

# Ethnozoological Knowledge about Aquatic Mammals in Public Schools: Proposals for an Intercultural Teaching of Science

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## ABSTRACT

This study assessed the knowledge, feelings, and life experiences of students in public middle schools in the Brazilian Amazon toward aquatic mammals by applying semi-structured interviews, with a qualitative-quantitative approach. A total of 241 students, from all genders, aged between 12 and 14 years old, from four public schools of Pará State were interviewed. The data were transcribed and analyzed in an inductive way, in dialog with the literature of scientific education and ethnozoology. This methodology was developed and validated during the doctorate research of the first author of this paper. The students showed a rich knowledge, feelings, and life experiences regarding the Amazonian aquatic mammals, those related to biological, morphological, behavioral, ecological, and taxonomic aspects, as well as the threat to these species. The research reveals the need for schools of the region to develop and use didactic resources and strategies for intercultural dialogue in science classes, favoring the development of reflective attitudes in students and promoting decision-making favorable to the conservation of aquatic mammals.

**KEY WORDS:** Aquatic mammals; ethnozoology; intercultural dialog; scientific education

## INTRODUCTION

The interactions of local populations in Brazil with cetaceans – that involve natural and supernatural aspects (e.g., commercial, handicraft, food, and imaginaries) – are important to establish the status of those species' conservation (Alves et al., 2010). The vast number of relations between the humankind, their cultures, and the living world, are frequently approached by the ethnobiology, an academic research field about the biological knowledge and the conceptualization developed by any society and its culture (Posey, 1997). As a branch of ethnobiology, ethnozoology studies the knowledge, meanings, and uses of animals into human societies and their cultures (Alves and Souto, 2010).

Alves et al. (2010) revealed that the interactions of human beings, their cultures and aquatic mammals are greatly attractive throughout Brazil. Although, specifically into the Amazonian, the relevant existence of *Boto Folk Tale* that tells the transformation of those animals (boto or Amazon River dolphin) into a man, which during the nights wears white clothes and seduces lonely women, convincing them to take a walk near to the riverbanks; impregnating them immediately; and becoming a dolphin again the following day. A result of this folk tale, it has attributed to the boto any child with incognito father (Alves and Rosa, 2008).

This tale has created interactions of another magnitude, putting on risk the life of those animals and likely creating a conservation problem. To Rodrigues and Silva (2012), this fact is worrisome, damaging the ecological relationships in the ecosystem where those animals are present. There is, therefore, an urgent need for detailed studies regarding locals' perceptions and boto conservation.

Studies on the knowledge and practices of local populations of northern of Brazil are yet insufficient, if considering realities local schools (Razera et al., 2006). Specially, if compared with ethnozoological studies conducted in schools in other regions of the country (Vargas-Clavijo and Baptista, 2014). According with Almeida (2014), basic level students construct their knowledge about the animals from the interactions that people of their communities establish with the representing species of the surrounding fauna. This information is extremely important to scientific education, which finds on the dialogue an opportunity to enlarge the cultural knowledge of the students.

Intercultural dialog in science teaching has varied advantages because it allows, in addition to addressing scientific concepts and contents, to make questions about the cultural conception of the organisms. That opens the possibility to discuss about the attitudes (positive or negative) that the population could have toward these animals, also fostering the possibility to introduce into the traditional ecological and behavioral knowledge

(Gallois and Reyes-Garcia, 2018). A culturally appropriate scientific education values and considers how different societies, from different cultures, understand the natural world, and what are the possibilities to relate this knowledge with the science teaching process; within the current school contexts, which are markedly multicultural spaces, characterized by an incredible richness of knowledge, worldviews, and ways of see the natural world (Van den Boog et al., 2017).

In the science education process, the classrooms were seen, for a long time, as homogeneous spaces, and so with only one culture represented in there: The scientific culture, embodied by the teacher (Cobern, 1996). Science can be thought of as a culture, socially, and historically constituted, that involves a set of theories and practices, as well as activities, ideas, habits, norms, and values that are shared by the scientific community (Aikenhead, 2009). The principal issue pointed out here is that science culture (represented by the teacher) ends up overcoming the student's culture. According with Southerland (2000), the issue, when referring to the teaching of science and the cultural diversity, is not the representation of scientific culture by teachers: In the end, teaching science is teaching scientific knowledge, but it is problematic to privilege a vision of epistemological superiority of science over other systems of knowledge. Local knowledge cannot be represented despite being present in the classrooms, since, in most cases, they are lessened by the school culture and teaching itself, by silencing the voices of the students (Robles-Piñeros et al., 2018).

Students bring a set of cultural meanings to the classroom and, as such, these spaces gather different worldviews that can greatly contribute to the processes that involve teaching and learning itself (Baptista, 2010). In this sense, if science teaching presents only the scientific view about nature, that is, the science as a superior epistemology and therefore to be considered as the only way of knowing, ignoring students' previous knowledge (Southerland, 2000).

This knowledge is not necessarily derived from school education but may also come from systems of knowledge other than Western science (El-Hani and Mortimer, 2007). Given this it is possible to find both, scientific and non-scientific knowledge, within the conceptions of the students. Traditional knowledge or local knowledge can be cited as an example of non-scientific knowledge, which are generated and transmitted based on cultural interaction with nature (Baptista, 2010).

In seeking to investigate and understand the cultural knowledge of students, establishing relationships among them, teachers will be promoting the intercultural dialog into the classroom, giving spaces for the enlargement of students' knowledge with scientific ideas and concepts. Banks (2009) defined it as being able to travel between these two worlds, that of their own knowledge and cultural baggage and that of scientific knowledge, its own cultural knowledge and, so that they can scientifically empower themselves and make choices in which scientific knowledge can be used at times when convenient or appropriate. In other words, teaching based on intercultural dialog and the enlargement

of knowledge, makes students informed and able to make convenient choices about their own cultural context. It helps the students to understand the diversity of forms of knowledge built by humanity, including scientific knowledge, which may form part of their cognitive structure (Cobern and Loving, 2001). This certainly constitutes an intercultural scientific education that respects the cultural differences and promotes tolerance and peaceful coexistence in the classrooms.

We understand that school, as former of opinions and attitudes, can contribute enormously into reflection and awareness of people, intervening effectively in the actions inside their communities; specially, when they could generate irreversible damage to natural environments and their organisms. The school as a space formed by cultural differences constitutes excellent opportunities to negotiate and mediate between different understandings about the nature and the scope of scientific knowledge (Meyer and Crawford, 2011). Culture is not static, it is modified, enriched, in a permanent process along time, as the result of people's decisions, by random or by needs. To Geertz (1989) the concept of culture is in essential semiotic, then "... *man is an animal*" (p. 15).

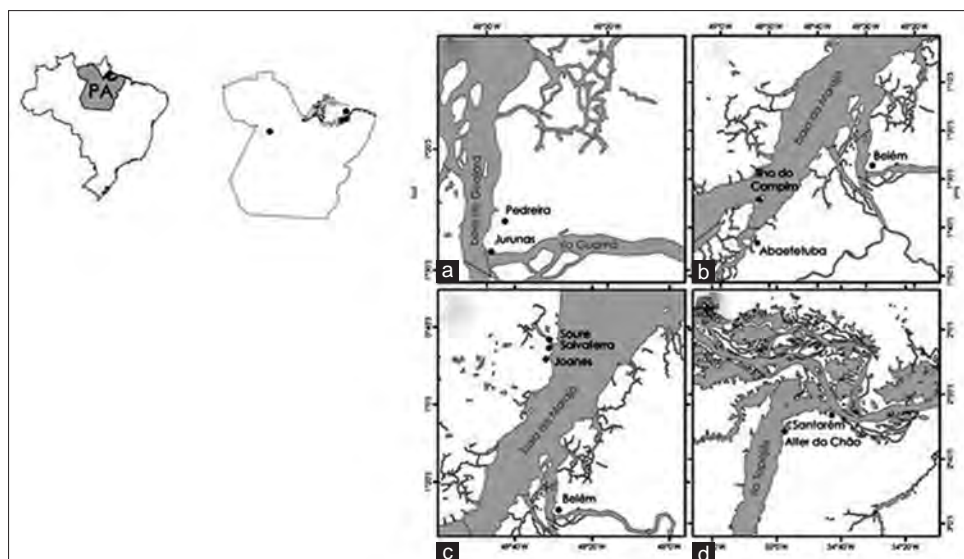
The study was carried out to identify the students' knowledge, feelings, and practices about the aquatic mammal species from Pará State (Eastern Amazon), to propose an alternative to scientific intercultural education into the schools, aiming the conservation of those species. The following research questions guided the study: What etnozoological knowledge do students have about aquatic animals in different localities in Pará State? How are aquatic animals classified by topography? What are students' feelings toward Amazonian River dolphins?

We hope that the present research will be a contribution to promote studies about this thematic in Brazil, and, in the same way in other countries with similar realities. We aim to contribute to the conservation of aquatic mammal species starting from the insertion of this topic into the classrooms.

## METHODS

The research occurred between 2010 and 2014, as part of the doctorate research of the first author of this paper. A total of 241 students, from all genders, and belonging to rural areas of Abaetetuba (Low Tocantins River), Joanes (Marajó Island), Vila de Alter-do-Chão (Lower Tapajós River) and metropolitan area of Belém (Figure 1) constituted the sample for the study. They volunteered to collaborate with the research after the previous parents', teachers, or school director consent, in case of under 18 age students. The principal reason to choose these study areas was the confirmation of occurrence of aquatic mammals from systematic monitoring, developed by researchers and undergraduate students, specialists on this faunistic group that began in middle of 2005.

The students of 7<sup>th</sup> and 8<sup>th</sup> grades of middle school (between 12 and 14 years old) from Capim Island (Abaetetuba in the low river of Tocantins), and Vila de Joanes (Marajó Island), and



**Figure 1:** Study area map, (a) Metropolitan Region of Belém, State capital, (b) Capim Island, Aboetetuba; (c) Vila de Joanes, Salvaterra, Marajó Island, (d) Vila de Alter-do-Chão, Santarém

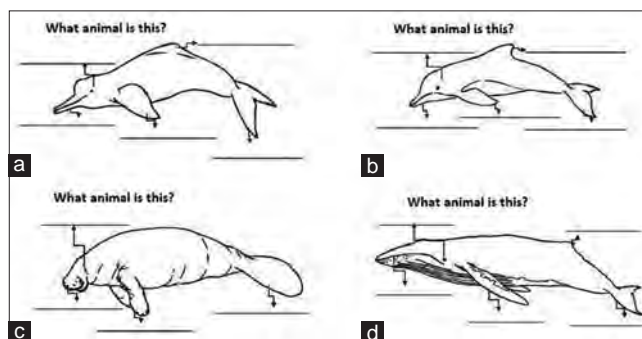
the metropolitan area of Belem and Vila de Alter-do-Chao in Santarém, participated on semi-structured interviews.

Before the interviews, students received explanations about the study and its objectives. The consent terms were signed by the students and their parents. They were scheduled with date and time to organize the visits on their homes. If the guardian could not authorize participation, the school director signed a document formalizing the authorization to carry on the research with the student inside school installations.

It was applied a protocol containing questions about specimens belonging to the orders: (1) Cetartiodactyla (Cetacea): represented by the boto (*Inia* sp.), the Guiana dolphin and tucuxi (*Sotalia* sp.), humpback whales (*Megaptera novaeangliae*), and (2) Sirenia: Represented by the manatee (*Trichechus* sp.). All chosen species have confirmed occurrence in Amazonian rivers and estuaries, likely observed by communities in the region. The students had to choose one of the animals presented to them through images (Figure 2) and, accordingly, they answered the questions about ecology and natural history of species.

The images served to identify the body structures of the animals, also the morphological parts that compose it, according to the methodology proposed by Souto (2004). This methodology consists of making a register of vernacular terminology, which different communities used to denominate various parts of the body of the animals, a phenomenon known as body topography (Figure 2).

The responses were recorded and transcribed. To maintain data integrity, the interviews were qualitatively and quantitatively processed into a grid in SPSS Statistics software. To present the results, we created categories according to the theme of the answers then we calculated the frequency of citations of each category per question. The objective was to verify the particularities of the responses focused on each species of



**Figure 2:** Set of images for choice and description. (a) Boto (*Inia* sp.); (b) Guiana dolphin and Tucuxi (*Sotalia* sp.); (c) Manatee (*Trichechus* sp.); and (d) Humpback whales (*Megaptera novaeangliae*)

aquatic mammal. We selected questions with the aim to propose alternatives to science teaching and promote intercultural dialogue and species conservation in the region's schools, through the description of the local ethnozoological knowledge.

## RESULTS AND DISCUSSION

The students own a rich baggage of knowledge and practices about the Amazonian aquatic mammal. This phenomenon is product of their cultural life-experience and could suffer variations depending on species and locality. These knowledge and practices are related, with biological, morphological, behavioral, ecological, treat-suffering, and taxonomical aspects. The principal ethno-species indicated by students were boto (*Inia* sp.), manatee (*Trichechus* sp.), Guiana dolphin and tucuxi (*Sotalia* sp.), and humpback whales (*Megaptera novaeangliae*). Students tends to refer to these animals, due to constantly watching in media about run aground on the beaches and rivers, of both, adults, and offspring.

Answers related to boto, and aquatic ecosystems exposed that students' have their family as main font of information. The

exception was Belém, was mass media and internet searching of knowledge by themselves (students learned for themselves).

In the case of manatee and the humpback whale, most students highlight the mass media as their source of information, except the students from Capim Island who learned about those animals by cultural heritage, generation by generation. The lack of electrical energy or internet in places like that hampers the access to mass media like TV or streaming services. Research on Traditional Ecological Knowledge (TEK) of young and old hunters, about ecology of beluga (*Delphinapterus leucas*) pointed convergence spots of knowledge and addition of other knowledge systems about this species but is important to have in mind that this TEK have been threatened of disappear due to being restrict to older people (Mymrin et al., 1999). The significant importance of families in the knowledge heritage process, on an educational and cultural viewpoint, avoids the restriction of this knowledge to the older people, letting disappear. It gives spaces to the knowledge, and guarantee of valorization into school education, allowing a more expressive performance between the students. Our study corroborates, with ethnozoological research made by Razera et al. (2006) with Tupinamba indigenous students from Bahia State, where most students learn about animals through their relatives.

### Biological Aspects

In places where families survive from the fishing resources, there is high citation of river dolphins due to proximity of these species and fishing activities (Beltran Pedreros and Felgueiras-Henriques, 2010; Loch et al, 2009). Indeed, families of interviewees from Capim Island, Joanes and Alter do Chão (44%) predominantly live off fisheries. They showed a most detailed knowledge on behavior, food items consumed by dolphins, whales, and manatees, in addition to the threats to the conservation of these species (Table 1).

A more thorough description of those species is likely due to students' interactions and observations with these animals while helping their relatives and friends in the craft fishing or during times that they are swimming and playing in the rivers, where they have the chance to see animals in swimming or stranded (Canto, 2007).

Almeida (2014) coincides with our studies illustrating students from urban areas of the Amapá state that tend to be unaware of certain species of wildlife at the expense of the very disappearance or scarcity of wild animal populations in urban areas. This fact can help to natural science and/or biology class into the schools of the region, when teachers can scientifically address problems that threaten wild species by establishing interactions with students' traditional knowledge.

In the case of aquatic mammals, and due to during informal talking with science teachers, they reported that this topic is rarely approached, leaving to be treated for other knowledge areas such as Portuguese language and History. Which refer to dolphins only because of their symbolic and cultural value, and thus suppress the ecological role of these animals in nature. Another consideration is due to the fact of those animals inhabit the aquatic environment, and for this reason they are almost unseen into the natural environment due to the turbidity of river water near to Belém. The term "boto" have a polysemic issue between students, which may refer to both, marine, and freshwater species. Likewise, it may involve natural as well as supernatural aspects, referring to the entity that assumes both, the representation of the animal and the legend, which tells the story of the pink-dolphin that on party night turns into a man who seduces women, takes them to the bottom of the river where those women get pregnant.

### Morphological Aspects

Depending on the signaled anatomical part on the topographic tables, the students assigned several names, and being able to

**Table 1: Ethnozoological knowledge of students about aquatic mammals from different localities into the Pará State, Brazil**

Locality/Grades	Ethnospecie	Aspect	Citation
Capim (8 <sup>th</sup> grade - Elementary School)	Manatee (Peixe-boi)	Sighting/feeding	"When I was putting the matapi [Handcrafted traps building with the palm jupati ( <i>Raphia vinifer</i> ) to catch shrimp], I saw a peixe-boi [manatee] eating the stalk from aninga ( <i>Montrichardia sp-Aracea</i> )"
Capim (8 <sup>th</sup> grade - Elementary School)	Manatee (Peixe-boi)	Behavioral	"It's inoffensive, does not cause bad, when it sees somebody, it flees"
Capim (8 <sup>th</sup> grade - Elementary School)	Pink Dolphin (Boto-malhado)	Morphological/ Behavioral and Magical-religious	"It's big, black, and just keep whistling" "My grandfather told me the tale of the girls that were over a cone, and the botos pass under them. The girl who was menstruating went to the bottom and in the next day she was white and without blood"
Alter do Chão (7 <sup>th</sup> grade - Elementary School)	Pink Dolphin (Boto-rosa)	Feeling	"The boto it's an animal that I don't like. I feel that it's a destroyer of the malhadeira [Fishing net used by the anglers], because they rip the nets"
Joanes (7 <sup>th</sup> grade - Elementary School)	Tucuxi (Boto Cuxi)	General	"I saw boto out of water. They go in-group. We find died boto in the nets. There are fights between pink and grey dolphin. They have male and female, they are mammals, because the cub sucks. They suffer with the garbage, petroleum oil and pollution"
Joanes (7 <sup>th</sup> grade - Elementary School)	Humpback Whale (Jubarte)	Conservation	"Men kill them, sell the fins and the meat"

**Table 2: Corporal topography of aquatic mammals related with the classification of public school's students**

Species	Morphological part	Place			
		Belém	Capim	Joanes	Alter do Chão
<i>Inia</i> sp.	Eye	Eye (94%)	Eye (96%)	Eye (70%)	Eye (98%)
	Dorsal fin	Fin (49%)	Didn't know (29%)	Fin (20%)	Fin (58%)
	Caudal fin	Tail (86%)	Tail (50%)	Tail (44%)	Tail (52%)
	Pectoral fin	Fin (88%)	Fin (27%)	Fin (54%)	Fin (68%)
	Face	Mouth (74%)	Mouth (54%)	Mouth (58%)	Beak (56%)
<i>Sotalia</i> sp.	Eye	Eye (98%)	Eye (96%)	Eye (83%)	Eye (100%)
	Dorsal fin	Fin (51%)	Didn't know (30%)	Tail (21%)	Fin (70%)
	Caudal fin	Tail (88%)	Tail (50%)	Tail (44%)	Tail (53%)
	Pectoral fin	Fin (83%)	Paddle (30%)	Fin (54%)	Fin (68%)
	Face	Mouth (76%)	Beak (50%)	Mouth (54%)	Beak (60%)
<i>Trichechus</i> sp.	Eye	Eye (95%)	Eye (92%)	Eye (81%)	Eye (100%)
	Caudal fin	Tail (84%)	Tail (44%)	Tail (50%)	Tail (55%)
	Pectoral fin	Fin (65%)	Fin (29%)	Fin (52%)	Fin (62%)
	Mouth	Nose (51%)	Nose (40%)	Nose (41%)	Mouth (46%)
<i>Megaptera noveangliae</i>	Eye	Eye (95%)	Eye (83%)	Eye (91%)	Eye (98%)
	Dorsal fin	Fin (53%)	Didn't know (42%)	Others (38%)	Fin (65%)
	Caudal fin	Tail (86%)	Tail (39%)	Tail (46%)	Tail (50%)
	Pectoral fin	Fin (84%)	Fin (35%)	Fin (61%)	Fin (70%)
	Face	Mouth (87%)	Mouth (83%)	Mouth (91%)	Mouth (84%)

find variations for the same member or organ and variations by locality (Table 2).

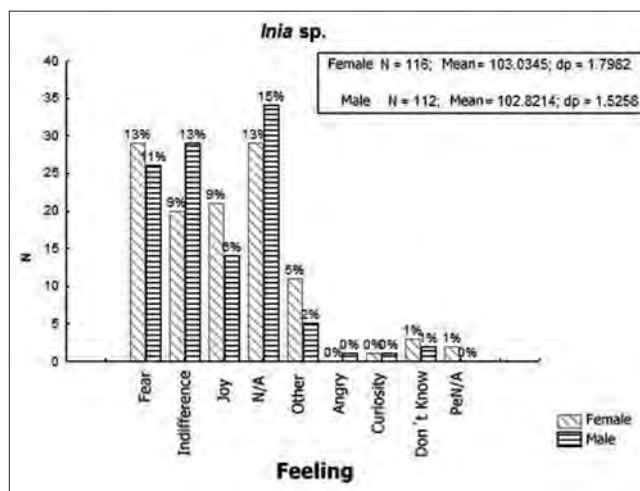
The terms most used by students for each segment of the body of aquatic mammals (gray outlined for the most frequent). Concerning to the eyes was used: Eye and head for all species; for dorsal fin: Fin and shoreline; in cases of caudal fin: Tail; and for oral region, beak (cetaceans), muzzle (manatee), and mouth (Table 2).

The students easily recognized the parts of the body of animals and used the same synonymies of classification of anatomical parts of fish to refer to cetacean fins, since it is common for them to refer to botos and whales as “special fish” because their cub suck. Souto (2004) discusses three general patterns of body topography: polynomial, which is the application of more than one name to the same body structure; attributed functionality, which refers to the assignment of functions to structures; and the coding of anthropomorphic analogy, which demonstrates the strong influence of terms of human morphology in the designation of parts of animals.

### Behavioral Aspects

In the issue of feelings attributed to Amazon River dolphin, we grouped the students' responses into three categories: Positive (joy, curiosity, and feather), negative (fear, anger, and fright), and a feeling of indifference toward the animal according to the students when they see the images of the animals or have seen them in a natural environment (Figure 3). Figures 4 and 5 group the samples of students from: Belém (Figure 4a), Alter do Chão (Figure 4b), Abaetetuba (Figure 5a), and Joanes (Figure 5b).

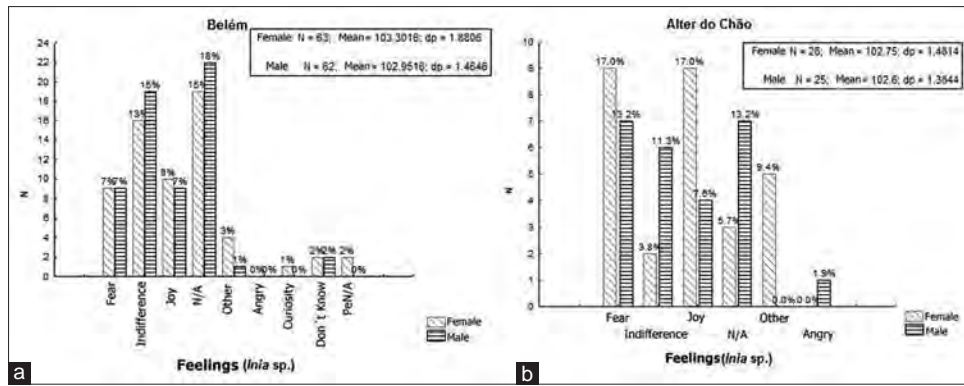
Indifference (30%) and fear (32%) were the most frequent adjectives in the students' speech (Figure 3). This result is



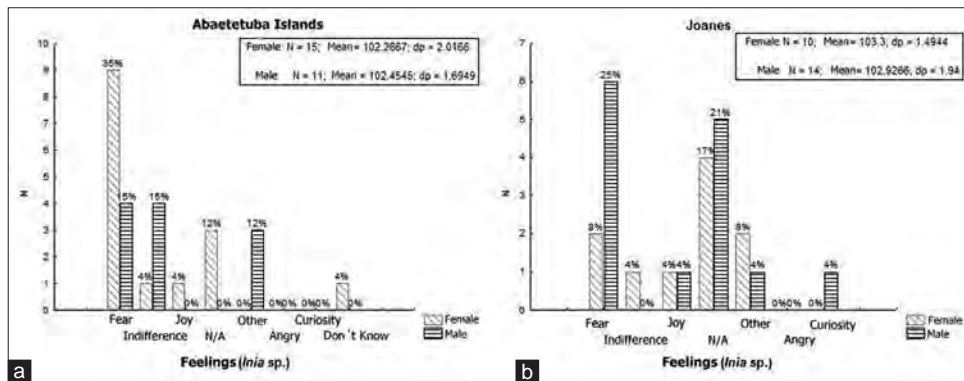
**Figure 3:** Students' feelings toward Botos (*Inia* sp.)

compatible with research conducted by Rodrigues and Silva (2012) on the feelings of children from riverside communities in the Salgado region of Paraense and Abaetetuba, in the lower Tocantins River.

Regarding the feeling attributed specifically to the boto the frequency of girls who say they feared the species was equivalent to the frequency for the male gender (Figure 3). These results differ from the findings of Rodrigues and Silva (2012) who verified the presence of fear and distrust of animals due to the diffusion of stories that refer to cetaceans as being enchanted. On the other hand, in the urban zone of Belém, Andrade et al. (2014) verified that the students showed indifference toward the boto, while they were curious about the dolphins of the genus *Sotalia*.



**Figure 4:** Students' feelings toward Botos (*Inia sp.*). In (a) Sample of Belém students. (b) Sample of Alter do Chão students



**Figure 5:** Students' feelings toward Botos (*Inia sp.*). In (a) Sample of Abaetetuba students. (b) Sample of Joanes students

The most predominant feelings in the student's answers from the urban zone of Belém were the indifference while another significant group did not answer (Figure 4a). On the other hand, the fear and joy were into the more cited feelings between Alter do Chão students (see Figure 4b). Despite the apparent fear among the students of this last municipality, the part of students who rejoice when they see the animals, may be related to the cultural factor originating from the "Çairé Festival," which has as symbol the pink dolphins and tucuxi. Another aspect is the tourist attraction for the feeding of the dolphins in the Tapajós river and that gained support among the residents as a profit alternative (Rodrigues et al., 2014).

Students from Capim (Figure 5a) and Joanes (Figure 5b) showed fear as a more accentuated feeling comparing with other localities. The factors that corroborate this fact, in the case of the islands of Abaetetuba, are due to the lifestyle of the students of this locality, typical of the populations living on islands with absence of electric energy, where the dependence of natural resources prevails. In this type of environment, the relationship with nature is remarkably close, leading to the maintenance of oral traditions such as legends, and the perception that dolphins cause losses due to competition for fish and thereby reinforce aversive behaviors (Lodi and Borobia, 2013).

In Joanes case, students showed that, boys (25%) feel more fear than girls do (8%). A justification may be due to the dangers experienced in the fishing sector and that they are supposed

to use the dolphin as a threat to keep them away from life-threatening environments such as the Marajó bay, in front of Joanes side of the river (Figure 5b). This expressive dichotomy between the perceptions between boys and girls about animals may have been influenced by the stratification found in the tasks and activities that a given culture attributes to each gender and to the genera that it recognizes (Vieira et al., 2013).

Located on the banks of the mouth of the Amazon, the Marajó Bay known among the anglers as the "opposite coast" or "north," represents due to its physical and oceanographic characteristics, a place of risk for those who venture into artisanal fishing. As the influence of the tide is constant and at certain times of the year the turbidity becomes greater by the influence of the Amazon River. Based on this aspect, to challenge oneself in the fishing of the Marajó Bay becomes a ritual of passage for the boys who enter for the first time in the fishing sector. Only the fit ones resist and continue in the activity following in the footsteps of the relatives, the others return to their communities and, having given up their studies plan, start living from agriculture and subsistence fishing.

### Ecological Aspects

About the knowledge toward reproductive aspects of the species, students signaled that the species present male and female specimens, although, when we asked if they could identify them, most part of respondents affirm negatively or avoid the question. This lack of knowledge may be related to

the fact that, in aquatic mammals, the sexual organs are inside the body, in crevices (Andersson and Iwasa, 1996). In addition, it is rarely possible to visualize them since the body of the animal is completely submerged and due to the low visibility of the rivers in the Amazon, it becomes difficult to perceive the sexual differences. Another aspect that contributes to this is the question of being a more specific subject of the content of sciences and, therefore, not contemplated in the content of the disciplines of Brazilian elementary education.

For the Amazon River dolphin, 71% of the students affirmed the existence of male and female, while for the genus *Sotalia*, 64% know about the existence of both sexes. However, 69% do not differentiate genera when it comes to the Amazon River dolphin and 67% cannot differentiate between male and female dolphins of the genus *Sotalia*. As for the manatee, 67% of the students do not differentiate between males and females, but they know that there are both sexes (65%). About humpback whales, 77% answered that they cannot distinguish two sexes, but 62% of the students affirm their existence.

When we asked about the way that species reproduce, a 56% of students could not answer. However, in some cases, we obtained answers such as sexual reproduction, placenta, and egg, concepts found in the final degrees of elementary school contents.

Regarding the dietary habits of the investigated species, the fish was the most frequent option. Although in the case of manatee, they claim that in addition to fish (30%) they feed on vegetables (22%). In the region of the Urucum River, Franzini et al. (2013) investigated the ethnoecological perception of manatee feeding with residents and raised 29 species of aquatic and semi-aquatic plants as possible food items of the sirenians cited. Paschoal et al. (2013) identified the knowledge of Amazonian River dwellers regarding the Amazon River dolphin and in relation to the diet of the animals all the interviewees affirmed that the river dolphin is an animal that feeds on fish at any time of the day.

The question about direct or indirect contact with the animals, for the Amazon River dolphin, 38% reported seeing them in the river, and 21% in the media, while for dolphins of the genus *Sotalia*, 48% saw them on TV, and regarding to the manatee, students reported the only opportunity to see them in spaces such as zoobotanical parks (36%). It is interesting to highlight that 33% of the students from Joanes, had a place of confirmed occurrence of manatees according to findings of Siciliano et al. (2008), when they mentioned to see them on the beach.

### Threats Suffered by These Animals

Regarding the questions that touch on threats to aquatic species, an average of 50% of the sample surveyed stated that dolphins, whales, and manatees are in extinction endangered and that the main factor is the hunt in the case of manatees and fishing for the remaining. It was also frequently pointed among the responses, the risk for pollution from marine environments. Souza (2013) reports that among the fishermen subjects of

the research in the Marajó Island region, more than 70% accidentally caught Guiane dolphin (*Sotalia guianensis*) in fishing nets, implying a potential negative impact, without many studies for this species yet, besides the economic damages for the anglers.

We highlight that, two students from Joanes School cited that the fear could be a threat to the Amazon River dolphins. The unknowing of behavioral and biological aspects of species and the attribution of supernatural powers to the animals can be a reinforcing factor for distancing or avoiding cetaceans (Rodrigues and Silva, 2012). Paschoal et al. (2013) suggest that the local knowledge could delineate educational activities, regarding the cetacean conservation in the region, due to the mysticism that involves cetaceans tend to promote conflict and fear among the local people and the dolphins.

### Taxonomical Aspects

The students use terms to classify those animals into two different taxonomical groups. One term is “mammal,” because they recognize that the offspring suckle when born, and the other term is “fish,” due to the fact of living into aquatic environment and owns fins. Pinto et al. (2013) registered 162 vernacular names to fish category and among these are references to dolphins, whales, and manatees to same zoological taxa.

Students tend to use several zoo-synonymic referring to dolphins of *Inia* sp., among the most cited vernacular names highlights: boto (72%), pink-boto (12%), and golfinho (13%). Students from Belém, Capim Island and, Alter do Chão use frequently the term ‘boto’, meanwhile “pink-boto” is outstanding in Joanes population. Emin-Lima et al. (2011) stand out that to the same species into Marajó region, Abaetetuba, Belém and surroundings are used the next regional denominations: Boto-malhado, squared-coast, and pail-head.

It was interesting to notice how 219 students said to know the cetaceans and named this group of animals using the terms golfinho (74%), boto (14%), and tucuxi (5%) among the most frequent. Although in the illustrative tables, students were presented with a photograph of a dolphin of the species *Sotalia guianensis* – an estuarine species that does not occur in the region of Santarém – the differences with the fluvial species were very subtle to the students so that they were perceived and, therefore, differentiated. However, some students from Alter do Chão (N=33) identify it as a “golfinho” (dolphin), term that references animals founded in oceans and estuaries. We arise the hypotheses that the students could not identify those animals by the species, and they used most folkloric terms to classify aquatic mammals belonging to *Cetartiodactyla* order. The fact of *Sotalia* sp. dolphins belongs to same family (*Delphinidae*) as saltwater cetaceans, can be a factor to they give the term “golfinho” (dolphin), because the external morphological characteristics are similar; principally, with the bottlenose dolphin, representative species in films and cartoons. Almeida (2014) argues that both elementary and middle school students have their own ideas of classification

based on common sense that are not necessarily exclusive to the system of scientific categorization, but complementary to it. Thus, this author suggests that teachers can use these different types of knowledge to enrich and instigate students to understand various subjects in the field of Zoology.

When we showed pictures of the genus *Trichechus*, 95% of students used the generic term peixe-boi (manatee), except a minority (3%) that identify them as sea lion. Although in the 19<sup>th</sup> century, manatees were popularly classified as a tropical kind of walrus because of body shape, adaptations, and habitats. Manatees and pinnipeds (group that includes walruses, sea lions and wolves and seals) do not share common ancestors (Reynolds and Odell, 1991). The manatee is a charismatic and symbol species in the Amazonian, becoming a flagship species into conservation campaigns, using pictures on touristic brochures and the maintenance of living specimen in captivity.

As representation of mysticeti (Bearded whale), we choose humpback whale, flagship species of conservation projects of Cetaceans in Brazil and that had constantly its image linked with the mass media due to stranding events and for the migratory behavior during the warm waters in the east coast of the country in reproductive periods. Two hundred and three (203) students answered the question about the different names given to this species. From this universal sample, 86% used the synonym whale, and 4% used the vernacular term humpback whale, in addition with other terms as *white whale*, *orca*, and *blue whale*. We suppose that besides the media influence, the students are careless about specific details between species, keeping only the general semantic terms. Another hypothesis would be the possibility of the students to recognize only the size and behavior of cetaceans, without realizing about the classification of the animal, a characteristic just reached through scholarly knowledge or in conservation campaigns promoted by academic research groups.

### Final Considerations: Proposals and Implications for Science Teaching

The considering of students' previous knowledge that derives from their own relationships with their sociocultural environment is important. That knowledge provide subsidies to access local realities and to understand their relationships with their surrounding nature. In this process, the family should become more present actors in the process of diffusion of knowledge and guidance in conservation programs, as also they are the first and main source of transmission of knowledge about the natural environment in places where prevail dependencies of primary resources for subsistence, as in the case of fishing.

More detailed thematic noticed by the students over the main species of aquatic mammals are related to behavior, ecology, threats, and cultural factors such as the folk tales. Although a portion of the sample belongs to an urban area, the belief in the Boto legend is widespread, and thus contributes to keeping the myth alive in the Amazonian popular imagination and shows that oral tradition is still present in the population of urban areas.

Students who live in traditionally fishing environments present detailed knowledge about the most coastal species such as dolphins and manatees, and therefore such knowledge deserve to be valued in science classes to awaken in student interest and consolidation of knowledge necessary for the scientific improvement of the people during basic education.

Aversive behaviors against aquatic mammals, especially dolphins due to the folk tales and competition with anglers, deserve systematic studies in both, the biological and social sciences, so that in the medium and long term they can guide conservation actions that consider science teaching and previous ethnozoological knowledge of students.

Our results demonstrate that investigation of student's ethnozoological knowledge about a species or group of animals is essential to identify which intervention strategies can be adopted in the promotion of scientific education aiming at the conservation of endangered species. To conduct training programs for educators and to contribute with the generation of new methodologies that include the participation of diverse social actors such as the students' own families, because they participate actively in the construction of the previous knowledge of the students (Cobern and Loving, 2001).

Aquatic mammals can represent flagship species for the conservation of the Amazonian, through scientific education allied to the prior knowledge of the students, it diffuses and builds knowledge that allows students to recognize and value animals from an ecological point of view. Thus, we can mitigate widespread beliefs that the presence of certain species, such as dolphins, represents danger and disadvantage to communities. This research provides support for the efficient design of awareness and information initiatives. It can also serve as a quantitative and conceptual reference, for future studies on this theme in other places of occurrence of aquatic mammals.

We propose that teachers on schools of those Amazonian regions and others whose realities are similar around the world – to develop and use didactic resources and strategies that contain students' prior knowledge with intercultural dialog in science classes, favoring the development of reflective attitudes among students, and promoting decision-making in favor of maintaining aquatic mastofauna. In this sense, we indicate games, short stories, dramatizations, songs, dances, and among other possibilities with negotiation of cultural meanings, which encourage students to work in groups. Likewise, the use of problematic questions that allow students to choose which knowledge can answer their doubts, be it scientific knowledge or those inherent in their communities. At such moments, teachers can use explicit approaches to the nature of science (NOS), facilitating the process of building scientific knowledge in its context of origin and applicability as well as delimiting science in relation to other forms of knowing, without hierarchizations and devaluations.



## ACKNOWLEDGMENTS

To the entire school community and the parents of the students who participated in this survey of the communities of Joanes, Capim River, Alter do Chão and Belém, state of Pará, Brazil, as well as the Cetacean International Society (CIS) for supporting field research. Also, to the support of Research Group in Biology and Conservation of the Amazonian Aquatic Mammals (Federal Rural University of Amazonia - UFRA).

## Ethical Statement

The study was conducted in accordance with ethical policy and in accomplish with the Brazilian norms on research involving human beings (Brazil, 2012). Authors acknowledge that the research was conducted anonymously, that a signed consent was obtained from all participants, and that all participants were informed about the publication of the results.

## REFERENCES

- Aikenhead, G. (2009). Research into STS science education. *Brazilian Journal of Research in Science Education*, 9(1), 1-21.
- Almeida, D.F. (2014). Ensino de zoologia e conhecimentos prévios sobre os animais: implicações conservacionistas. In: Baptista, G.C.S., Vargas-Clavijo, M., & Neto E.M.C., (Eds.), *A Etobiologia na Educação Iberoamericana: Uma Compreensão Holística e Pluricultural da Biologia [Ethnobiology in Iberoamerican Education: A Holistic and Pluricultural Understanding of Biology]*. UEFS. pp. 217-236.
- Alves, R.R.N., & Rosa, I.L. (2008). Use of tucuxi dolphin *Sotalia fluviatilis* for medicinal and magic/religious purposes in North of Brazil. *Human Ecology*, 36(3), 443-447.
- Alves, R.R.N., & Souto, W.M.S. (2010). Etnozoologia: Conceitos, considerações e importância. In: Alves, R.R.N., Souto, W.M.S., & Mourão, J.S., (Eds.), *Etnozoologia no Brasil: Importância, Status Atual e Perspectivas [Ethnobiology in Brazil: Importance, Actual Status, and Perspectives]*. Volume 1. Recife. pp. 21-40.
- Alves, R.R.N., Campos, B.A.T., Toledo, G.A.C., Mourão, J.S., Barboza, R.R.D., & Souto, W.M.S. (2010). Traditional uses and conservation of dolphins in Brazil. In: Pearce, A.G., & Correa, L.M., (Eds.), *Dolphins: Anatomy, Behavior, and Threats*. Hauppauge, New York: Nova Science Publishers. pp. 2-15.
- Andersson, M., & Iwasa, Y. (1996). Sexual selection. *Trends in Ecology and Evolution*, 11(2), 53-58.
- Andrade, A.M., Miranda, T.L., Carrara, D.C.C., Rodrigues, A.L.F., & Silva, M.L. (2014). *Ethnobiology, Technology, and Environmental Education: A Contribution to the Teaching and Conservation of Aquatic Mammals in Public Schools in Pará*. In: Proceedings of X Brazilian Symposium on Ethnobiology and Ethnoecology, Montes Claros (MG), Brazil. p. 49.
- Banks, J.A. (2009). Multicultural education: Dimensions and paradigms. In: Banks, J.A., (Ed.), *The Routledge International Companion to Multicultural Education*. Milton Park, Abingdon-on-Thames: Routledge. pp. 29-52.
- Baptista, G.C.S., & El-Hani, C.N. (2009). The contribution of ethnobiology to the construction of a dialogue between ways of knowing: A case study in a Brazilian public high school. *Science and Education*, 18(4), 503-520.
- Baptista, G.C.S. (2010). Importância da demarcação de saberes no ensino de ciências para sociedades tradicionais [Importance of knowledge demarcation in science teaching for traditional societies]. *Science and Education*, 16(3), 679-694.
- Beltrán-Pedrerros, S., & Filgueiras-Henriques, L.A. (2010). *Dolphin-fishery Interaction: Cost-benefit, Social-economic and Cultural Considerations*. Available from: <https://repositorio.inpa.gov.br/handle/1/19909?mode=full>
- Brazil. (2012). National Health Council. National Ethic Committee in Research. *Resolution n° 466: Normas Para Pesquisa Envolvendo Seres Humanos [Resolution No. 466: Standards for Research Involving Human Subjects]*. Health Ministry.
- Canto, O. (2007). *Várzea e varzeiros da Amazônia [Várzea and varzeiros of the Amazon]*. 1<sup>st</sup> ed., Vol. 1. Museu Paraense Emílio Goeldi [Paraense Emílio Goeldi Museum].
- Coburn, W.W. (1996). Constructivism and non-western science education research. *International Journal of Science Education*, 80(5), 579-610.
- Coburn, W.W., & Loving, C. (2001). Scientific worldviews: A case study of four high school Science teachers. *Electronic Journal of Science Education*, 5(2), 1-12.
- El-Hani, C.N., & Mortimer, E.F. (2007). Multicultural education, pragmatism, and the goals of science teaching. *Culture Studies of Science Education*, 2(3), 657-702.
- Emin-Lima, R., Rodrigues, A.L.F., Sousa, M.E.M., Arcoverde, D.L., Santos, G.M.A., Martins, B.M.L., Silva-Júnior, J.S., & Siciliano, S. (2010). Os mamíferos aquáticos associados aos manguezais da costa norte brasileira [The aquatic mammals associated with the mangroves of the Brazilian north coast]. In: Pessoa, L.M., Tavares, W.C.E., & Siciliano, S., (Eds.), *Mamíferos de Restingas e Manguezais do Brasil [Mammals of Restingas and Mangroves in Brazil]*. Nacional and Sociedade Brasileira de Mastozoologia [National and Brazilian Society of Mastozoology]. pp. 45-57.
- Franzini, A.M., Castelblanco-Martinez, N.D., Rosas, F.C., & Da Silva, V.M. (2013). What do local people know about Amazonian manatees? Traditional Ecological Knowledge of *Trichechus inunguis* in the oil province of Urucu, AM, Brazil. *Natureza and Conservação [Nature and Conservation]*, 11(1), 75-80.
- Gallois, S., & Reyes-Garcia, V. (2018). Children and ethnobiology. *Journal of Ethnobiology*, 38(2), 155-169.
- Geertz, C. (1989). *A Introdução à Cultura [Introduction to Culture]*. 1<sup>st</sup> ed. LTC.
- Loch, C., Marmontel, M., & Simoes-Lopes, P.C. (2009). Conflicts with fisheries and intentional killing of freshwater dolphins (Cetacea: Odontoceti) in the Western Brazilian Amazon. *Biodiversity and Conservation*, 18(14), 3979-3988.
- Lodi, L., & Borobia, M. (2013). *Baleias, Botos e Golfinhos do Brasil: Guia de Identificação [Whales, Porpoises and Dolphins of Brazil: Identification Guide]*. Technical Books.
- Meyer, X., & Crawford, B.A. (2011). Teaching science as a cultural way of knowing: merging authentic inquiry, nature of science, and multicultural strategies. *Cultural Studies of Science Education*, 6(3), 525-547.
- Mymrin, N.I. (1999). The communities of Novo e Chaplino, Sireniki, Uelen, and Yanrakinnot and Henry P. Huntington. Traditional knowledge of the ecology of beluga whales (*Delphinapterus leucas*) in the Northern Bering Sea, Chukotka, Russia. *Arctic*, 52(1), 62-70.
- Paschoal, E.D.M., Monteiro-Filho, E.L.D., & Marmontel, M. (2013). Local knowledge of the Amazon River dolphin (*Inia geoffrensis* Blainville, 1817) in the Lake Amanã region, Amazonas. *UAKARI*, 9(1), 25-35.
- Pinto M.F., Mourão, J.S., & Alves R.R.N. (2013). Ethnotaxonomical considerations and usage of ichthyofauna in a fishing community in Ceará State, Northeast Brazil. *Journal Ethnobiology and Ethnomed*, 9(17), 1-11.
- Posey, D.A. (1997). Etnobiologia: teoria e prática [Ethnobiology: Theory and practice]. In: Ribeiro, D., (Ed.), *Suma Etnobiológica Brasileira [Brazilian Ethnobiological]*. Columbia: University Publisher. pp. 1-15.
- Razera, J.C.C., Boccardo, L., & Pereira, J.P.R. (2006). Percepções sobre a fauna em estudantes indígenas de uma tribo tupinambá no Brasil: um caso de etnozologia [Perceptions about the fauna in indigenous students of a Tupinambá tribe in Brazil: A case of ethnobiology]. *Revista Electrónica de Enseñanza de las Ciencias [Electronic Journal of Science Teaching]*, 5(3), 466-480.
- Reynolds, J.E. 3<sup>rd</sup>, & Odell, D.K. (1991). *Manatees and Dugongs. Facts on File*. Marine Mammal Science Inc.
- Robles-Piñeros, J., Baptista, G.C.S., & Costa-Neto, E.M. (2018). Uso de desenhos como ferramenta para investigação das concepções de estudantes agricultores sobre a relação inseto-planta e diálogo intercultural [Use of drawings as a tool to investigate farmer students' conceptions of the insect-plant relationship and intercultural dialogue]. *Revista IENCI Investigações em Ensino de Ciências [IENCI Journal Investigations in Science Teaching]*, 23(2), 159-171.
- Rodrigues A.L.F., Santos, G.M.A., Andrade, A.M., Ramos, I., Arcoverde, D.L.,

- Sena, L.S., & Silva, M.L. (2014). Interactions between children and botos (*Inia* sp.) in markets and fairs of Eastern Amazon. [Video]. In: *XVI Reunión de Expertos en Mamíferos Acuáticos de América del Sur e X Congreso de la Sociedad Latinoamericana de Especialistas en Mamíferos Acuáticos (SOLAMAC) [XVI Meeting of Experts on Aquatic Mammals of South America and X Congress of the Latin American Society of Experts on Aquatic Mammals (SOLAMAC)]*. Cartagena, Colombia.
- Rodrigues, A.L.F., & Silva, M.L. (2012). Botos: Realidade e fantasia na concepção de estudantes ribeirinhos do estado do Pará, Brasil [Dolphins: Reality and fantasy in the conception of riverside students in the state of Pará, Brazil]. *Natural Resources*, 2(1), 29-43.
- Siciliano, S., Emin-Lima, N.R., Costa, A.F., Rodrigues, A.L.F., de Magalhães, F.A., Tosi, C.H., Garri, R.G., Silva, C.R., & Silva, J.S. Jr. (2008). Revisão do conhecimento sobre os mamíferos aquáticos da costa norte do Brasil [Review of knowledge about aquatic mammals from the north coast of Brazil]. *Arquivos do Museu Nacional [Archives of the National Museum]*, 66(2), 381-340.
- Southerland, S.A. (2000). Epistemic universalism and the shortcomings of curricular multicultural science education. *Science and Education*, 9(3), 289-307.
- Souto, F.J.B. (2004). *A Ciência Que Veio da Lama. Uma Abordagem Etnoecológica Abrangente das Relações ser Humano/Manguezal na Comunidade Pesqueira de Acupe, Santo Amaro, Bahi [The Science that Came from the Mud. A Comprehensive Ethnoecological Approach to Human/Mangrove Relationships in the Fishing Community of Acupe, Santo Amaro, Bahia]*. (Doctoral Thesis in Ecology and Natural Resources, Federal University of São Carlos).
- Souza, S.P. (2013). Payment for environmental services, fishers and cetaceans' conservation. *Labor and Engenho*, 7(4), 5-12.
- Van Den Boog, T., Van Andel, T., & Bulkan, J. (2017). Indigenous children's knowledge about non-timber forest products in Suriname. *Economic Botany*, 71(4), 361-373.
- Vargas-Clavijo, M., & Baptista, G.C.S. (2014). La etnozoología, un complemento para la enseñanza de la biología basado en el diálogo intercultural [Ethnozoology, a complement to the teaching of biology based on intercultural dialogue]. In: Baptista, G.C.S., Vargas-Clavijo, M., & Costa-Neto, E.M., (Eds.), *A Etnobiología na Educação Iberoamericana: uma Compreensão Holística e Pluricultural da Biologia [Ethnobiology in Iberoamerican Education: A Holistic and Pluricultural Understanding of Biology]*. UEFS. pp. 125-157.
- Vieira, N., Siqueira, D., Ever, M., & Gomes, M. (2013). Divisão sexual do trabalho e relações de gênero em contexto estuarino-costeiro amazônico [Sexual division of labor and gender relations in an estuarine-coastal Amazonian context]. *Revista de Antropologia [Journal of Anthropology]*, 5(3), 806-835.