
FOLK CLASSIFICATION OF SEA SPONGES (ANIMALIA, PORIFERA) BY ARTISANAL FISHERMEN OF A TRADITIONAL FISHING COMMUNITY AT CAMAMU BAY, BAHIA, BRAZIL

Loyana Docio, Eraldo Medeiros Costa-Neto, Ulisses dos Santos Pinheiro and Alexandre Schiavetti

SUMMARY

The folk classification of sea sponges by artisanal fishermen is presented by discussing how they recognize, label and classify these marine organisms. Research was carried out in the county of Pontal do Contrato, at Camamu Bay, Bahia State, Brazil. Fieldwork was accomplished from January to May 2008 by means of open-ended interviews, projective tests and direct observation, which were performed with 66 artisanal fishermen, both men and women, whose ages ranged from 18 to 75 years old. The data were analyzed following Berlin's principles of folk biological classification, as well as through Venn diagrams, ethnosemantic analyses and similarity indexes.

The results show that sea sponges are perceived as kinds of plants, and grouped together with cnidarians, ascidians and algae within a broader ethnocategory labeled as 'slime'. The majority of the interviewees recognized poriferans through physical attributes such as color patterns, body shape and consistency. However, sea sponges are preferably named taking into account their color patterns. Studying the way people recognize and classify sponges may assist wildlife inventories and appropriate conservation strategies for possibly endangered species.

Introduction

The vernacular names given to living organisms are keys to access a great amount of knowledge on those traditionally labeled beings (Daly, 1998). Humans interact with the living organisms present in their surrounding environments and inevitably group or separate them according to their similarities and differences (Hartmann, 1967; Berlin, 1973; Berlin *et al.*, 1973; Brown and Chase, 1981). They consider not only the intrinsic and extrinsic characters associated to those plants and animals, but, more significantly, the

emblematic representations that are very important in order to categorize them. Such processes of categorization (cognitive categories) are culturally influenced and arranged in logical patterns (taxonomic structures) that can be different for every human group (Hunn, 1982; Hays, 1983; Atran, 1990; Berlin, 1992).

The human need to order and classify the universe is a matter of survival, since only through order someone can comprehend, make reference, insert and adapt himself to the world (Lévi-Strauss, 1989). Linguistic expression patterns of a particular ethnic group are con-

sidered to show some regularity in classification systems (Greene, 2007). On this assumption, Berlin *et al.* (1973) established three main areas of study in folk biological systematics: classification, which refers to the set of principles by which the classes of organisms are naturally mind-organized; nomenclature, which refers to the description of the linguistic principles of designation of the organized classes of living beings in a given language; and identity, which relates to the physical characteristics used to assign a particular organism to a specific category. According to Berlin *et*

al. (1973), the ethnobiological taxonomy has a hierarchical character because the most exclusive categories (ethnogenus or generic and ethnospecies or specific) occur at the lower levels, while more inclusive categories (for example, life forms) occur at the higher levels.

Regarding animal categorization by humans, ethnozoological classification systems are closely linked to the way in which each culture, in its particular way, thinks, feels and acts towards the animals in their environment (Santos-Fita and Costa-Neto, 2009). Analytic tools provided by linguistics permit to understand not

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CLASIFICACIÓN POPULAR DE ESPONJAS MARINAS (ANIMALIA, PORIFERA) POR PESCADORES ARTESANALES DE LA COMUNIDAD DE BAÍA DE CAMAMU, BAHIA, BRASIL

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RESUMEN

Se estudió la clasificación popular de esponjas marinas por parte de pescadores artesanales. La investigación fue realizada en la comunidad do Pontal do Contrato, Bahía de Camamu, Estado de Bahía, Brasil. El trabajo de campo se llevó a cabo entre enero y mayo de 2008, por medio de entrevistas abiertas, tests proyectivos y observación directa, que fueron realizadas a 66 pescadores artesanales con edades entre 18 y 75 años. Los datos fueron analizados considerando los principios de clasificación propuestos por Berlin, además de diagramas de Venn, análise etnosemántico e índices de similaridad. Los resultados muestran que las esponjas son percibidas como

plantas y agrupadas junto con algas, cnidarios y ascidias en una etnocategoría denominada limo. La mayoría de los entrevistados reconoce las esponjas con base en atributos físicos, tales como patrones de color, forma del cuerpo y consistencia. No obstante, las esponjas son preferentemente nombradas de acuerdo a su coloración. Estudios sobre cómo las personas reconocen y clasifican a las esponjas pueden ayudar en la elaboración de inventarios de la fauna y en la formulación de estrategias adecuadas para la conservación de especies posiblemente amenazadas.

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RESUMO

O presente artigo trata da classificação popular de esponjas marinhas feita por pescadores artesanais. A pesquisa foi realizada na comunidade do Pontal do Contrato, na Baía de Camamu, Estado da Bahia, Brasil. O trabalho de campo foi realizado entre janeiro e maio de 2008, por meio de entrevistas abertas, testes projetivos, e observações diretas, que foram feitas com 66 pescadores artesanais, homens e mulheres com idades entre 18 e 75 anos. Os dados foram analisados considerando os princípios de classificação propostos por Berlin, bem como através de diagramas de Venn, análises etnosemântica

e índices de similaridade. Os dados mostram que as esponjas são percebidas como plantas e agrupadas junto com algas, ascídias e cnidários em uma etnocategoria chamada limo. A maioria dos entrevistados reconhece as esponjas com base em atributos físicos, como padrões de cor, forma do corpo e consistência. No entanto, as esponjas são preferencialmente nomeadas devido à coloração. Estudos sobre como as pessoas reconhecem e classificam as esponjas podem auxiliar inventários faunísticos e estratégias de conservação adequadas para possíveis espécies ameaçadas.

only how each ethnozoological classification is built and structured, but also the causes and consequences of the perception, identification, categorization and naming of animals, both real and/or mythological, that populate the universe of ethnic groups all over the world. Classification criteria are somehow subjective, since it is not a simple rational activity, but rather expresses feelings and behaviors. Thus, perceptions, feelings (affective-emotional reactions) and attitudes (positive or negative) determine, ultimately, the types of relationships that humans maintain with non-human animals (Nolan *et al.*, 2006). There is, therefore, a rela-

tionship (Viertler, 2002) between what is thought (cognition), what is spoken (a word), and what is done (an action). Ethnotaxonomy can be an indicator of this cognitive-linguistic-behavioral process (Couto, 2007).

Sea sponges (Porifera) are benthic animals and their common names derive from the porous material that constitutes their bodies. Over 10000 living species have already been described, which present a varied range in size, shape, color and ecological habitats (Muricy and Hajdu, 2006). Only six species out of 393 which inhabit Brazilian coast (Muricy *et al.* 2011) were recorded to Camamu Bay at Bahia State (Peixinho *et al.*,

2005; Menegola *et al.* 2009; Fernandez, 2011; Menegola *et al.*, 2011). However, Mothes *et al.* (2006) estimate that hundreds of species are still to be discovered in Brazil.

There are records of the use of such primary metazoans for various purposes from antiquity to modern times (Gliesh, 1940; Pronzato, 1999, 2003; Müller *et al.*, 2004; Svanberg, 2007). For example, in ancient Rome women used to soak certain sea sponge species in milk and honey and give to their children in order to calm them, and they were also used as objects of personal hygiene by soldiers (Pronzato, 1999). However, systematic studies on the percep-

tion, classification and traditional use of sponges are still rare (Svanberg, 2007).

This work describes the folk classification of sea sponges, showing how artisanal fishermen from Camamu Bay, Brazil recognize, label, and classify them. Since there is no research related to traditional knowledge about this group of animals in Brazil, this paper represents the first record on Porifera ethnosciences, thus beginning the ethnospongiological research in the country. Ethnospongiology refers here to the study of interactions between humans and sponges, dealing with how individuals perceive, classify and use these aquatic sessile animals.

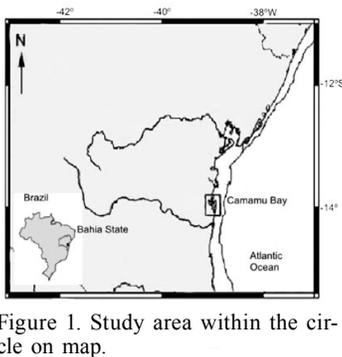


Figure 1. Study area within the circle on map.

Materials and Methods

Study area and data collection

The study was carried out in the county of Pontal do Contrato, municipality of Igrapiúna (13°49'35"S-39°08'32"W), at Camamu Bay, south of Bahia State, Northeastern Brazil (Figure 1). The economy of the local inhabitants is mainly based on artisanal fishing and subsistence agriculture. Tourism in this part of the bay is not fully developed (Docio *et al.*, 2009).

Fieldwork was carried out from January to May 2008, totalizing 45 days living in the county. The data were obtained based on usual ethnographic recordings by means of tape-recorded, open-ended interviews, projective tests (dried sponges, some specimens conserved in alcohol 80%, and photographs were shown to informants) and direct observations (French, 1963; Sturtevant, 1964). A total of 66 inhabitants, men (n= 44) and women (n= 22), whose ages ranged from 18 to 75 years old were interviewed. This sample represents 10% of the total inhabitants (n= 506) of the county. Most of the interviewees did not complete the elementary school (65%) and 74% of them have fishing activities as their only source of income.

The dialogue with all participants started with the question 'Do you know

this?', which was asked when they were shown to fresh collected and alcohol conserved sponge specimens, or even their photographs. An Open and Clarified Consent Form was elaborated based on the Brazilian Health Council Resolution number 196/1996, which rules the ethical aspects of the research involving human beings. It was read to the dwellers and distributed among those who participated in the study. The main objectives of the research were explained clearly at the beginning of each new interview and people were asked if they wanted to participate (Azevedo and Gomes, 2002). The study was approved by the Research Ethics Committee of the Universidade Estadual de Santa Cruz (protocol number 118/2007).

Six key interviewees were asked to make drawings of what they know as sea sponges in order to understand how they perceive them and differentiate them among the recognized types within this ethnocategory.

Some specimens were collected and identified by specialists; they are kept at the collection of the Invertebrates Laboratory, Universidade Federal de Pernambuco (Vouchers UFPE 691, 697, 701, 702, 709, 715, 716, 717, 719, 720, 721, 722, 724, 725, 727). All ethnographic materials (recordings, transcriptions, photographs and drawings) are kept at the Ethnobi-

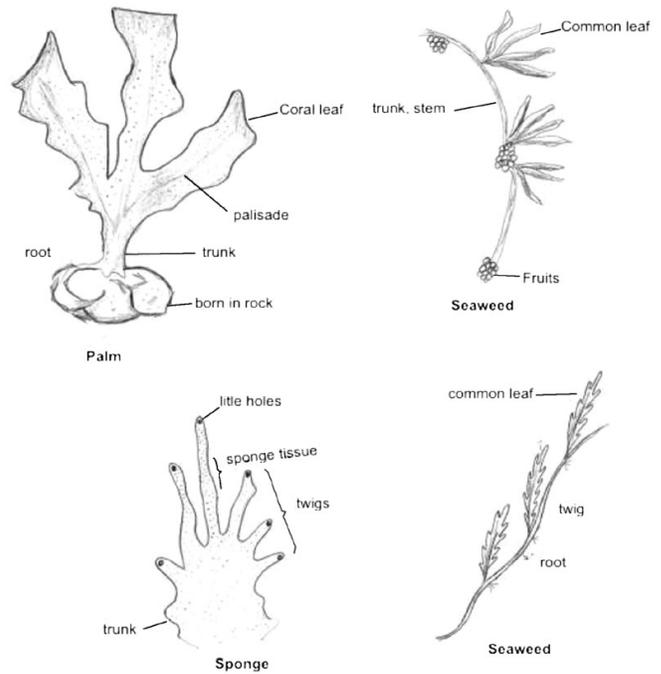


Figure 2. Figures shown to interviewers in order to understand how they differentiate algae (seaweed) from palm (gorgonian corals) and sea sponges.

ology and Ethnoecology Laboratory, Universidade Estadual de Feira de Santana (UEFS) for evidential purposes.

Data analysis

Data were analyzed qualitatively by following Berlin's principles of folk biological classification (Berlin, 1973), as well as through the elaboration of Venn diagrams and ethnosemantic analysis (Berlin, 1992). Interviewees' responses were assayed using the union model (Hays, 1976). According to this model, all available information on the surveyed subject is to be considered. Controls were done both through consistency checking tests and reply validity tests, which make use of repeated inquiries in synchronic and diachronic conditions, respectively. The former occurred when the same question was put to different people soon after each other; the latter occurred when the same question was asked to the same person at different times (Marques, 1991).

Analyses of percentage proportion were made through the equation

$$p = \frac{X}{n}$$

where p: proportion of cases in the sampling, X: number of cases, and n: sampling size (Vieira, 2003).

In order to evaluate how interviewees classified sponge-like objects, according to their perception, a pictorial questionnaire was made through which the six key informants had to identify the name of the morphological parts of these objects (Figure 2). They were algae, sponges and gorgonian corals. A total of 13 local terms used to refer to body parties were recorded. Due to the synonymization among some of them, 11 features were considered for similarity analysis. The Jaccard's index of similarity was used as

$$JI = \frac{a}{a + b + c}$$

where a: characters that occur in two elements; b: characters that occur only in the first element; and c: charac-

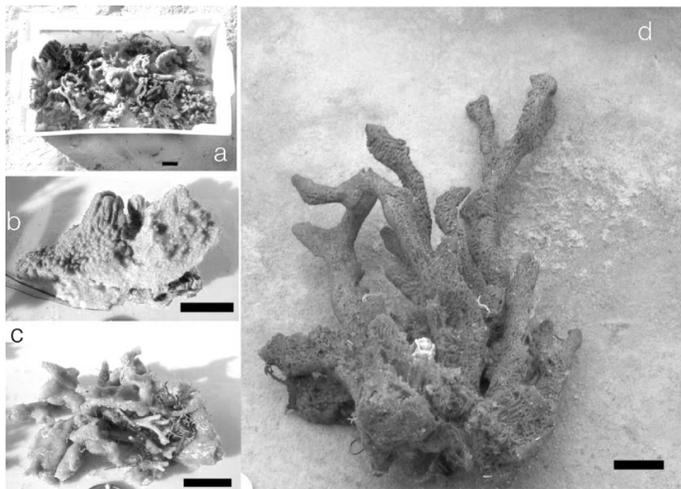


Figure 3. Some sponges detected by the interviewees. a: specimens used for interviews, b: red sponge or ‘cansanção’ (*Tedania ignis*), c: green sponge (*Haliclona manglaris*), d: red sponge or soft red bugail (*Desmapsamma anchorata*). Bars: 2cm.

ters that occur only in the second element. The UPGMA algorithm was used.

The data were analyzed by the Past Statistical Program version 2.3 (Hammer *et al.*, 2010).

Results

The diversity of sea sponges in the study area was revealed in expressions such as ‘They are of various kinds’. The differences between types of sponges, according to the respondents, are based on morphological criteria of consistency (porosity) and color. The character of shape seems to be no use, since two local types of red sponges that were collected showed quite remarkable morphological differences: *Desmapsamma anchorata* Carter, 1882 is digitiform, while *Tedania ignis* Duchassaing & Michelotti, 1864 has a massive body consistency (Figure 3b and d). Even though sponges present different shapes (massive, digitiform, encrustant, radial, and vase-shaped) and different body consistencies (ranging from rigid to soft), they are locally labeled based exclusively on their external color, such as white sponge, black sponge, yellow sponge, etc (Figure 3).

Out of 66 interviewees, 50 (76%) recognized and named the sea sponges. Local names used to refer to these marine invertebrates are: ‘sponge’, ‘foam’, ‘stone foam’, ‘slime’, ‘stone slime’, ‘soft slime’, ‘seaweed’, and ‘coral’. All of these terms are applied to all sponges indiscriminately, although most of the respondents (40% of the 50 interviewees mentioned above) have referred to these invertebrates using the local term sponge, as can be appreciated in the following statements:

“...We know that as sponge. It is like the fish, which there are several types of fish, are not there? All is fish, and so all is sponge for us”

“...We do not have a definition, a detailed name of them. Thus we call everything of sponge, which it could be anyone”

“...There is not that (?), this is such a sponge. Well, it is defined only by its color” (Mr. G., 41 years old).

The remaining 24% of the interviewees was composed by both residents who were totally unaware of these marine elements and those who reported having seen them but never minded to know what they were.

According to the inhabitants surveyed in this study, sea sponges and other sessile marine organisms from different taxa, such as cnidarians (subclasses Octocorallia and Hexacorallia) and seaweed, are grouped together into a single semantic domain designated as ‘slime’ due to their remarkable morphological characters and the perception regarding their ontogeny, morphology and ecological traits, mainly the habitat. Considering this, it is quite possible that other marine organisms, such as ascidians and bryozoans, also may be included in the ‘slime’ ethnocategory, since one interviewee referred to the existence of ‘sponge that squirt water’. However, sponges do not squirt water, this behavior being observed in Urochordata. Thus, it is possible that other sessile marine organisms are grouped together in the slime ethnocategory. These different taxa are culturally thought of and recognized as plant-like organisms. That is, people perceive all of them as kinds of the ocean flora representatives.

During the first interview sessions, this classification seemed somewhat complex but, gradually, the groupings were revealed, so that a set could be delineated with those elements. Firstly, the elements are distinguished in their animated state, if they are alive or not. Then they are classified according to morphological and ecological aspects. In the perception of respondents, alive are considered the sea water, the algae, the sponges, and the soft and stony corals. The soil of the sea is not alive, as in the case of ‘tubatinga’ (seabed with clay formation), nor is the ‘bugaial-duro’ (hard bugaial), which is an element of biogenic origin and externally similar to dried sponges. Sun-dried sponges are called as gravel, along with hard bugaial and dead stony corals.

Although there are different sea sponge species in

the studied area, few of them are culturally recognized in order to receive labeled binomial names. Two morphospecies have been recognized to this linguistic level according to three morphological characters, which are body consistency, color, and shape: ‘esponja-forro-de-tubatinga’ or tubatinga seabed sponge (*Suberites* sp1 and sp2.), and ‘bugaial-mole’ or soft bugaial (*Desmapsamma anchorata*; *Haliclona* (*Reniera*) *manglaris* Alcolado, 1984; *Haliclona* (*Reniera*) sp.; *Haliclona* sp.). Even varieties are known for these specifics: ‘esponja-forro-de-tubatinga-claro’ or light tubatinga seabed sponge (*Suberites* sp1.), ‘esponja-forro-de-tubatinga-escuro’ or dark tubatinga seabed sponge (*Suberites* sp2.), ‘bugaial-mole-vermelho’ red soft bugaial (*D. anchorata*), and ‘bugaial-mole-escuro’ dark soft bugaial (*Haliclona* spp.).

The species *Tedania ignis*, locally known as red sponge, was readily recognized by respondents, due to its offensive capacity to harm people through physical touch. That is why it is also popularly labeled as ‘cansanção’, a term which is used to designate cnidarians and terrestrial plants (stinging nettle, Urticaceae) that cause a burn sensation. Semantically, the term ‘cansanção’ is used both to refer to sea sponges and sessile cnidarians (Figure 3b).

According to Berlin (1992), ethnosemantic analyses show that all names given to sea sponges are primary lexemes, which are divided into simple, productive and unproductive lexemes. A simple lexeme does not allow to be decomposed into smaller units, the second type occurs when one of the constituents of each expression indicates a superordinate category (red sponge is a kind of sponge), and the later do not allude to the superordinate category; for example, hard bugaial do not

refer to a kind of sea sponge but a rock (Table I).

In order to know the conceptual framework of each element that composes the slime ethnotaxonomic complex, some figures of slime's representatives were arranged in a single white sheet for experts to rate their morphological parts (Table II). Based on what has been revealed through these drawings (Figures 2 and 4), it can be stated that there are observable characters that are mutually exclusive. Considering the presence and absence of these characters, a dendrogram was made in order to understand how individuals group together these organisms. There is a 40% of similarity of the characteristics between the algae and soft corals (Octocorallia), and only 22% of similarity of sponges in relation to these two other elements (Figure 5). Thus, according to respondents, the feature that would be synapomorphic for inclusion in the group of soft corals is the presence of 'palm fiber' (or palisade), whose morphologic equivalent is the axial skeleton that keeps the shape and support in a soft coral colony (Figure 4c). In sponges, the 'sponge-type tissue' and the presence of holes, whose equivalent is the aquifer sys-

TABLE I
LEXICAL ANALYSIS (ACCORDING TO BERLIN *ET AL.*, 1973) OF THE LOCAL NAMES ATTRIBUTED TO SEA SPONGES BY THE INHABITANTS OF ILHA DO CONTRATO, MUNICIPALITY OF IGRAPUÍUNA, BAHIA STATE

Primary lexemes		
Simple	Productive	Unproductive
Bucha (loofah)	Bucha-do-mar (sea loofah)	
Bugaial	Bugaial-mole (soft bugaial)	Bugaial-duro (hard bugaial)
Cansação (stinging nettle)	Bugaial-do-vermelho (red bugaial)	
Espanja (sponge)	Espanja-da-amarela (yellow sponge)	
Espuma (foam)	Espuma-do-mar (sea foam)	
Limo (slime)	Limo-mole (soft slime)	

TABLE II
BINARY MATRIX OF MORPHOLOGICAL CHARACTERS OF SEAWEED, SEA SPONGES, AND CORALS

Local names (Portuguese)	English name	Coral (Octocorallia)	Seaweed	Sponge
Raiz	Root	1	1	0
Folha	Leaf	0	1	0
Folha do coral	Arborescence	1	1	0
Tronco	Trunk	1	1	1
Tecido da esponja	Sponge tissue	0	0	1
Caule	Stem	0	1	0
Ramos	Twigs	0	1	1
Pequenos furos	Sponge porocytes	1	0	1
Fruitas	Fruits	0	1	0
Veia	Vein	1	1	0
Paliçada	Axial skeleton	1	0	0

tem, and the pores of this same system, respectively, would be the determinant factors of exclusion from this group. However, according to the interviewees' statements, ecological, behavioral and ontogenetic characters were constantly mentioned when talking about slime-origin organisms: They are born from the stone, are aquatic and sessile.

Moreover, the 'palms' (soft corals, Octocorallia) differ from the algae based on the presence of characters such as

branch and fruit, which are present in the latter. However, sponges, algae and soft corals share both ecological and morphological characteristics: they were born in the stone (on the surface of rocks and or coral reef) and have a trunk, respectively.

During field excursions six informants were asked to col-

lect specimens of marine objects locally recognized as sponges. Surprisingly, all of those organisms were indeed sponges, of the following species: *Callyspongia* (*Callyspongia*) sp., *Agelas* sp., *Tethya* sp., *Haliclona* (*Reniera*) *manglaris*, *Haliclona* (*Reniera*) sp., *Haliclona* spp., *Aplysina fulva*, *Aplysina cauliformes*, *Darwinella* sp., *Suberites* sp1. *Suberites* sp2, *Desmapsamma anchorata*, *Tedania ignis*. Even *Xestospongia* sp., that has a rigid conformation due to higher proportion of spicules in its body, has been also grouped among the sponges (Figure 4a). Thus, Porifera seems to be the member of the ethnotaxon slime that most differentiates itself from the other elements which are also perceived and identified as slime, sharing fewer characters; but the main feature presenting by sea sponges to be allowed in this ethnotaxon is the presence of pores, or 'holes' as the interviewees have mentioned.

Only one respondent drew varieties of the same sponge morphotype, but he did not know their local names. According to him, these varieties were differentiated by color, yellow and light red;

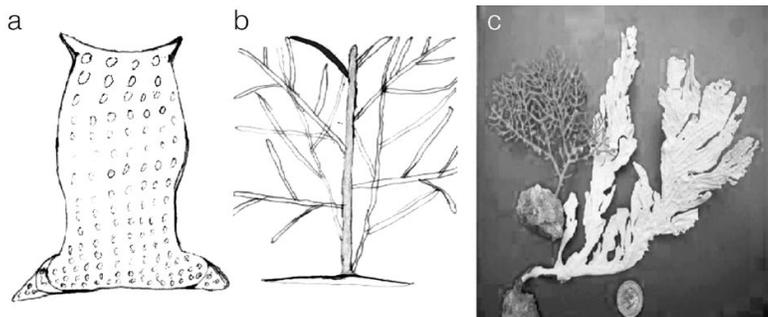


Figure 4. Types of locally labeled sea sponges. a: drawing of a vase-shaped sponge, b: drawing made to explain varieties of sponges based on color and shape, c: gorgonian corals locally known as palm.

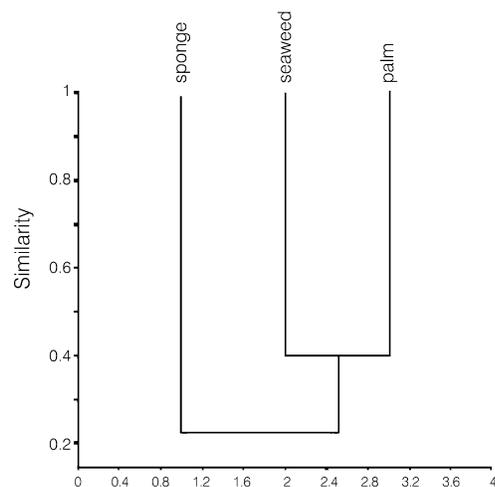


Figure 5. Dendrogram of the similarity between cnidarians, sea sponges and seaweed, using the Jaccard's index of similarity and the UPGMA algorithm.

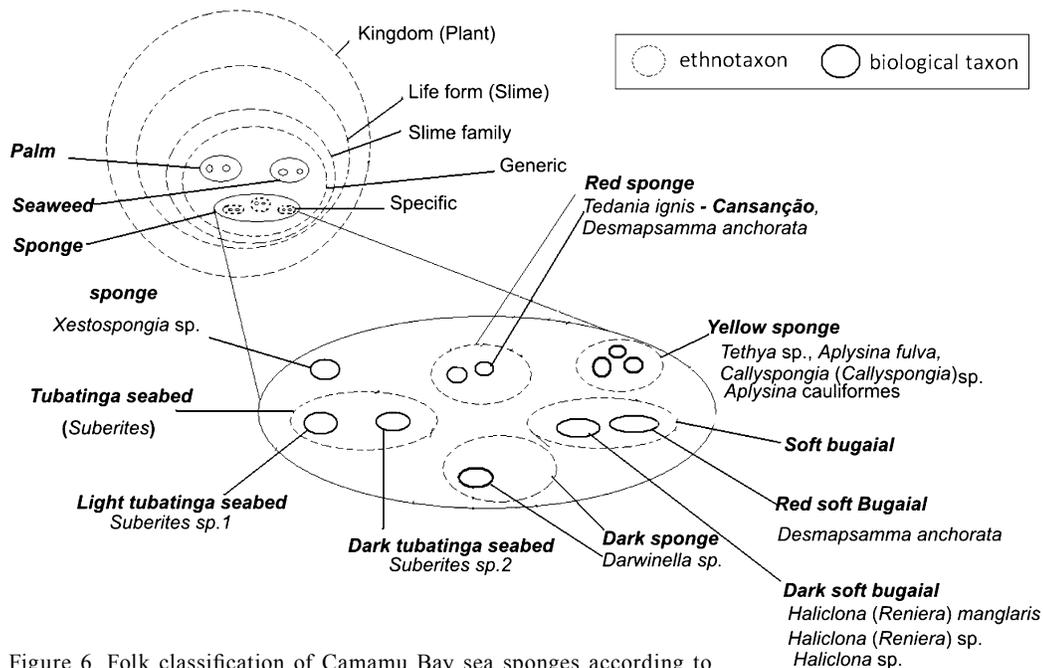


Figure 6. Folk classification of Camamu Bay sea sponges according to Berlin (1992).

however they have the same body shape and consistency (Figure 4b). This informant collected the morphotype that presents a yellow pale coloration, which was identified as *Aplysina fulva* (Pallas, 1977). His statement shows the possible existence of new species sharing some characters among them.

Discussion

The slime ethnocategory is equivalent to the Life Form ethnobiological rank according to Berlin's principles of ethnobiology classification. The slime-type organisms are then included in the Kingdom ethnobiological rank labeled as 'Plant' (see Figure 6). In general, folk classifications at a specific level are made based on the recognition of several characters (Berlin, 1973). At first sight, this statement would contrast with the classification of Porifera in this study. Most of the interviewees just use the color pattern to classify and nominate sea sponges, although they do recognize different shapes and consistencies. It seems that coloration is the most salient and easiest character used by people in order

to transmit knowledge about them.

Berlin (1973) claimed that the identification of animals within the taxa included in the specific ranking is due to, in general, the high cultural significances they present, no matter if these are of usefulness, dangerousness or other. Thus, it is possible that fishermen from Pontal do Contrato do recognize *Tedania ignis* due to its dangerousness. As Haddad-Júnior (2003) mentions, *Tedania ignis* is responsible for many accidents involving fishermen and marine sciences students.

Taxonomically, the main characters used for identification of Porifera are: color, shape and body texture, shape of the openings of the exhalant and inhalant channels, consistency, skeleton organization, and types and sizes of spicules (Mothes *et al.*, 2006). The respondents observed many of these traits, such as the presence of holes (big or small), which were cited when informants referred to the material a porifer is made of ('soaked small hole'). Indeed, this trait is the one that differentiates sea sponges from the other marine elements grouped together in the ethno-

category 'slime'. Moreover, the local knowledge on the components of the skeleton is absent, because fishermen do not have the technological means to see them, as spicules of most species are microscopic. On the other hand, these structures have been noticed as something causing an itch in some species.

As Berlin *et al.* (1973) stated, ethnobiological classifications that are in total accordance with the scientific classification are very rare, even if their hierarchical rankings are equivalent. This occurs due to the disagreements about how to characterize plants and animals among the taxa by both classificatory systems. As an example, the present study shows that animals are culturally perceived and taken as plants. However, the distinction between these knowledge systems is not accentuated, since science itself has also classified poriferans as plants for centuries. There was a time that sea sponges were classified as an intermediate group, situated between plants and animals, the zoo-phytes (Haeckel, 1879; Muri-cy and Hajdu, 2006). Historical accounts show that this debate had initiated in antique

Greece with Aristotle (century III b.C.; Hooper and Soest, 2002). In this regard, the inhabitants of the county of Pontal do Contrato, perceiving sea sponges as plants, did nothing different than the scientific thinking before the end of the XVIII century. Moreover, authors like Boster *et al.* (1986) have suggested that the similarities between folk and scientific classification may indicate a universal principle of classification, at the same time they reinforce the idea of the true existence of species.

Concluding remarks

Artisanal fishermen from the county of Pontal do Contrato, at Camamu Bay, Bahia State, Brazil, have a direct contact with sea sponges of various types, shapes and colors, which are fished by trawl nets. These fishermen consider sponges as plants, along with other marine organisms, including algae. Therefore, it is possible that there is a marine botanical folk knowledge, another ethnobiological area little explored. Moreover, studies like this can help in conservation strategies, as well as in other areas of science offering memes, places where organisms live, ecological interactions, and how they are used for cultural or medicinal purposes.

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