



# Nyale: Sumba's Typical Polychaeta in Cultural and Science Studies as Authentic Science Learning Materials

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**Abstract:** One of Indonesia's local wisdom is *Timba Nyale*. The *Timba Nyale* tradition is held every year in March-April, where the people of Sumba flock to the coast while waiting for the appearance of *Nyale*. This research aims to understand the meaning of *Timba Nyale* cultural studies and analyze the importance of Science in *Nyale* to be used as authentic Science learning material. This research was conducted in Buku Bani Village, Ate Dalo Village, Kodi District, Southwest Sumba Regency, East Nusa Tenggara. The method used is a qualitative method using grounded theory. Data collection was done through interviews, observation, documentation, and literature study. The results showed that *Nyale* has a significant meaning which is a marker for the success or failure of the harvest for the people of Sumba. *Nyale* in the Sumba tradition also has scientific values, including the importance of preservation and maintaining the conservation of species called *Nyale*. Analysis of learning outcomes in Animal Anatomy and Physiology courses in one of the private universities in Sumba shows that *Nyale* can be studied in the practicum of animal anatomy and physiology courses.

**Keywords:** Culture study; *Nyale*; Science learning material; Science study

## Introduction

Indonesia is the largest archipelago in the world, with 17,499 islands stretching from Sabang to Marauke. This condition gives Indonesia a wealth of local culture and potential. Local wisdom is also understood as an effort made by humans to use reason in understanding and determining attitudes toward an object or event in a specific time and space (Fajarini, 2014; Hasim et al., 2017; Rummar, 2022; Suhartini, 2009). One of Indonesia's local wisdom is *Timba Nyale*, the local wisdom of Sumba Island, East Nusa Tenggara. "*Timba Nyale*" is one of the local cultural heritages still being implemented and awaited by the people of Sumba Island, East Nusa Tenggara. The *Timba Nyale* tradition is held every year in March-April, where the people of Sumba flock to the coast while waiting for the appearance of *Nyale*. The people attending are those from the coastal area and from all communities who want to pick up *Nyale* as a delicious food ingredient missed every year.

"*Nyale*" is one of the sea animals (sea worms) whose appearance has an essential meaning for the indigenous people of Sumba. The culture adopted by the people of Sumba today is part of the ancestors' cultural heritage and will continue to be passed on to their descendants. The inheritance of *Nyale* culture aims to make every descendant understand their cultural history (Khoirul, 2017). The preservation of tradition is important and must be done internally and externally. Internally, the local community of Sumba uses an oral way to tell a culture to the next generation. However, because of the oral story, not all Sumbanese people know, and many things are missed. In addition, from the external side, there has been no effort to preserve this culture through writing or a form of inheritance that future generations can use to understand the existing culture. In the aim of preserving and maintaining local culture, especially *Nyale*, education has an important role.

Education must be able to train students to be sensitive to see and explore information on all problems faced in the real world. Education is no longer concerned

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with conceptual knowledge but more than that; education must train and familiarise various skills and shape student character. Education today must be able to design a learning process that can optimize the entire learning process by utilizing various learning resources in the surrounding environment. Learning what is close and honest will make learning more meaningful for each student.

Authentic learning is very suitable for education in Indonesia because it has abundant natural resources that must be explored and used. The potential and local wisdom in Indonesia is an exciting learning resource and will make learning more meaningful for students because it relates to their culture and environment. Indonesia's cultural wealth needs to be studied as an authentic learning resource in addition to presenting real problems in learning and a way to preserve the culture that will be passed on to descendants (Huda, 2017). Authentic learning exposes learners to real problems and invites students to design authentic projects that direct students to solve these fundamental problems (Apedaile, 2020; Hidayati et al., 2022; Lombardi et al., 2007; Taasoobshirazi et al., 2006).

In authentic science learning, learning about and learning from nature is integral. Ethnoscience is a strategy to create a learning environment by integrating culture as part of the science learning process (Fahturrozi, 2022; Rusman, 2013; Sarini et al., 2019; Setiawan et al., 2017) so that the learning provided to students becomes useful for their lives (Dewi et al., 2017; Khusniati, 2014). *Timba Nyale*, as a specialty and local wisdom of Sumba, needs to be studied so that the meaning of this tradition is not simply lost. In Science learning, *Nyale* is a marine invertebrate animal that needs to be studied more deeply. Many questions need to be studied in science learning to provide deep meaning for students in Sumba. Questions What is *Nyale*, and where does it appear? Is it true that it only appears once a year? Why does it only appear in a particular month? Become a vital basis for exploring. In authentic learning, by presenting problems and questions about *Nyale*, science learning will become meaningful and exciting for students in Sumba. Based on the above description, this research aims to understand the meaning of *Timba Nyale* cultural studies and analyze the meaning of science contained in *Nyale* itself to be used as authentic science learning material. So, this research aims to understand the meaning of *Timba Nyale* cultural studies and analyze the importance of Science in *Nyale* to be used as authentic Science learning material.

**Method**

This research was conducted in Buku Bani Village, Ate Dalo Village, Kodi District, Southwest Sumba Regency, East Nusa Tenggara. This location was chosen because it is the location of the *Timba Nyale* ritual. The research location can be seen in Figure 1.

This research is a qualitative study using grounded theory (Huang et al., 2008; Rahayu et al., 2021, 2017) where data collection is collected using interviews, observation, documentation and literature review. Interviews used an open structure which was then developed based on research needs. Interviews were addressed to traditional leaders, in this case, who are special customary elders who handle the *Nyale* tradition called *Rato Nyale*; *Rato Nyale*'s representative, the traditional elders of Buku Bani village, and the people of Buku Bani were present and participated in the interview process. During the interview process, an Indonesian language teacher assisted us in translating some of the sentences that were delivered using the Kodi language. This teacher is also a child of Buku Bani village who lives in the traditional village and always participates in the *Timba Nyale* ritual. The characteristics of the informants can be seen in Table 1.



**Figure 1.** Research location (Bani Village Books, Kodi Sub-district, Southwest Sumba Regency, NTT)

**Table 1.** Information Characteristics

Village	Information Characteristics	Quantity
Buku Bani	Men, <i>Rato Nyale</i> , Farmer, > 60 years old	1
	Men, Vice of <i>Rato</i> , Farmer, > 60 years old	1
	Men, indigenous people, Farmer, 50 - > 60 years old	5
	Men, Teacher, 35-45 years old	2

Following up on the interview results, the researcher observed the plants used by traditional leaders in predicting the accuracy of the *Nyale* collection day. Researchers were allowed to walk around the traditional village and take documentation on the plants used in predicting the appearance of *Nyale*.

Furthermore, researchers conducted a literature study to analyze the value of science that may be contained in the *Nyale* tradition. Furthermore, we will analyze the Graduate Learning Outcomes (LLOs) in animal anatomy and physiology courses as authentic learning materials for students in Sumba. This analysis becomes the primary material that will be carried out for further research to develop a learning program for animal anatomy and physiology using *Nyale*.

Qualitative data analysis through several processes, including 1) recording the results of interviews and other field notes, 2) coding data, 3) collecting and clarifying the results that have been obtained, 4) making explanations and descriptions by connecting various information obtained, and 5) concluding.

**Result and Discussion**

*Timba Nyale* culture is a culture that has been carried out for generations and is believed by the Kodi community in an interview conducted on Sunday, February 27, 2022. Rato *Nyale* (Tari Mone accompanied by Rangga Mete's representative) with the Buku Bani Village, indigenous people explained several essential points related to the Meaning of *Nyale*, the History of *Nyale*, and the *Nyale* Ritual.



**Figure 2.** a) The people of Sumba flock to the coast to witness the tradition of *Nyale* summoning by Rato Adat. b) The community caught *Nyale*. c) Excuse me ritual (Source: Documentation of Geterudis Kerans, 2022)

Figure 2c shows the ritual of excuse and permission before starting the interview. When we were welcomed to interview traditional leaders, we were first welcomed with a traditional village tradition as a sign of permission so that what was discussed and conveyed in the interview was genuine and approved. In this ritual, we gave betel nuts and areca nuts, which were put into eight wooden plates. These eight wooden plates represent the eight traditional houses in the village.

*Nyale Culture Study*

*Nyale* in Kodi culture has a significant meaning regarding planting. The indigenous people of Kodi believe that the appearance of *Nyale* is a sign to them of how their crops will turn out that year. The appearance of *Nyale* in large numbers and with varied colors indicates that the Kodi people will have an abundant harvest. Conversely, if the *Nyale* appears in small numbers, it will signify hunger in the Kodi community. However, according to Rato *Nyale* (one of the

extraordinary customary figures referred to as the King of *Nyale*), many or few *Nyale* appearances must remain grateful, and rituals will still be carried out as usual. *Nyale* culture has been traditionally practiced by the indigenous people of "Buku Bani" (Figure 3). It is in this village that the *Nyale* ritual has been performed since ancient times.



**Figure 3.** The traditional village of Buku Bani, Southwest Sumba, is one of the locations for the *Timba Nyale* tradition (Source: Documentation of Geterudis Kerans, 2022)

Once upon a time, there was a couple, Rato Mangil and Mama Boro. They have a Karabba or *Nyale* place because only they can do the *Nyale* tradition and know its appearance. Besides Karabba, they also prepared colorless Sumba cloth and sarong (Kambala). The ends of the cloth do not yet linger, so Rato Mangil and Boro spin each end of the cloth and sarong. After preparing everything, Rato Mangil counts seven darks, which means counting seven nights after the moon is dark and then going to the sea wearing a cloth that has been woven and spun at the end. After arriving at the sea, Rato Mangil will dive and rise seven times, then return to the land and throw a little thread from the spun end of the cloth into the sea. The pulled thread symbolises the many *Nyale* that vary in length and twists and turns. Boro, and his wife, rato *Nyale* will then go to the sea and perform the same ritual by diving six times and returning to land to take the thread at the end of the twisted sarong and throw it into the sea.

After that, they say that *Nyale* has existed, and to be grateful for the appearance of *Nyale* as a symbol of an

abundant harvest, they go ashore and rejoice and give thanks by performing pascola (Figure 4). Pasola tradition continues *Nyale* culture because it expresses gratitude for the abundant harvest. In Pasola culture, throwing activities are carried out on horses. This celebration used to mean great gratitude for the abundance they would get in their harvest. At first, this Thanksgiving celebration was only carried out by the indigenous people, but later to make it more crowded and many people involved, they began to invite people from various villages in Kodi.



**Figure 4.** Pasola tradition as an expression of gratitude for the appearance of *Nyale* (Source: Documentation of Geterudis Kerans, 2021)

This *Nyale* cultural tradition is performed by Rato *Nyale*, who comes from the village of "Buku Bani". Rato *Nyale* is hereditarily determined by his lineage; not everyone can perform the *Nyale* ritual. Rato *Nyale* and the indigenous people of the Bokubani village will perform the *Nyale* ritual with the following stages:

**Poddu:** is the initial ritual as a symbol of purifying the village and is performed for one month starting in November. During this ritual, the Kodi community is prohibited from doing activities such as selling animals, burning animals, and not pounding rice in the afternoon. These activities are prohibited as a symbol of cleansing and purifying the village.

**Kabba:** is a follow-up ritual to poddu where, after one month of cleansing and purifying the village, the Rato then announces to each village that the purification ritual has been completed and the community can now carry out activities prohibited in the previous stage. After paying attention to the moon's position (when the

moon has risen), the rato will pick coconuts, catch crabs and then feed the traditional dogs, followed by the next stage of the ritual.

**Kawoking:** At this stage, traditional poems are sung as a ritual to call the *Nyale* to emerge.

**Pandogolong:** While chanting verses, the ritual of pulling on the sand is performed with the aim that the *Nyale* that appear will be wrapped around each other and appear in large numbers. After seeing the dark moon in February, Rato *Nyale* and the indigenous people will count seven darks (7 nights after the dark moon) to catch *Nyale*. *Nyale*, which appears in February, is called Nale Bokolo by the community. After the dark moon in March, the community will count six darks and then perform the *Nyale* collection ritual.



**Figure 5.** A. Bamboo plant; B. Wuumarupa plant used by Sumba people as a sign to predict the time of *Nyale*'s appearance

Figure 6 shows the types of plants used in predicting the time of *Nyale*'s appearance. Rato *Nyale* can predict the appearance of *Nyale* by looking at three types of plants, namely bamboo shoots (figure 5a), Todo, and Wuumarupa (figure 5b). These plants grow around the traditional village. The bamboo plants used as markers are old bamboo plants that have been planted since the ancestors' time and even existed before the interviewed figures were born. Researchers could only see and document bamboo plants and Wuumarupa plants during the observation. Based on information obtained from indigenous people, Todo plants only grow during the rainy season, so these plants cannot be seen when it is not the rainy season. *Nyale* ritual not only contains cultural values for the indigenous people and the people who interpret it but has various studies that can be used in learning, especially in Science learning. Some rituals in *Nyale* ritual activities have links to original science studies and scientific explanations, as seen in Table 2.

**Table 2.** *Nyale* Ritual Activities Linked to Indigenous Science and Scientific Explanations

<i>Nyale</i> Ritual	Original Science Studies	Scientific review/explanation
The ceremony purifies the village by prohibiting all animal trading, slaughtering, and burning.	The community obeys all prohibitions because they fear the consequences of breaking the rules.	The community has carried out activities to preserve domesticated animals by prohibiting trading and slaughtering.
<i>Nyale</i> clues by seeing the emergence of bamboo shoots, which have existed and been planted since the ancestors' time.	The community does not cut down or cut bamboo carelessly because it is an ancestral heritage and has meaning in the rituals performed.	By not cutting bamboo carelessly and preserving bamboo that has existed for many years, the community also preserves the bamboo itself. The bamboo used has a classification: Kingdom: plantae Sub kingdom: viridiplantae Super divisi: embryophyta Divisi: tracheophyta Sub divisi: spermatophytina Kelas: magnoliopsida Super ordo: lilianae Ordo: poales Family: poaceae
<i>Nyale</i> collection is not done carelessly and must go through a ritual initiated by the customary rato.	The community picks <i>Nyale</i> only at the time determined by Rato Adat, and they believe it is the right time, and there will be.	By not taking it carelessly and only in the season of its appearance, it also aims to preserve the natural <i>Nyale</i> because this sea worm exists throughout the year, only appearing on the surface of the seawater in certain months with a specific purpose, namely to carry out the mating process. The traditional collection then helps to maintain the survival of <i>Nyale</i> . To properly understand the scientific study of <i>Nyale</i> , further research is still needed, so it is very appropriate if it is raised in the teaching process so that the understanding of <i>Nyale</i> , in terms of anatomical structure and physiology, can be well described.
<i>Nyale</i> appears in large numbers and only once a year	People believe the appearance of <i>Nyale</i> in large numbers symbolizes prosperity, and the time determined by Rato Adat is the best time to pick <i>Nyale</i> .	The appearance of <i>Nyale</i> in large numbers and certain seasons is intended for its breeding process. This process must be studied further scientifically because appearance is not always appropriate. There are environmental factors that influence its appearance.

*Nyale* Science Study from Literature Review

*Nyale* is a type of marine worm that appears in large numbers to reproduce and appears once a year in February-March (Mailoa et al., 2020; Pamungkas et al., 2021). The protein content ranges from 10.55% - 15.05% and has an Iodine content that is good for growth, the immune system and fetal growth (Hermawan, 2015; Liline, 2017; Pamungkas et al., 2021). It was reported that the average protein content of seaworms is above 50% and the average fat content below 15%, so seaworms are suitable as an alternative animal protein for the community.

The specificity of *Nyale* needs to be studied to maintain its survival. Polychaetes are considered indicator organisms of marine pollution (Belan, 2004; Giangrande et al., 2005; Solis-Weiss et al., 2004) as the main prey of benthic fishes, as bait for angling targeted species of bycatch fishermen, as fishing bait as well as food supplements in aquaculture (Olive, 1999) as well as a dietary component due to its positive effects on shrimp reproduction (Meunpol et al., 2005) and high levels of polyunsaturated fatty acids (Wouters et al., 2001). As a natural food, marine worms positively influence the reproductive system of Penaeid shrimp, where marine worm feed can improve sperm quality, gonad

maturation, and increased ovulation. This positive effect is because sea worms contain progesterone, 17 $\alpha$ -hydroxyprogesterone, prostaglandin E2, arachidonic acid, eicosapentaenoic acid, and docosahexaenoic acid, which have an essential role in gonad maturation (Meunpol et al., 2007; Younsi et al., 2010). Sea worms also contain a 28 kDa serine protease enzyme with active characteristics up to 500C and pH 4-12, which is resistant to detergents (Joo et al., 2001). The body of marine worms also contains a new peptide compound, Perinereis aibuhitensis (Perinerein), composed of 51 amino acid residues and structurally hydrophobic. Activity tests show that Perinerein is antibacterial against gram-negative and gram-positive bacteria and antifungal (Meunpol et al., 2007).

The appearance of "*Nyale*" sea worms in large numbers is intended for breeding (Pamungkas et al., 2021). Sea worms (Polychaeta) usually appear on the sea surface during the breeding season because the breeding system is external, with a period once a year in March or April. Polychaeta sea worms can be reproduced in clonal (asexual) and epitoky (sexual). Clonal reproduction is done by regenerating the cut body parts or forming stolons. While in reproduction in epitoky, half or all parts of the worm's body, at certain times, will become

sexually mature. When swarming, marine worms will change from benthic organisms that live on the bottom of the water to planktonic organisms that float in the water column.



**Figure 6.** *Nyale* from Kodi Beach is a collection of sea worms in various colours (brown, white, green) (Source: Geterudis Kerans documentation, 2022)

*Graduate Learning Outcomes Analysis*

*Nyale* is one of the unique characteristics of Sumba Island. The appearance of *Nyale*, a hereditary tradition celebrated and anticipated by the people of Sumba in general, is an interesting phenomenon that needs to be studied and developed in the learning process so that this cultural heritage does not become extinct. This diversity must continue to be preserved so that efforts to preserve existing diversity begin now. Preservation efforts can only be made if *Nyale* is introduced in learning as a faunal wealth owned by Indonesia, especially Sumba Island, and needs to be preserved. Sustainable in the sense that the preservation of *Nyale* diversity and *Nyale* culture can still be passed on to future generations. For this purpose, regional specialties must be raised in Science learning in the classroom to make learning more meaningful. Authentic learning about *Nyale* will be exciting and valuable for students in Sumba.

**Table 3.** Analysis of Graduate Learning Outcomes Imposed on Animal Anatomy and Physiology Courses

Graduate Learning Outcomes imposed on Animal Anatomy and Physiology courses
Attitudes
S6. Cooperate and have social sensitivity and concern for the community and environment.
S9. Demonstrate an attitude of responsibility for work in their field of expertise independently
Knowledge
P2. Mastering the theoretical concepts of problem-solving in science education procedurally through a scientific approach
P5. Mastering operational knowledge about the function and how to operate practical tools in the field of science to support the learning process.
General Skills
KU2. Demonstrate independent, quality, and measurable performance
KU5. Make appropriate decisions in the context of problem-solving in their field of expertise, based on the results of analysis of information and data;
Special Skills
KK4. able to make decisions and provide appropriate solutions to science education problems based on accurate data and information either independently or in groups
KK10. Able to conduct conventional and instrumentation practicum in science by utilising the surrounding nature and local culture.
Learning Outcomes for Animal Anatomy and Physiology Course
1. Outline the basic concepts of Anatomy and Physiology
2. Analyse and describe anatomical structures in vertebrate and invertebrate animals.
3. Describe physiological processes, including the integumentary, muscular, and skeleton. Digestive system, respiratory system, circulatory system, excretory and reproductive systems, nervous system, endocrine glands, sensory organs, and immune system in vertebrate and invertebrate animals.
4. Describe the characteristics of typical Sumba animals based on their growth patterns to provide ideas and directions in compiling and planning an authentic inquiry project-based practicum.
5. Plan and design a practicum on the identification of typical Sumba animals Plan a practicum on cultivating typical Sumba animals by describing the factors that affect their life patterns.
CPMK can be developed to raise <i>Nyale</i> as a practicum material in learning Animal Anatomy and Physiology
S1: Contributing to the improvement of the quality of life in the community.
S2: Work together and have social sensitivity and concern for the community and environment.
S3: Demonstrate an attitude of responsibility for work in their field of expertise independently.
P1: Analyse and explain the body structure of Annelida animals, one of which is <i>Nyale</i> .
P2: Analyse and explain the physiological processes that include the digestive, respiratory, and reproductive systems in Annelida animals, including <i>Nyale</i> .
P3: Synthesise various information and data related to <i>Nyale</i> cultivation.
KU 1: Plan and design <i>Nyale</i> identification and cultivation practicum based on Authentic inquiry project critically and creatively.
KK 1: Carry out and compile a report on the results of the Authentic inquiry project-based practicum on <i>Nyale</i> .
KK3: Reflecting on the Practicum Process

From the appearance of *Nyale* on the sea surface only once a year and appearing with interesting color variations, many questions arise that can then be raised in appropriate learning to understand the phenomenon. The questions that arise as science are: a) What exactly is *Nyale*? b) What environmental conditions invite *Nyale* to surface in the sea? c) Is it true that *Nyale* only appears once a year, or is there a native habitat for *Nyale* on the coast? d) Is *Nyale* one type of marine worm or a collection of several types? e) What is the anatomical and physiological structure of *Nyale*?

To answer these questions, science learning must bring this uniqueness into learning and practicum in the classroom so that science learning becomes more meaningful and can answer the problems around students. Before conducting learning and practicum using *Nyale*, it is necessary to analyze the learning outcomes of graduates. For this purpose, researchers tried to analyze the learning outcomes of the Animal Anatomy and Physiology course in one of the private universities on Sumba Island. Analysis of Graduate Learning Outcomes associated with the presence of *Nyale* can be seen in Table 3.

Based on Table 3, *Nyale* can be used as one of the authentic learning materials for learning animal anatomy and physiology. *Nyale* in learning animal anatomy and physiology can be studied through practicum activities. In practicum activities about *Nyale*, students can learn about the anatomical structure and physiology of *Nyale* and then can conduct *Nyale* cultivation trials in the laboratory. For this purpose, future researchers must conduct a trial and design a practicum program based on the field test results.

## Conclusion

*Nyale* is a type of sea worm that comes to the surface of seawater in certain seasons and becomes a cultural characteristic celebrated and awaited every year. For the cultural community on Sumba Island, *Nyale* has a significant meaning which is a marker for the success or failure of the harvest in that year. *Nyale* in Sumba tradition also has scientific values, including the value of preservation and maintaining the preservation of species called *Nyale*. In order to preserve *Nyale* culturally, it is necessary to present authentic science learning by using *Nyale* in science learning. The results of the Learning Outcomes Analysis in the Animal Anatomy and Physiology course at one of the private universities in Sumba show that *Nyale* can be studied in the practicum of animal anatomy and physiology courses.

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## Author Contributions

Research team contributed to writing of this scientific work, namely: ideas, conception, data collection, analysis and

interpretation of results, manuscript preparation, article writing, and revision process of this research.

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## Conflicts of Interest

The authors declare that there is no conflict of interest in the publication of this article.

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