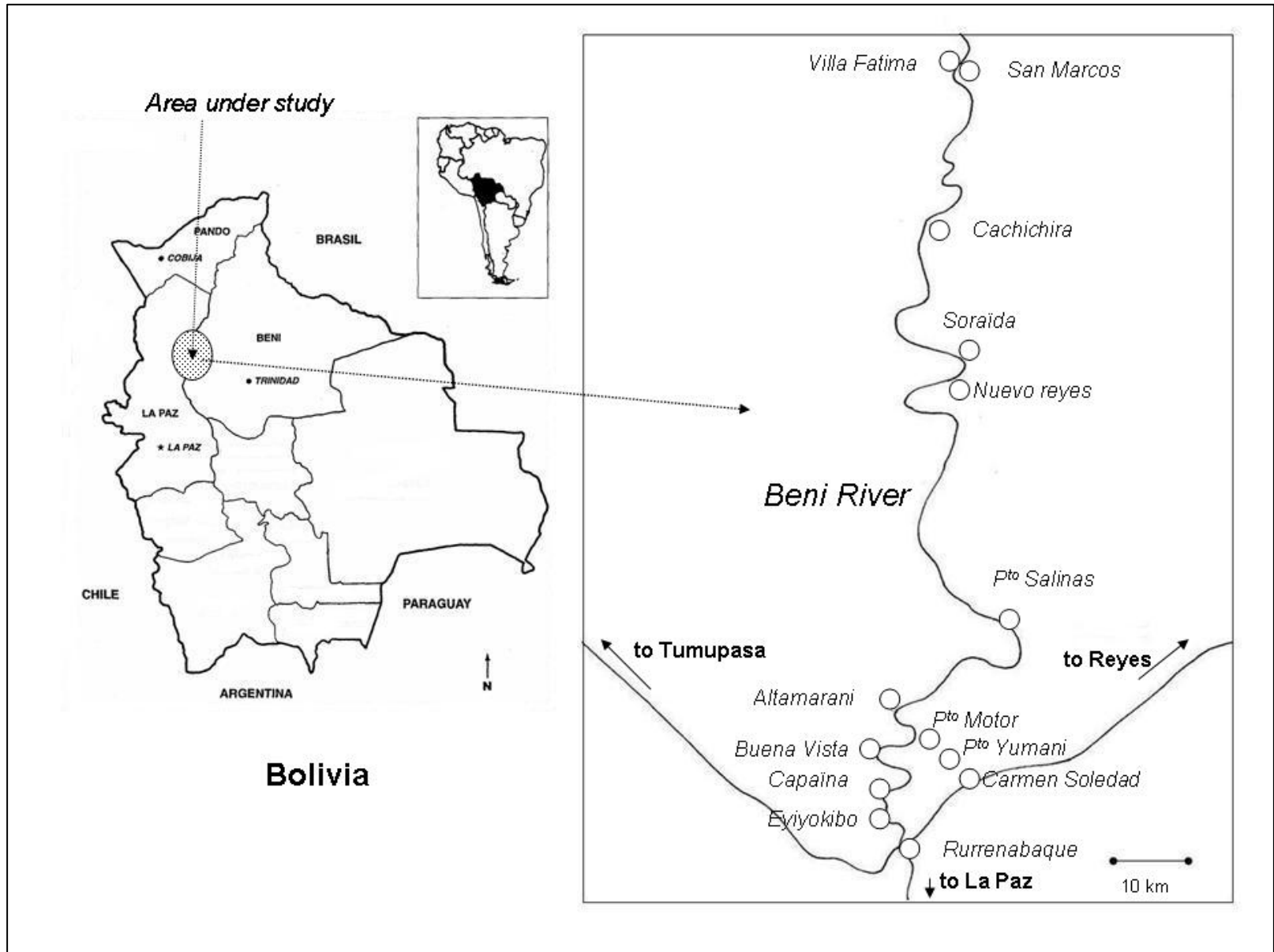
- To document mercury contamination in riverside communities
- To examine associated risk factors risk factors  
(importance of fish consumption)
- To analyze possible interaction with the nutritional status of that communities



# Study context



# Study area



# Subjects and sampling



- Study area: Beni flood plain
- 14000 inhabitants
  - 4000 along the riverside
- 173 mothers and 458 children (<15 yo)
- Ethical clearance



# Field procedures



- Informed consent
- Dietary survey



Clinical examination



Anthropometry



Iron deficiency anemia



Parasitological examination



Hair strand cut 8

# Mercury content analysis

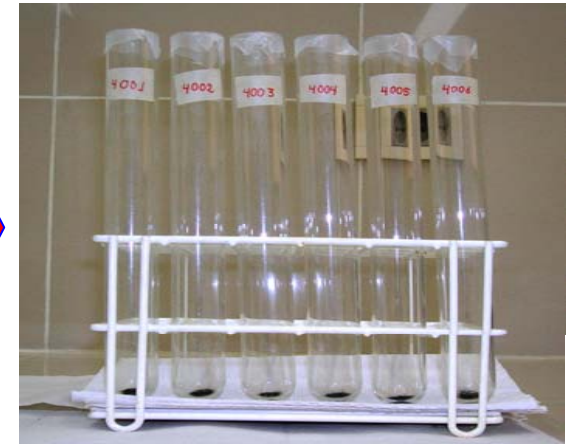
Rinsing: EDTA 0,01%  
and H<sub>2</sub>O Milli Q



Weighing



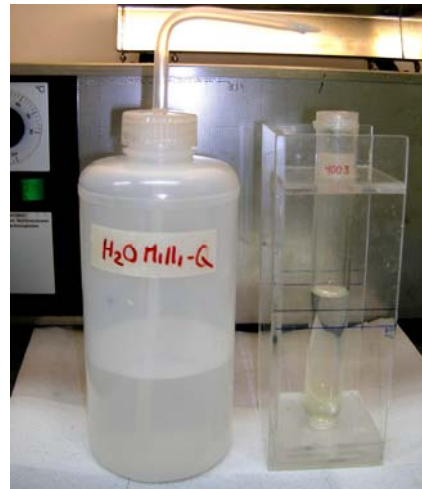
Mineralization



Measurement with atomic absorption  
spectrometry (PERKIN ELMER 3110)



End of digestion



Digestion



# Results

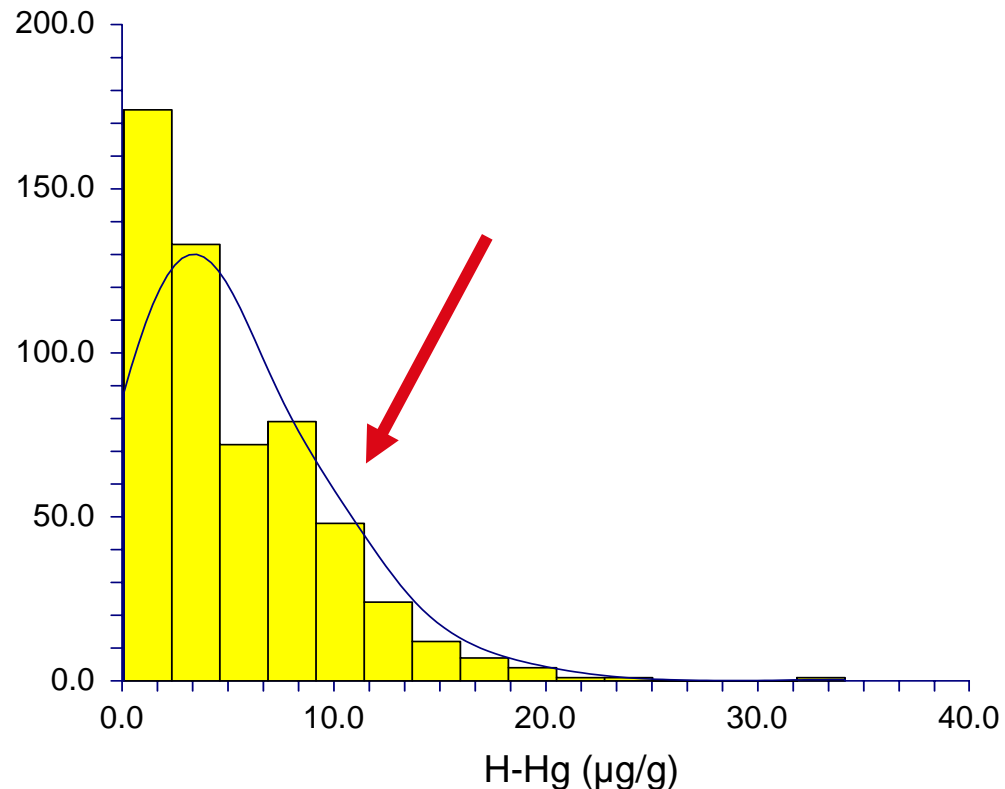
# Health characteristics: general

- 70% of mothers gave birth without medical assistance
- High mortality rate
- Anemia prevalence (women): 42 %
- Chronic malnutrition (preschoolers): 41%
- Intestinal parasitism (children): 85%
- Acute infections: 30%

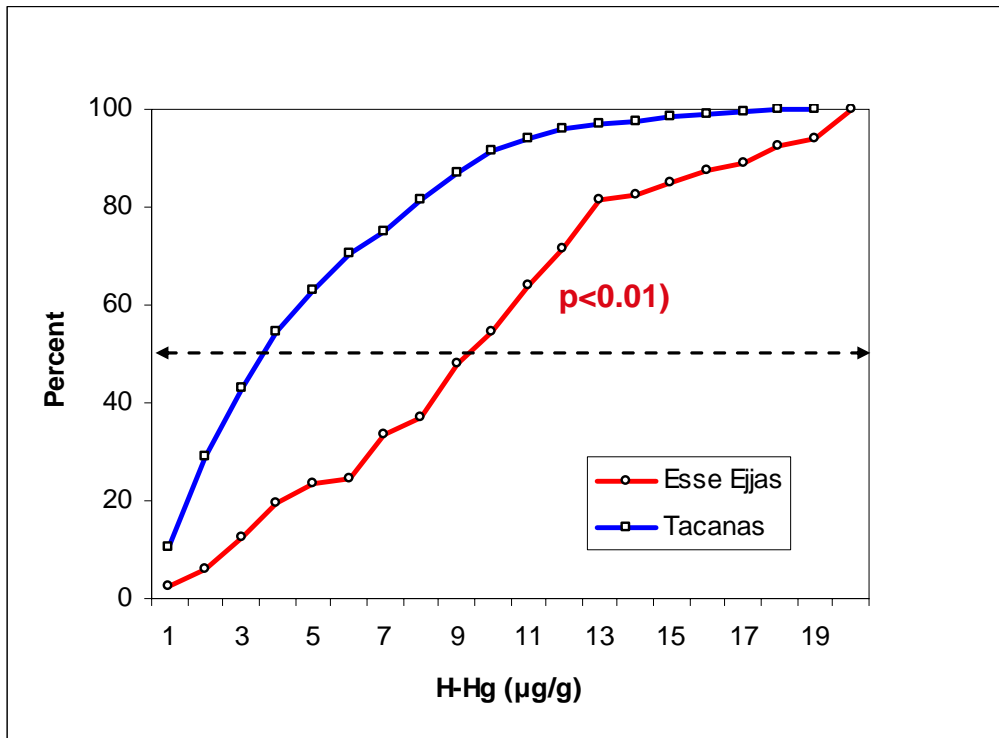


# Hair mercury content H-Hg ( $\mu\text{g/g}$ )

Group	Median (IC <sub>95%</sub> )
Overall sample (n=556)	4.0 (3.6 ~4.4)
Children (n=393)	3.9 (3.4 ~4.4)
Mothers (n=163)	4.4 (3.5 ~5.4)
Pregnant (n=18)	3.3 (1.3 ~3.9)
Lactating (n=57)	5.5 (4.4 ~6.4)
Non-pregnant non-lactating women (n=93)	4.1 (3.0 ~5.4)



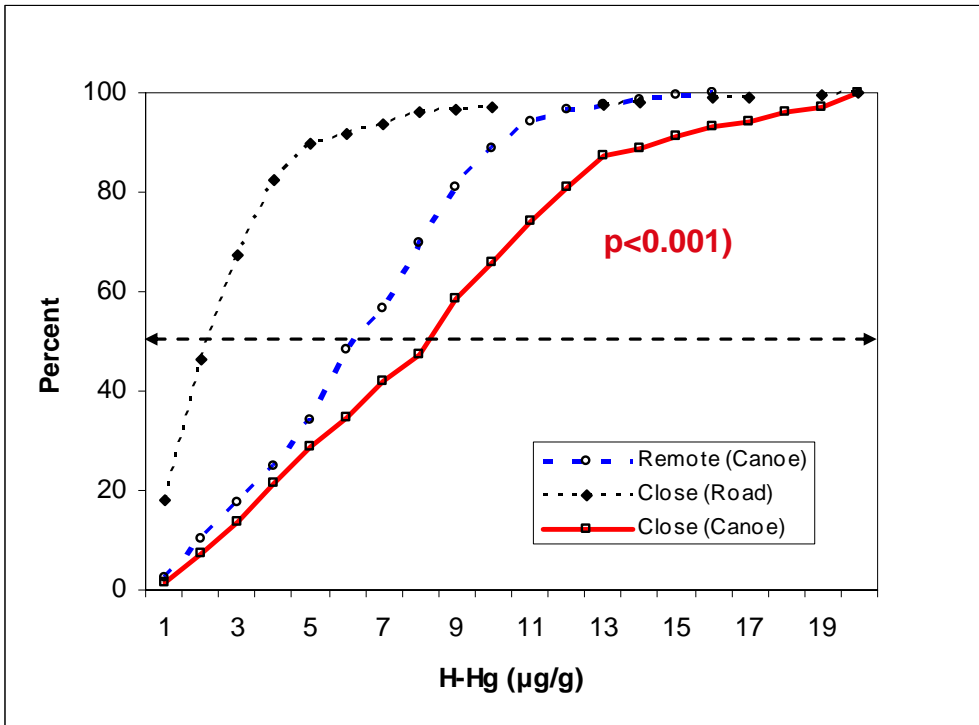
# H-Hg and community characteristics (1)



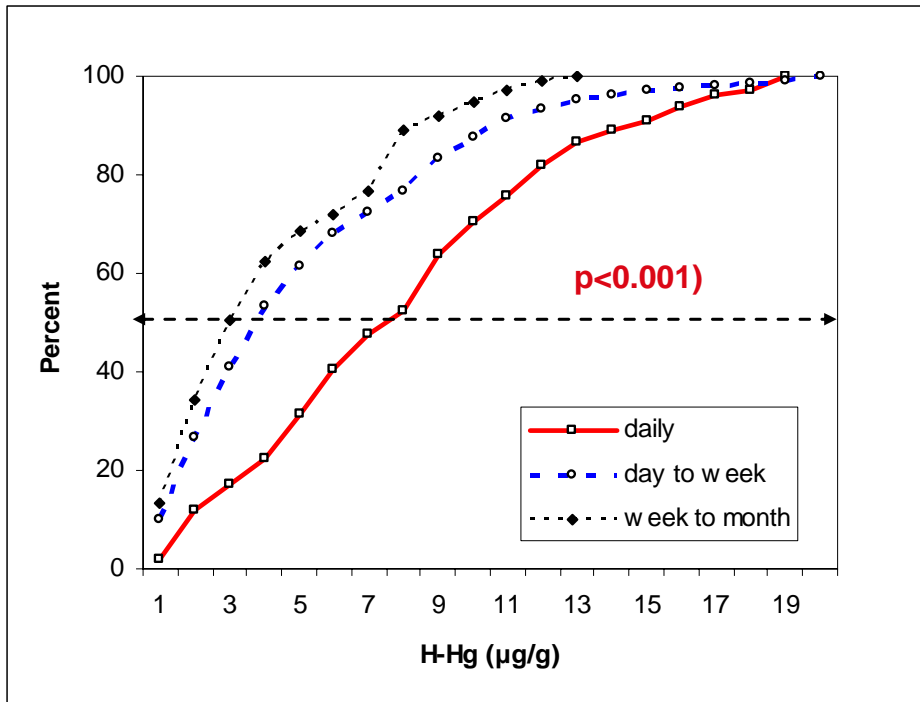
**Cumulative distribution of H-Hg according to ethnicity**



# H-Hg and community characteristics (2)



# H-Hg and community characteristics (3)

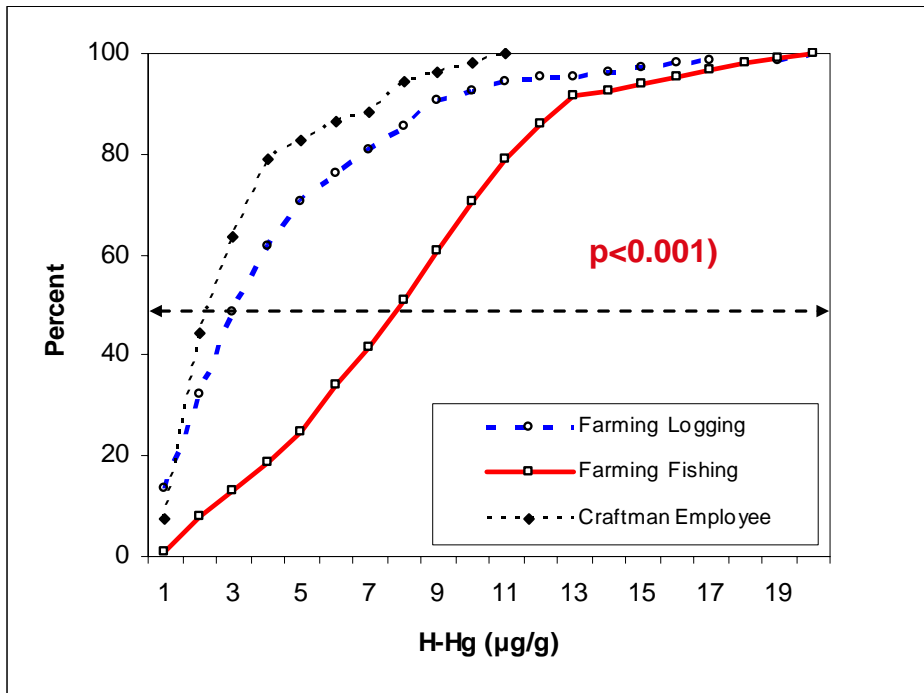


**Cumulative distribution of H-Hg according to fish consumption**





# H-Hg and community characteristics (4)



**Cumulative distribution of H-Hg according to economic activity**



# Multivariate analysis

- Village accessibility
  - Fish consumption
- } ***Significant predictive effect***

- Ethnicity
  - Subsistence activity
- } ***No significant effect***

***Significant interactions between:***

- ***Accessibility \* Fish consumption***
- ***Subsistence \* Fish consumption***

# Nature of fish consumed

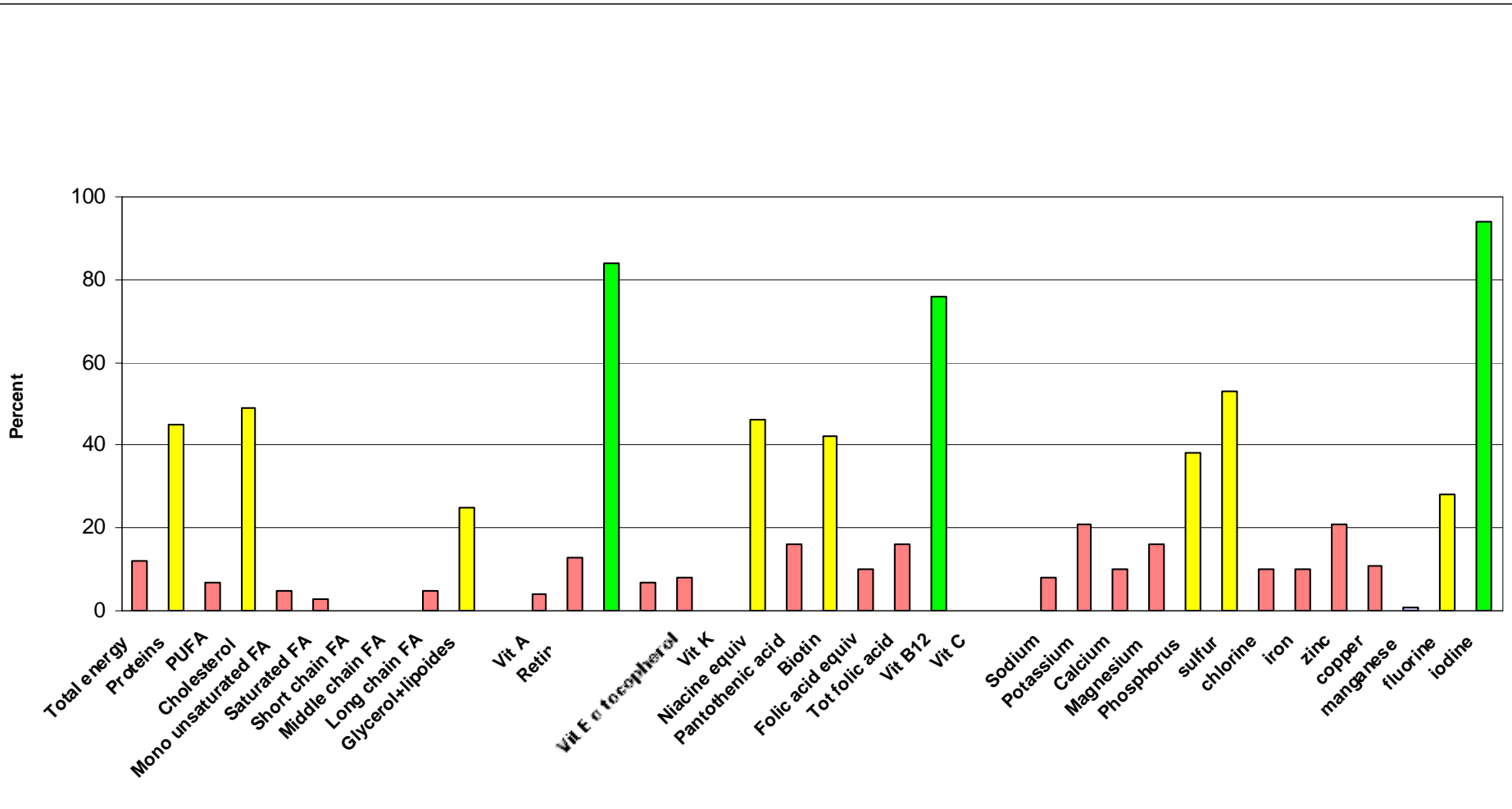
Scientific name	Common name	Feeding Behavior	Consumption (%)
<i>Prochilodus nigricans</i>	Sábalo	herbivorous	43.5
<i>Leiarius marcocatus</i>	Tujuno	piscivorous	11.7
<i>Colossoma brachypomum</i>	Pacú		9.1
<i>Pseudoplatystoma fasciatum</i>	Pintado		9.1
<i>Astronotus ocellatus</i> o <i>Pygocentrus nattereni</i>	Palometa	carnivorous	6.4
<i>Schizodon fasciatum</i>	Ruta		3.9
<i>Plagioscion squamosissimus</i>	Curbina		3.9
<i>Mylossoma duriventre</i>	Jatara		2.6
<i>Brachyplatystoma filamentosum</i>	Dorado		1.9
<i>Hoplias malabaricus</i>	Benton		1.9
<i>Pimelodus maculatus blochii</i>	Griso	omnivorous	1.3
<i>Serubim lima</i>	Tahuaya		1.2
<i>Hoplerythrinus unitaeniatus</i>	Yayu		0.7
<i>Brycom s.p.</i>	Mamuri		0.7
<i>Tripottheus sp</i> o <i>Markiana nigripinis</i>	Sardina		0.7
<i>Serrasalmus spp</i>	Piraña		0.7
<i>Pseudoplatystoma tigrinum</i>	Surubí		0.7

# Fish consumed

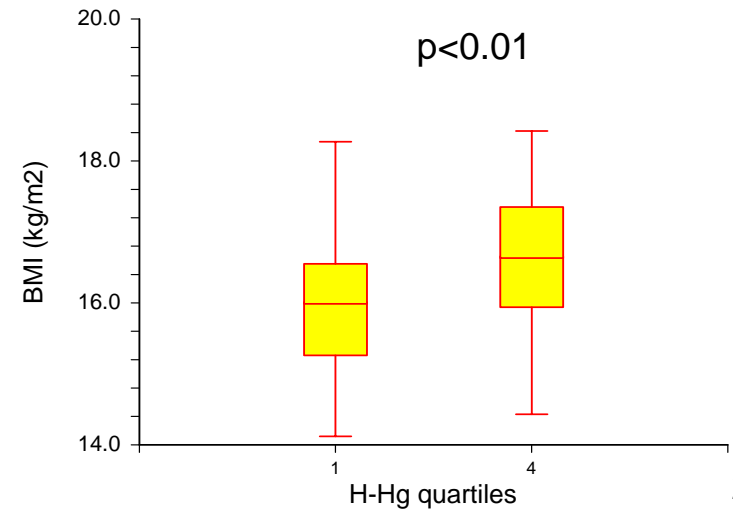
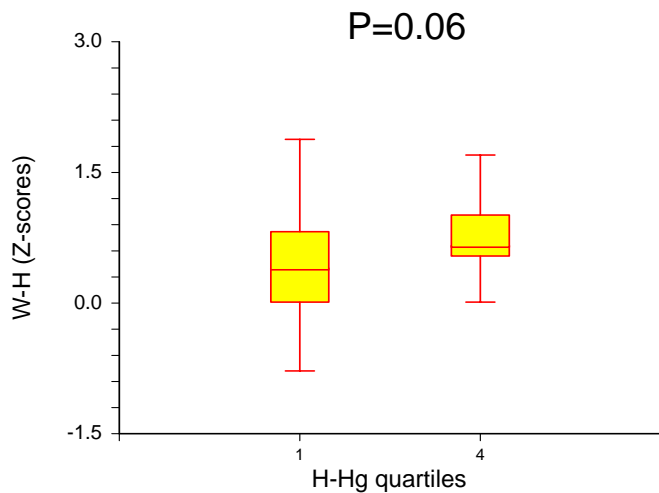
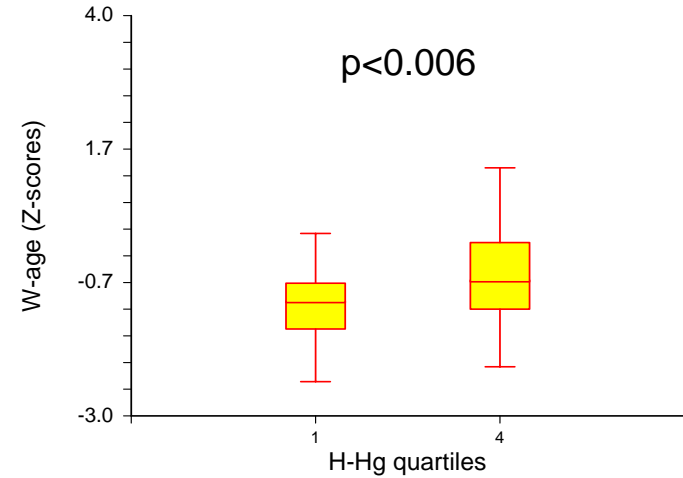
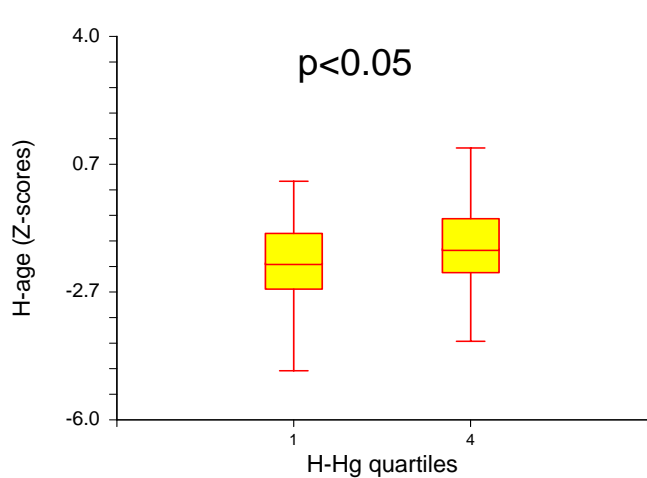
- 63% herbivorous and omnivorous
- 37% piscivorous and carnivorous
- No differences between ethnic groups but
- **Remote communities consumed significantly more carnivorous fish than the others**



# Nutritional importance of fish: percent of energy and nutrients provided by fish



# Relationships between H-Hg and anthropometric indices in 5-10-year-old children



# Conclusions

# 1) Mercury exposure

- H-Hg seems relatively low by comparison with other Amazonian areas (ex Tapajos basin): 86% of subjects < 10 µg/g
- But greater exposure of “traditional” and more vulnerable groups of population
  - Isolated
  - Less access to health and schooling facilities
  - Higher consumption of contaminated fish



## 2) Fish consumption

- Important for the nutritional balance of the diet
  - Macro nutrients (proteins) vitamins and micronutrients (iodine, sulfur...)
- Isolated groups consumed more carnivorous (i.e. Hg contaminated) fish than the others

# 3) Nutritional status

- H-Hg acts as a bio-indicator of fish consumption
- Positive effect on nutritional indices of school age children
  - Fish consumption is the intermediate link
- Public health: Does the advantage of a fish based diet overcome the risk of Hg poisoning?

# Recommendations

- Mercury will not disappear and will continue to bio accumulate unless severe law enforcement is applied
- Fish consumption is very important for certain groups of population
- Advice aiming at reducing consumption of harmful fish should be cautious
- A regular assessment of the Hg content of the most frequently consumed species is required

# Acknowledgements

- To the riverside communities of the Beni River
- To Carlos for his constant devotion to the team
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