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Using Ethnotaxonomy to Assess Traditional Knowledge and Language Vitality: A Case Study with the Vaie People of Sarawak, Malaysia

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Abstract This article demonstrates the potential of using ethnotaxonomy and nomenclature to assess the vitality status of indigenous languages and traditional knowledge at the ecosystem level. We collaborated with the Vaie people of Sarawak, Malaysia, applying a mixed methodology approach that relies on free-listing to a large extent. We applied the Traditional Knowledge and Language Vitality (TraLaVi) index to assess traditional knowledge and language vitality against five major parameters, specifically: language priority, retrieval of information, knowledge erosion, lexical recognition, and social support for exchange of traditional knowledge. The results show that with a TraLaVi score of 0.84, the Vaie language can be considered "safe". Individuals practicing the traditional occupation of fishing fared better (mean=0.90) than those of the non-fishermen group (mean=0.77). However, when the language vitality was assessed using the Language Vitality and Endangerment assessment tool of UNESCO, the results indicate that the Vaie language could potentially be in the "unsafe" zone, highlighting the differences between the ecosystem based approach of TraLaVi and the macro-approach of UNESCO. However, these approaches can be applied in a complementary manner to generate a more accurate portrayal of the language vitality scenario.

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Introduction

One of the major contributions of ethnobiology was the conceptualization in the 1960s of a theoretical framework for folk taxonomy (Hunn 2007). Three decades later, the concept of Biocultural Diversity was born, coinciding with a renewed academic interest in the synergy between indigenous languages, traditional knowledge (TK), and biological diversity. This concept paved the way for a new wave of research that focused significantly on the use of vernacular/folk names, analyzing them both from a linguistic and TK perspective (Evans 1997; Kakudidi 2004; Turpin 2013; Unasho 2013; Zariquiey 2014). Researchers have demonstrated that folk names are not mere lexemes, but condensed forms of knowledge with multiple applications. Analyses of folk names have helped us understand how migrant populations adapt to their new ecosystems (van Andel et al. 2014), indicate linguistic stratigraphy (Bostoen 2007), solve important questions related to distribution of iconic trees (Rangan et al. 2015), and unravel mysteries of domestication of food plants (Donohue and Denham 2009). Drawing from a collaborative study conducted with the Vaie people of Sarawak in Malaysia, this article demonstrates an additional dimension of folk taxonomy: the possibility of using folk names to assess a community's TK and language vitality simultaneously (Franco et al. 2015).

The Vaie People and Language

The Vaie people, popularly known as Ba'ie or Bintulu, speak a language known by various names such as Bintulu, Ba'ie, or Vaie (Asmah 1983; Ibrahim 1971). The community prefers to refer to themselves and

their language as "Vaie". Consequently, in this article the term "Vaie" is used to refer to both the community and their language. Traditionally, they practice a fishing system called *panau* where fishes such as *Parastromateus niger*, *Atule mate*, *Carangoides praeustus*, *Carangoides armatus*, and *Carangoides coeruleopinnatus* are trapped using a lure made from *nipah* leaves (*Nypa fruticans* Wurmb). Some researchers consider Vaie to be a variant of the Melanau language (Asmah 1983), though Blust (1974) and Zaini (1989) consider it to bear little similarities to other Melanau languages in the region. *Ethnologue* too lists the language as a distinct one under the name "Bintulu" (Simons and Fennig 2017), in concurrence with the emic consideration. Most of the Vaie people in Bintulu maintain a diglossic situation in which Malay and Vaie languages are used for different purposes. Besides native speakers, the Vaie language is also spoken by a small section of other indigenous communities in Bintulu. Today, the Vaie language is spoken in the *kampung* (villages) close to Bintulu town, namely: Kampung Masjid, Kampung Sinong, Kampung Datuk, Kampung Sibiew, Kampung Baru, Kampung Jepak, Kampung Sebuan, Kampung Batu Sepuluh, and Kidurung. According to the Department of Statistics, Malaysia, the total population of Bintulu in the year 2010 was 183,892, with Ibans comprising 42%, Chinese 21%, Melanau 12%, Malays 10%, and Bidayuh, Indian, Non-Malaysians and other indigenous groups 14%. It is highly possible that Vaie people were included under the Melanau group, bringing the population to an estimated 23,000. Our interviews with the Vaie people indicate that the population may in fact number only around 18,000, qualifying it as a "small" community as defined by Krauss (1991). The Alliance for Linguistic Diversity (2015) considers Vaie to be a "vulnerable" language (also see: Ghani 2006).

Methodology

We assessed language priority (criterion A), adeptness in retrieving information in both the autochthonous language and allochthonous language (criterion B), knowledge erosion (criterion C), lexical recognition (criterion D), and social support for exchange of TK (criterion E) by applying the TraLaVi index developed by Franco et al. (2015). The study closely follows the methodology suggested by Franco et al. (2015), except that plants have been replaced by fishes in the present study. As the community is traditionally a fishing community, we assumed that knowledge related to fishes would be common to all members of the community, and community members who have drifted away from the traditional occupation of fishing could show decline in TK related to fishes. The fieldwork for the research was undertaken in December 2014–February 2015 in collaboration with the Vaie people of Kampung Kuala Tatau, Kampung Segan, Kampung Sebuan, Kampung Jepak, Kampung Batu 10, Kampung Sebiew, Kampung Baru, Kampung Dato, Kampung Sinong, and Kampung Masjid, Kidurong, and Kampung Asyakirin in the Bintulu region.

Ethical clearance for the study was obtained from the Curtin Ethics Committee (Approval No. CSEA 041214, dated 4 December 2014), and a research permit was attained from the Sarawak State Planning Unit prior to the commencement of the study. Informed consent was obtained from each individual before the interview; the entire study conforms to the code of ethics of the International Society of Ethnobiology (2006). In addition, informal conversations were carried out with prominent individuals of the community to ensure that the methodology and outcome were culturally relevant, and reflected the community's needs and concerns. Fourteen knowledgeable individuals aged 59 and above (male n=8, female n=6), selected on the basis of their reputation as traditional knowledge holders, were invited to participate in open-ended interviews to elicit baseline information on the Vaie culture, language, and TK. Vaie TK on fishes, including folk names and their meanings, culinary recipes, totems, taboos, ecology, and folklore were documented through in-depth interviews. We used the International Phonetic Alphabet (IPA) to transcribe Vaie fish names following Ghani (1992), and the data were analyzed to develop an outline of Vaie ethnotaxonomy and its nomenclatural system.

In the second phase, 16 elders (male n=8, female n=8) above the age of sixty who did not participate in the previous phase were randomly selected and invited to free-list 25 fish names. This participant group was limited to only Vaie people with Vaie parents and Vaie grandparents, to conform to the cultural definition of "Vaie" prevailing within the community. From the interviews, 25 final candidate fishes were shortlisted on the basis of salience (Table 1). Open-ended conversations were carried out after the focused interviews to elicit TK on all fishes known to the Vaie community. The shortlisted fishes were identified scientifically using field guides and identification

sheets (Khiok and Ali 2014; Khiok and Gambang 2009). The primary author then accompanied community members to various fish landing sites and local markets to collect specimens and to photograph the identified fishes; these photographs were later used as visual stimuli for criterion D.

The third phase involved interviewing members of the younger generation identified through snowball sampling (Luborsky and Rubinstein 1995). Since the community practiced fishing traditionally, fishing was considered a key indicator of their culture and the participants in this phase were divided into two clusters: Cluster 1 was comprised of participants who were involved in the traditional profession of fishing (n=30, 20–50 years); Cluster 2 (n=30, 20–50 years) was comprised of participants who were not involved in fishing as a profession. Cluster 1 was comprised of 15 males who practiced fishing and 15 female participants whose husbands were fishermen. Culturally, Vaie women are not involved in fishing, yet they play an important supportive role in helping their husbands to grade fish according to their quality, and in converting them into value-added products. Cluster 2 included five individuals who practiced fishing as a hobby, as well as their wives, in addition to people who did not practice fishing. Participants were requested to answer a simple questionnaire for assessing language proficiency. The questions were:

(1) What is your first language (L1)?

(2) How many languages do you speak?

(3) What is your second language (L2)?

(4) My proficiency in Vaie language is*…

(5) My proficiency in (L2) is*…

*Note that questions 4 and 5 used a five point Likert scale: very poor (1), poor (2), moderate (3), good (4), and very good (5).

Subsequently, semi-structured interviews were also conducted to elicit information required to calculate the Traditional Knowledge and Language Vitality Index (TraLaVi), and results were tabulated following Franco et al. (2015) for analysis. During the interviews, participants free-listed fish names both in L1 and L2; the time taken for free-listing was noted following Franco et al. (2015). In addition, the results of the language proficiency questionnaire used by the participants were correlated with Criteria A of the TraLaVi table to understand if the participants' self-assessment reflected the actual extent of priority accorded to L1. Criterion C of the TraLaVi assesses participants' ability to interpret vernacular names, which becomes problematic in the case of fishes denoted by unanalyzable lexemes; participants with sound language and TK would not be able to provide the meaning for such names. To overcome this, a full rating was given for such lexemes provided that participants clearly identify the lexeme as "unanalyzable". While the values for the TraLaVi table indicate the overall vitality status of the community's language and TK, sub-analyses of the clusters and the genders provide insights into the intra-communal dynamics of the language and TK. To provide a comparative outlook of the linguistic vitality scenario, the TraLaVi values were then compared against that of the Language Vitality and Endangerment (LVE index) developed by the UNESCO Ad Hoc Group on Endangered Languages, in 2003. Further, an open-ended interview consisting of leads meant to elicit information required for the nine factors listed by the LVE was carried out with the 60 respondents who had participated in the TraLaVi interviews. These results were also compared with that of TraLaVi.

Results and Discussion

As a fishing community, the Vaie people regard fish as being culturally significant. All 25 fishes salient in the community are either fried, steamed, made into curry, or smoked/ salted for preserving. Notable mentions were *njen tengiriq* (*Scomberomorus commerson* and *Scomberomorus guttatus*) consumed as a tonic/vitalizer by new mothers, *njen tavai* (*Wallago leerii*) that is featured prominently in folklore connected to the origin of the Vaie people, and *njen gilau* (*Clarias nieuhofii*) and *njen seqael* (*Plotosus canius*), which are considered toxic, thus requiring detoxification before consumption. A noteworthy feature of the shortlisted fish names is that the majority (20/25) of the lexemes used to denote the fishes were unanalyzable. The results of the study are presented in Tables 1–3. On the basis of the average value obtained, the TraLaVi scale categorizes language and TK into dead (0), moribund (0.1–0.25), endangered (0.25–0.5), vulnerable (0.5–0.75), and safe (0.75–1). With an average value of 0.84, the Vaie language can be deemed in the "safe" category on the TraLaVi scale (Table 2). This indicates that the Vaie people have been adept in balancing their proficiency in L1 and L2 while at the same time maintaining their TK. In general, individuals from the fishermen group C1 did better (mean=0.90) than

Table 1 Twenty-five culturally salient fishes of the Vail people.

No.	Vernacular Name	Scientific Name	Uses	Meaning of Vernacular
1	*Njen ruay*	*Parastromateus niger* (Bloch, 1795)	Sold fresh, unaffordable fish around 20-35 MYR/ kg. It is given three names according to its life stages and size. Used to prepare *umai raway.* The stomach is used to prepare *tagik* (preserved in glass bottle).	Unanalyzable
2	*Njen tengiriq*	*Scomberomorus commerson* (Lacepède, 1800)	Sold fresh, smoked, or salted. Commonly fried, cooked with turmeric, or as curry. Preparation of *pipos* that is consumed by new mothers.	Unanalyzable
		Scomberomorus guttatus (Bloch & Schneider, 1801)		
3	*Njen jamah*	*Atule mate* (Cuvier, 1833)	Sold fresh. Caught using the *panau* traditional fishing technique. Preparation of *umai.* One of the favorite fishes of Vaie.	Refers to the *Carangidae* group
4	*Njen puqoq*	*Otolithoides biauritus* (Cantor, 1849)	Sold fresh, dried or salted. Favorite fish; dried or salted, fried or cooked as curry.	Unanalyzable
5	*Njen buleng*	*Nemapteryx macronotacantha* (Bleeker1846)	Sold fresh and smoked. Has a corrupted name *njen proton saga.*	Unanalyzable
6	*Njen piras*	*Setipinna breviceps* (Cantor, 1849)	Sold fresh. Preparation of *umai.* The most favorite fish for making *umai.* Sometimes also fried.	Unanalyzable
7	*Njen pay*	*Neotrygon kuhlii* (Müller & Henle, 1841)	Sold fresh or salted. Heart of the fish is highly priced. Commonly cooked as curry, roasted, or as *masak sambal*.	Unanalyzable
8	*Qeret*	*Carcharhinus amblyrhynchos* (Whiteley, 1934)	Sold fresh. Preparation of *umai*, commonly cooked as curry and soups. Sometimes roasted without oil since the fish is oily.	Unanalyzable
9	*Njen seqael*	*Plotosus canius* (Hamilton, 1822)	Sold fresh. It is toxic and requires treatment before cooking. Commonly cooked with coconut milk, curry, or *masak sambal.*	Unanalyzable
10	*Njen lata'*	*Lobotes surinamensis* (Bloch, 1790)	Sold fresh. Head is the favorite part, commonly cooked as curry or spicy-sour curry. Some people also like to roast the fish.	Unanalyzable
11	*Njen gagog*	*Arius* sp.	Sold fresh and smoked. Has a corrupted name *njen proton saga.*	Unanalyzable

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Table 1 Twenty-five culturally salient fishes of the Vail people.

No.	Vernacular name	Scientific name	Uses	Meaning of Vernacular
12	*Njen reman*	*Rastrliger kanagurta*	Sold fresh or salted. Commonly fried. Abundant and always available in markets.	Unanalyzable
		Rastrelliger brachysoma (Bleeker, 1851)		
13	*Njen taoq*	*Osteogeneiosus militaris* (Linnaeus, 1758)	Sold fresh or smoked**.**	Unanalyzable
14	*Njen tavai*	*Wallago leerii* (Bleeker, 1851)	Sold fresh. Commonly cooked inside bamboo (*pansuh*). Appears in the folklore connected	Unanalyzable
15	*Njen bageng*	*Arius maculatus* (Thunberg, 1792)	Sold fresh and smoked, has a corrupted name *njen proton saga*.	Unanalyzable
16	*Njen bibeq*	*Pampus argenteus* (Euphrasen, 1788)	Sold fresh. Commonly fried for consumption.	Unanalyzable
17	*Njen da'ie*	*Kryptopterus kryptopterus* (Bleeker, 1851)	Sold fresh. Commonly cooked without gut due to the high fecal content. Considered as a favorite fish of Chinese.	*Da'ie*= *ta'ie* = feces; the fish feeds on feces
18	*Njen kelapa*	*Lactarius lactarius* (Bloch & Schneider, 1801)	Sold fresh or dried. Abundant and always available in market. Commonly fried or cooked with turmeric.	*Kelapa*= coconut; fish is as white as coconut meat.
19	*Njen selusong*	*Lates calcarifer* (Bloch, 1790)	Sold fresh. Unaffordable fish around 35 MYR/ kg. Usually steamed, head preferred and	Unanalyzable
20	*Njen terupbuk*	*Tenualosa toli* (Valenciennes, 1847)	Sold fresh or salted following Kuching culture. Usually fried.	Unanalyzable
21	*Njen bengetot*	*Ilisha pristigastroides (*Bleeker 1852)	Sold fresh or dried and salted. Usually made into the pickle "*masak sambal*" and roasted. Makes a sound "tod" when caught.	"*tot*"= sound tot; the fish produces a "tot" sound when caught.
22	*Njen gilau*	*Clarias nieuhofii* (Valenciennes, 1840)	Sold fresh and usually fried, cooked with coconut milk, and *masak sambal*. It is mildly toxic and has to be detoxified before consumption	Unanalyzable

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Table 1 Twenty-five culturally salient fishes of the Vail people.

No.	Vernacular name	Scientific name	Uses	Meaning of Vernacular
23	*Njen qapaw*	*Epinephelus sexfasciatus* (Valenciennes, 1828) *Cepalopholis boenak* (Bloch, 1790) *Epinephelus areolatus* (Forsskål, 1775)	Sold fresh. Fish with one of the highest price tags; in huge demand for seafood restaurants. Commonly prepared as *masak sambal,* curry, or fried.	Unanalyzable
24	*Njen tuqol*	*Thunnus tonggol* (Bleeker, 1851)	Sold fresh or smoked. Usually fried, cooked with turmeric, cooked as curry or with coconut milk. Abundant and always available in mar-	Unanalyzable
25	*Njen alu-alu*	*Sphyraena barracuda* (Edwards, 1771)	Sold fresh, Usually cooked as curry or with coconut milk.	*Alu-alu* = rice pestle; the fish is cylindrical and long as the pestle used to pound rice.

Table 2 Traditional Knowledge and Language Vitality of Vaie people.

			Proficiency		Time (s)		Criteria					TraLaVi
P[a]	Cluster	Sex	L1[b]	L2[c]	L1	L2	A	B	C	D	E	Score
1	1	M	5	5	219	269	25	24	24	23	23	0.952
2	1	M	5	5	217	452	25	24	23	23	23	0.944
3	1	M	5	5	196	537	25	25	25	23	23	0.968
4	1	M	5	3	261	303	25	24	24	24	24	0.968
5	1	M	5	3	189	377	25	24	24	23	23	0.952
6	1	M	5	3	276	562	25	25	25	24	24	0.984
7	1	M	5	5	604	602	25	21	21	23	23	0.904
8	1	M	5	5	249	427	25	25	25	24	24	0.984
9	1	M	5	4	225	871	25	24	24	23	23	0.952
10	1	M	5	5	240	256	25	22	22	20	20	0.872
11	1	M	5	5	233	335	25	23	23	17	17	0.840
12	1	M	5	3	329	1050	25	21	21	19	19	0.840
13	1	M	5	5	114	233	25	22	22	17	17	0.824
14	1	M	5	4	128	267	25	25	25	21	21	0.936
15	1	M	5	4	147	150	25	24	24	25	25	0.984
16	1	F	5	5	267	332	25	25	25	22	22	0.952
17	1	F	5	5	161	338	25	24	24	21	21	0.920
18	1	F	5	5	178	234	25	24	24	20	20	0.904
19	1	F	5	5	905	745	25	23	23	19	19	0.872
20	1	F	5	5	360	891	25	25	25	20	20	0.920
21	1	F	5	5	334	863	25	25	25	18	18	0.888
22	1	F	5	5	303	189	25	24	24	21	21	0.920
23	1	F	5	5	224	180	25	24	24	18	18	0.872
24	1	F	5	5	283	319	25	24	24	17	17	0.856
25	1	F	5	5	385	413	25	22	22	16	16	0.808
26	1	F	5	5	233	315	25	24	24	18	18	0.872
27	1	F	5	4	365	716	25	23	23	16	16	0.824
28	1	F	5	5	114	120	25	22	22	13	13	0.760
29	1	F	5	3	211	Gave up	25	24	24	20	20	0.904
30	1	F	5	3	236	Gave up	25	22	22	15	15	0.792

[a]Participant, [b]Vaie language, [c]Malay language,*part-time fishermen.

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Table 2. Traditional Knowledge and Language Vitality of Vaie people.

			Proficiency		Time (s)		Criteria					TraLaVi
P[a]	Cluster	Sex	L1[b]	L2[c]	L1	L2	A	B	C	D	E	Score
31	2*	M	5	3	447	861	25	23	23	21	21	0.904
32	2*	M	5	5	199	462	25	24	24	23	23	0.952
33	2*	M	5	5	220	308	25	24	24	22	22	0.936
34	2*	M	5	5	447	867	25	23	23	22	22	0.920
35	2*	M	5	5	207	209	25	25	25	23	23	0.968
36	2	M	5	5	259	242	15	23	23	20	20	0.808
37	2	M	5	5	200	252	25	21	21	6	6	0.632
38	2	M	5	5	233	180	15	23	23	15	15	0.728
39	2	M	5	5	772	347	0	20	20	13	12	0.520
40	2	M	5	5	368	316	15	23	23	13	12	0.688
41	2	M	5	5	247	293	25	25	25	19	19	0.904
42	2	M	5	3	364	335	15	25	25	15	0	0.640
43	2	M	5	5	364	335	15	25	25	15	15	0.760
44	2	M	5	5	262	618	25	24	24	20	20	0.904
45	2	M	5	4	309	154	0	22	22	20	20	0.672
46	2	F	5	5	181	334	25	24	24	24	24	0.968
47	2	F	5	5	675	304	0	24	24	17	17	0.656
48	2*	F	5	5	287	349	25	23	23	22	22	0.920
49	2	F	5	2	468	1006	25	22	22	10	2	0.648
50	2	F	5	4	511	482	15	23	23	12	2	0.600
51	2	F	5	4	649	229	0	21	21	12	5	0.472
52	2	F	5	5	231	229	15	24	24	11	11	0.680
53	2	F	5	5	227	212	15	21	21	14	13	0.672
54	2	F	5	3	265	258	15	23	23	13	10	0.672
55	2	F	5	2	668	Gave up	25	24	24	11	11	0.760
56	2	F	5	2	224	411	25	25	25	14	14	0.824
57	2*	F	5	5	280	204	15	25	25	21	21	0.856
58	2*	F	5	4	236	456	25	23	23	19	19	0.872
59	2*	F	5	3	236	456	25	23	23	17	17	0.840
60	2*	F	5	5	419	562	25	23	23	15	15	0.808

[a]Participant, [b]Vaie language, [c]Malay language,*part-time fishermen.

those who belonged to the non-fishermen group, C2 (mean=0.77). However, with a mean score of 0.77, the language and TK vitality of the non-fishermen group is only slightly above the score of 0.75 that would indicate a "vulnerable" status as per the TraLaVi scale. The results of the study can be further compartmentalized as below.

Language Priority and Retrieval of Information (Criteria A, B)

The Vaie people are generally proficient in more than one language. In addition to Vaie, they may also be adept in Melanau, Iban, Kedayan, or Malay, with the Malay being either standard Malay, Brunei Malay, or both (Edris and Ghani 1992; Ghani 2014). All 60 participants declared themselves as proficient in Vaie in the language proficiency questionnaire. Thirty-nine (65%) participants declared that they were "very good" in Malay, while eight (13%) participants stated that they were "good" in Malay (four from C1 and 4 from C2); ten participants (17%) regarded their proficiency in Malay to be "moderate" (six from C1 and four from C2), and three participants (5%) rated their language skills in Malay to be "poor" (all from C2). All participants who declared themselves not fully proficient in Malay were above 40 years old, indicating greater acquisition of Malay in the age group < 40. Three respondents (one from C1 and two from C2) were unable to complete the list of 25 fishes in Malay and withdrew from the survey after ten minutes. A weak correlation (r=-0.235) was found between self-assessed language proficiency and the time taken for free-listing in L1 and L2 (criteria A). This indicates that Vaie people are unaware of the loss of proficiency in L1, with their L2 gradually replacing L1. This is ascertained from the fact that people who self-assessed their L1 proficiency as "very good" had difficulty in free-listing fish names in L1, but had little difficulty in L2. Although the mean score for Criteria A that assessed adeptness in bilingualism is 21.7, the non-fishermen group (C2) had a noticeably lower score of 18.3 than the group (C1, 25.0) who practice fishing. Perhaps this is the beginning of a language shift in the case of Vaie members who have moved away from their traditional occupation of fishing. However, both clusters returned similar scores for Criterion B indicating that participants exhibited a healthy trend in retrieving information in L1. This could also mean that any shift towards L2 happening on the ground can be reversed with appropriate interventions or measures.

Knowledge Erosion (Criterion C)

As understood from the average values, participants from both the clusters did well in this criterion (C1=23.6; C2=23.3) indicating that knowledge erosion is not a concern at this stage. However, it should be noted that the majority of the fishes in the culturally salient list (20/25) were identified by unanalyzable lexemes by the community (Table 1). This is a major drawback of the methodology noted during the course of study. Although unanalyzable lexemes are a vital component of ethnotaxonomic systems, this criterion may not be reliable in situations where a large number of unanalyzable lexemes turn out to be salient.

Lexical Recognition (Criterion D)

All participants reported that they were able to relate positively to the visual stimuli comprising of 25 fish images. Participants from Cluster 1 had a higher mean score of 20.1, while those in Cluster 2 had a lower mean score of 16.6, indicating that individuals who followed the traditional occupation of fishing were more skilled in recognizing the species due to their constant interaction with the marine ecosystem and the diversity of fishes they came across. Our study also found noticeable differences between the mean scores of males (C1=21.9, C2=17.8) and females (C1=18.3, C2=15.1). This phenomenon could be attributed to the fact that Vaie women culturally play a supportive role in fishing, though it is predominantly the men who carry out the fishing activities. The inability to recognize visuals may not always correspond to lack of knowledge, as lack of familiarity with the medium (Case et al. 2006), or lack of ability to feel the specimens (Wester and Yongvanit 2006), could also influence the ability to recognize specimens. Our interviews also showed that Vaie TK is gender sensitive with men specializing in areas such as the ecology and morphology of fishes while women are the custodians of knowledge related to the processing and grading of fish, recipes, and folklore.

Social Support for Exchange of TK (Criterion E)

Of the total sample pool (C1 and C2), 65% reported that their parents were the primary source from which they had acquired TK. However, a cluster-wise analysis shows that all participants of the fishermen group (C1) had acquired their knowledge on fish (primarily) from parents and grandparents. In the non

they had acquired knowledge from the local markets where they procure fish, 31% from parents and grandparents, 3% from media, 2% from books and schools, and 11% from friends. This shows that for the community members who had experienced occupational shift, the market had become the main source of knowledge of fishes, though parents and family members continued to impart TK.

The surveys undertaken at the three main markets of Bintulu (Pasar Utama Bintulu, Pasar Kampung Baru, and Pasar ABF) show that Malay, Melanau, Vaie, Chinese, Iban, and Bahasa Indonesia are the most frequently used trade languages depending on the ethnicity of the traders and consumers. It is known that people who migrate from various places, with different sets of TK and skills, adapt to new ecosystems while influencing each other (van Andel et al. 2014). This feature was also observable at the markets studied, where vendors traded fish along with the knowledge and lexemes connected to them. Two phenomena directly influencing TK and language noted in this study are: 1) the grouping of fishes and 2) the modification of fish names based on the market language.

The grouping of fish is the clustering of fishes in the market for trade purposes. At these local markets, the terms *satu tompok* (one bundle), *ikan campur* (mixed fish) and *ikan satu Malaysia* (One Malaysia Fish) are used to group multiple fishes. Thus*, satu tompok* is a simple cluster of otherwise unrelated fishes put together in a plate, bucket, or simply heaped and sold together, while *ikan satu Malaysia* is another group of unrelated fishes named after the popular "One Malaysia" campaign of Malaysia's Prime Minister that emphasizes ethnic harmony, national unity, and efficient governance. Consumers who buy these groups of fishes gradually develop a cognitive notion that these categories of fishes are related to each other. An example of a modified name is "*ikan proton saga"* meaning "Proton Saga fish", used to group four different species such as *Osteogeneiosus militaris*, *Nemapteryx macronotacantha*, *Arius* sp., and *Arius maculatus*. Proton Saga is a popular car brand, produced by Proton Malaysia Ltd., and fishes generally grouped under this name tend to have a larger head profile with a black-silver color, reminding people of the car brand. The Vaie names for these fishes are *njen buleng, njen taoq, njen gagog* and *njen bageng* respectively. These two phenomena show how markets influence TK and language in the non-fishermen group (C2). An analysis of how markets contribute to the distortion of traditional knowledge related to fish names showed that markets were the source of 58% of inaccurate knowledge (modification/substitution of local folk names with non-local ones), and 53% of the correct knowledge related to fish names and identification. Additionally, markets have also replaced 31% of fish names with names from languages other than Vaie.

Of the total participants of both clusters, 97% (58 people) were married adults who reported active transmitting of fish knowledge to their children. Participants from C2 reported their inability to acquire TK from the formal schooling they had undergone, and 20 participants of this cluster were of the view that the TraLaVi assessment helped them realize the limitations they had in terms of depth of Vaie TK. Interestingly, only 10% of the 60 respondents reported acquiring knowledge from folklore and taboos (C1 n=5 individuals, C2 n=1 individual). Our baseline study documented very little information on folklore and taboos, indicating that a significant portion of this segment of TK and language may irrevocably be lost. The results for this criterion show that social interaction had been taking place, albeit at different levels, that are specific to the clusters. In the fishermen group, the traditional route of TK acquisition and transmission largely prevailed, while in the non-fishermen group, the market provided the main platform for knowledge acquisition. Although rural markets are referred to as important sites for social interaction and exchange of knowledge (Tumbuan et al. 2006; Watson and Studdert 2006), they open up greater possibilities of external knowledge infusion into the community, in the absence of community-driven conservation efforts.

Assessing Vaie Language Vitality Using UNESCO's LVE Framework

Table 3 provides the summarized results of the Language Vitality assessment using UNESCO's Language Vitality and Endangerment index (LVE). The results show that the language vitality scenario of the Vaie language can be considered as largely "unsafe" despite the high language pride exhibited by the community. The results of LVE indicates that intergenerational transmission, number of speakers, trends in language usage, response to new domains and education, policy support, and documentation are not on the side of the language and urgent intervention measures are required.

Table 3 Results of the Language Vitality and Endangerment index (UNESCO 2003).

Factor	Degree	Statement
1. Intergenerational Language Transmission	4 (Unsafe)	All sixty participants declared that they speak Vaie and are also involved in transmitting it to the younger generation. Vaie children and families speak Vaie as L1. However, our interviews show that the language usage is confined exclusively to the domains' family and peer group (Vaie to Vaie), and transmitted incompletely between generations. Thus, the Vaie language falls into the Unsafe (rating: 4) category, as suggested by the LVE.
2. Absolute Number of Speakers	18,000 (Unsafe)	Spoken by around 18,000 individuals, Vaie can be categorized as a small language community.
3. Proportion of Speakers within the Total Population	4 (Unsafe)	Three participants reported that 60% of the community speak Vaie, another three people reported 70%, 21 reported 75%, 11 reported 80%, 10 reported (85%), four reported 90%, and seven reported 95%. The maximum percentage of 100% was declared by just one participant. The mean value of 80% could be considered as the proportion of Vaie speakers to the total Vaie population, and can thus be categorized as "unsafe".
4. Trends in Existing Language Domain	4 (Multilingual parity)	1. Malay becomes the primary language for official purposes 2. Vaie is used in social domains 3.Vaie people are bilinguals 4. The Vaie believe that Malay is the language of social and economic opportunity
5. Response to New Domain and Media	1 (Minimal)	The Vaie language is used only in a few new domains. Of the 60 participants, 43 were of the view that Vaie is used only in a few new domains and 17 stated that there were no new domains where Vaie is applied. Although we see the beginning of a progressive upward trend here, as we came across a few websites, blogs, social media pages using Vaie, we provide a rating of "1" indicating a long way ahead.
6. Material for Language Education and Literacy	1 (Little material)	Vaie orthography is known to the community and some material is being written. We could document only two books and a dictionary in Vaie. Participants were of the view that little educational materials are available in Vaie despite the earnest efforts of a few community members. Thus, we assign a score of "1", indicating that little materials are available to the community in L1.

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Table 3 Results of the Language Vitality and Endangerment index (UNESCO 2003).

Factor	Degree	Statement
7. Governmental and Institutional Language Attitudes and Policies, Including Official Status Use	4 (Differentiated support)	Malay is the national language Government recognizes the Vaie language The Vaie language is mostly confined to domestic and social domains
8. Community Members' Attitudes toward Their Own Language	5 (High language pride)	Immense language pride; all participants were of the view that the Vaie language has to be promoted in all domains. Participants link the Vaie language with their identity, heritage and ecosystem.
9. Amount and Quality of Documentation	1 (Inadequate)	Only a few grammatical and short word lists exist; there are no known audio-visual recordings of Vaie. People widely hold the belief that Vaie is an orally transmitted language.

Conclusion

The study concludes that the Vaie language could be regarded as "safe" for the moment. However, closer scrutiny indicates that community members practicing traditional fishing demonstrate greater language and TK vitality than non-fishermen. Although the results for the non-fishermen group indicate a "safe" status, the results hover close to the "vulnerable" status, indicating the need for intervention. An important outcome of the TraLaVi approach is the insight into knowledge transmission patterns within the community, as understood from criterion E. This provides opportunities for planning precise intervention measures for sustaining the Vaie language and TK. As expected, TraLaVi provides an ecosystem level evaluation of the status of language and TK vitality. Nevertheless, it addresses only one part of the question and ignores the external factors influencing language and TK vitality. In this study, the external factors influencing language vitality have been established only by the application of the UNESCO index that deals exclusively with language vitality. Other limitations noted during the course of study are: 1) tracing the origin of fish names. Our respondents often struggled to identify the loan words. In-depth interviews delving into the cultural background of the lexemes were helpful; a superficial application of the index would have been either insufficient or resulted in erroneous data. 2) Elaborate fieldwork is required at least during the initial stage to document information on fishes. The lead researcher was living with the community for the entire course of the study which helped in expediting data collection. 3) As noted in Franco et al. (2015), the TraLaVi approach may not be suitable for languages that are not ecosystem specific. In the Vaie context, both the language and the TK are ecosystem specific. With due consideration to the abovementioned limitations, the study shows that TraLaVi can be successfully applied on the field to assess language and TK vitality, so as to complement existing indices such as the LVE developed by UNESCO.

Declaration of Conflicting Interests

We declare no conflict of interest with respect to the research, authorship, and/or publication of this article.

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