Philippine Journal of Science
154 No. (1): 27-35, February 2025
ISSN 0031 - 7683
Date Received: 19 Jul 2024

Seaweed Ethnobotany of Eastern Camarines Sur, the Philippines

Eljenmer L. Sindo[1,2]*, Michael A. Clores[1], Elluna Jane J. Bigcas[1], and Richard V. Dumilag[3]

[1]College of Sustainable Communities and Ecosystems (Caramoan Campus), Partido State University, Caramoan, Camarines Sur 4429 the Philippines
[2]Institute of Fish Processing Technology, College of Fisheries and Ocean Sciences, University of the Philippines Visayas, Miagao, Iloilo 5023 the Philippines
[3]Graduate School, Sorsogon State University, Sorsogon City Campus, Magsaysay St., Salog (Poblacion), Sorsogon City 4700 the Philippines

As traditional knowledge and its transmission gradually decimate, this study responds to the pressing need to document the local traditional knowledge regarding the use of seaweeds in eastern Camarines Sur. A semi-structured survey revealed that the locals were familiar with the food use of five seaweed species – namely, *Acanthopora spicifera*, *Caulerpa lentillifera*, *C. racemosa*, *Gelidiella acerosa*, and *Kappaphycus alvarezii*. *Caulerpa lentillifera* (use value or UV: 0.87; fidelity level or FL: 43.64) and *C. racemosa* (UV: 0.66; FL: 38.86) claimed medicinal properties to cure digestive and glandular diseases. *Caulerpa* species appeared to be the most ethnobotanically important seaweeds, whereas the carrageenan-producing species – *Kappaphycus alvarezii* – is farmed for livelihood purposes. Locals from Caramoan and Garchitorena have significantly better knowledge of seaweed use than the other municipalities. The transmission of traditional knowledge largely involved women as they were the primary source. Our results validated previous reports with traditional uses corresponding to their phytochemical properties (*i.e.* antimicrobial, antioxidant, and anti-inflammatory). Our study provides fundamental information for the sustainable resource management of these targeted species. The present results extend future work in extensive spatial and temporal coverages, the implication of modernization, and existing gaps in the sustainable management of seaweed ethnotaxa resources in eastern Camarines Sur and elsewhere in the Philippines.

Keywords: alternative livelihoods, Caramoan, *Caulerpa lentillifera, Caulerpa racemosa*, eucheumatoid, *Kappaphycus alvarezii*

INTRODUCTION

Although seaweeds are commonly used as food or medicine in the Philippines, the local ethnobotanical knowledge of these resources is at risk of being lost due to modernization and lack of documentation and transmission across generations (Dapar *et al.* 2020; Dumilag *et al.* 2022). The recognition of seaweeds as a promising resource has been established in the past (Blikra *et al.* 2021) and is a potential candidate for resilient foods due to their scalability and fast growth (Jehn *et al.* 2024). Due to the wide array of compounds produced by seaweeds, humans have also utilized them as sources of medicine (Anggadiredja 2009; Pérez-Lloréns *et al.* 2023).

The locals of eastern Camarines Sur, particularly in the Partido District, are facing the challenges and opportunities presented by tourism development and

*Corresponding author: elsindo@up.edu.ph

modernization. While tourism offers economic benefits and an opportunity to showcase local culture and natural resources, it raises concerns about sustainability and environmental preservation (Bradecina 2016; Lo and Alejandro 2022). The local use of seaweed as food and medicinal alternatives has been historically prevalent due to limited access to commercial food and medicine. However, recent publications rarely consider the human use and interaction with the resource (Magsayo *et al.* 2024). Thus, ethnobotanical studies are only imperative to ensure that this vital information is adequately documented, justifying the need for a seaweed ethnobotanical survey in the Partido District of eastern Camarines Sur.

MATERIALS AND METHOD

Data Collection

Twelve (12) coastal *barangays* with seaweed farms (Figure 1) were selected for the study – namely three sites each from Caramoan (13°46′15″ N 123°51′47″ E) at Paniman, Bikal, and Tabgon; Garchitorena (13°53′ N 123°42′ E) at Pambuhan, del Pilar, and Ason; Lagonoy (13°53′ N 123°42′ E) at Panicuan, Cabotonan, and Kinahulugan; and Tinambac (13°49′06″ N 123°19′28″ E) at Santa Cruz, Buenavista, and Cagliliog. Informed consent was obtained from each local government unit prior to the conduct of the interviews. In selecting the participants for the interview, stratified random sampling was used.

The surveys were conducted *via* interviews between October and December 2023, following the procedures outlined by Dumilag *et al.* (2022). A semi-structured survey questionnaire written in the local (Bikol) language was used to gather information on the respondent's demographics (see Table 1), local knowledge of seaweed use (*i.e.* local names and methods of utilization), and knowledge transmission (*i.e.* from whom they received the knowledge and to whom they transmitted it). Following Ong and Kim (2014), the locals were presented with an alphanumerically coded pictorial species list to validate our identified seaweeds. A species list was compiled for each site, with specimens (voucher) lodged at the Conservation and Restoration Laboratory of the College of Sustainable Communities and Ecosystems of Partido State University and in the *Herbarium Sorsogonense* of Sorsogon State University.

Data Analysis

Quantitative ethnobotanical indices used included use report (UR), use value (UV), and percent fidelity level (% FL). We followed the formula from Friedman *et al.* (1986), Trotter and Logan (2019), and Phillips and Gentry (1993) to measure these indices, respectively. Descriptive statistics was used to compare variables, with the Kruskal-Wallis test to determine the significant differences between variables at $p < 0.001$. Knowledge transmissions (*i.e.* sources and receivers) were visualized using a Sankey flow (https://sankeymatic.com/build/).

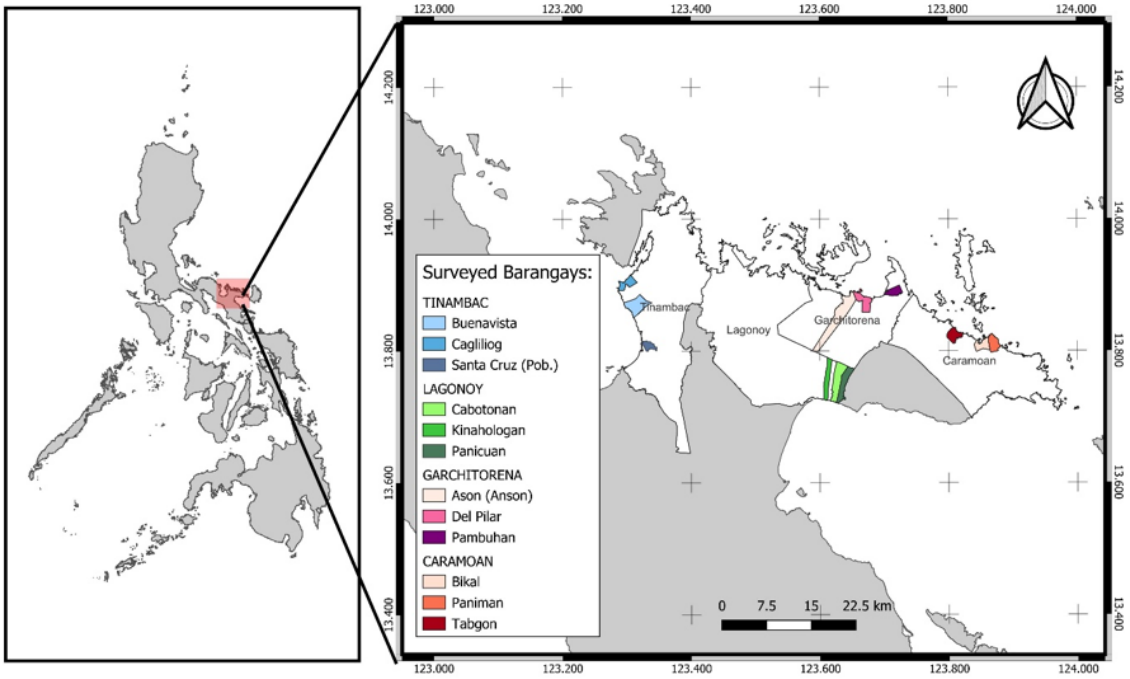

Figure 1. Map of the study site showing the 12 surveyed *barangays*.

RESULTS AND DISCUSSION

Demographic Profile

Table 1 presents the summary of the demographic profile of our respondents. Among them, 54.31% were female, 33.62% were 33–47 yr old, 62.77% were married, 51.98% graduated high school, and 51.72% were unemployed. Many worked as fishers or farmers (29.7%), laborers (17.6%), or *barangay* workers (19.8%).

Edible and Medicinal Seaweeds, Their Uses, and Mode of Preparation

The locals of eastern Camarines Sur consume five seaweed species (Figure 2) consisting of three rhodophytes [*Acanthopora spicifera* (M.Vahl) Børgesen*, Kappaphycus alvarezii* (Doty) L.M.Liao*,* and *Gelidiella acerosa* (Forsskål) Feldmann & Hamel] and two chlorophytes [*Caulerpa lentillifera* J.Agardh and *Caulerpa racemosa* (Forsskål) J.Agardh]. All rhodophytes were collectively known as *gulaman*, whereas chlorophytes were locally referred to as *lato*. The use of local names is prone to misidentification; thus, correct taxonomic identifications are critical. Only the *Caulerpa* spp. were claimed to have

Table 1. Demographic profile of the locals from eastern Camarines Sur.

Parameter	Municipality				
	Caramoan	Garchitorena	Lagonoy	Tinambac	All sites
Sample size	60	53	60	60	233
Sex					
Male	37 (61.67)	25 (47.17)	20 (33.90)	24 (40.00)	106 (45.69)
Female	23 (38.33)	28 (52.83)	39 (66.10)	36 (60.00)	126 (54.31)
Educational attainment					
Elementary level	12 (21.05)	18 (35.39)	19 (32.40)	23 (38.33)	72 (31.72)
High school level	33 (57.89)	28 (54.90)	26 (44.07)	31 (51.67)	118 (51.98)
College	10 (17.54)	5 (9.80)	13 (22.03)	6 (10.00)	34 (14.89)
Vocational/TESDA	2 (3.51)	–	1 (1.69)	–	3 (1.32)
Age, years old					
18–32	21 (35.00)	12 (23.08)	16 (26.67)	17 (28.33)	66 (28.45)
33–47	16 (26.67)	16 (30.77)	23 (38.33)	23 (38.33)	78 (33.62)
48–62	17 (28.33)	21 (40.38)	15 (25.00)	11 (18.33)	64 (27.58)
63–77	5 (8.33)	2 (3.85)	6 (10.00)	5 (8.33)	18 (7.76)
> 77	1 (1.67)	1 (1.92)	–	4 (6.67)	6 (2.59)
Nature of employment					
Professional	–	2 (3.85)	–	–	2 (0.86)
Non-professional	27 (45.00)	26 (50.00)	37 (61.67)	20 (33.33)	110 (47.41)
Unemployed	33 (55.00)	24 (46.15)	23 (38.33)	40 (66.67)	120 (51.72)
Civil status					
Single	19 (32.20)	6 (11.54)	23 (38.33)	16 (26.67)	64 (27.71)
Married	36 (61.02)	41 (78.85)	31 (51.67)	37 (61.67)	145 (62.77)
Widowed	4 (6.78)	5 (9.62)	3 (5.00)	7 (11.67)	19 (8.23)
Separated	–	–	3 (5.00)	–	3 (1.30)
Use seaweed as food					
Yes	59 (98.33)	48 (90.57)	39 (65.00)	30 (50.00)	176 (75.53)
No	1 (1.67)	5 (9.43)	21 (35.00)	30 (50.00)	57 (24.46)
Use seaweed as medicine					
Yes	42 (70.00)	43 (81.13)	20 (33.33)	10 (16.67)	115 (49.36)
No	18 (30.00)	10 (18.87)	40 (66.67)	50 (83.33)	118 (50.64)

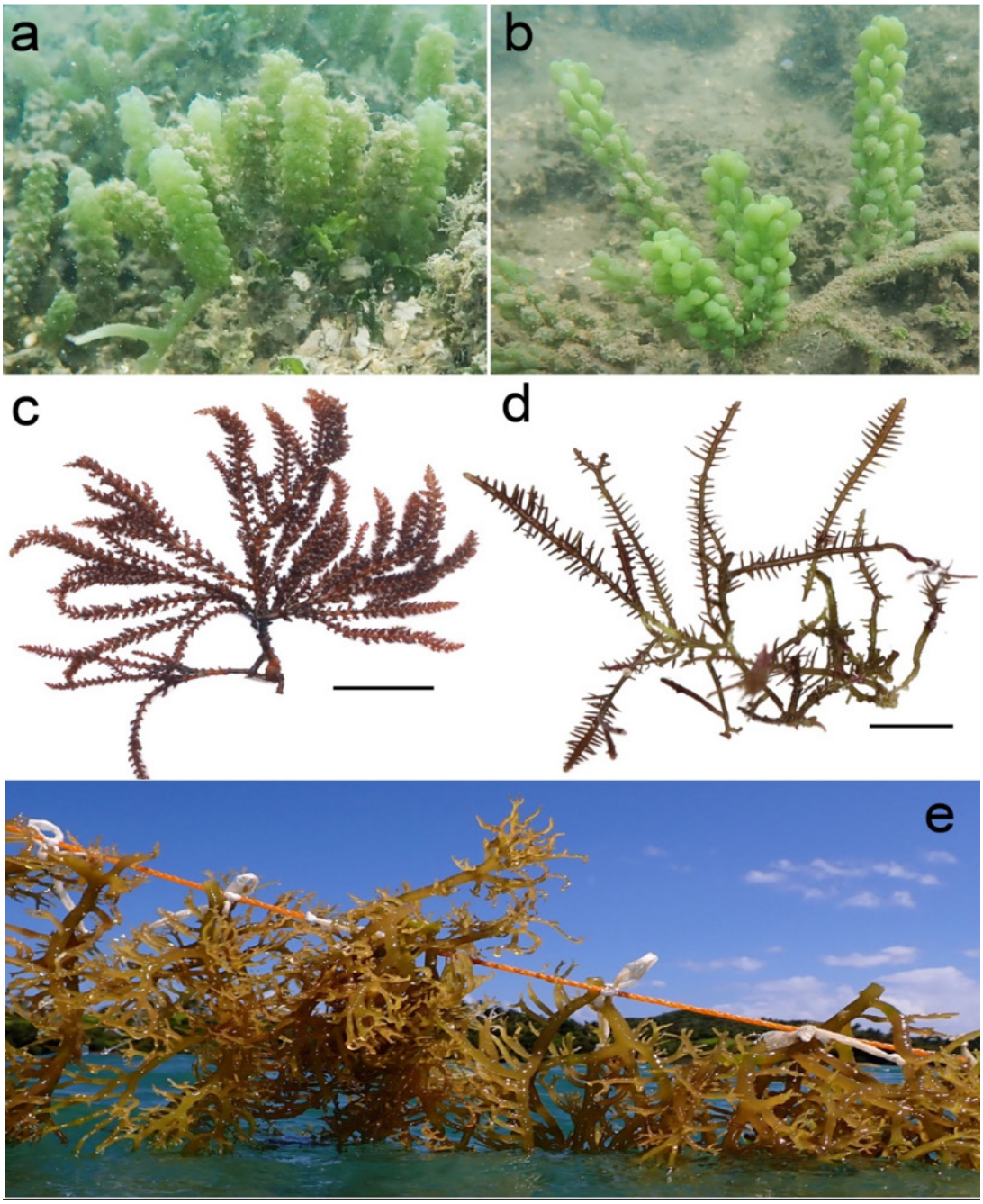

Figure 2. Edible and medicinal seaweeds used by the locals in eastern Camarines Sur: *Caulerpa lentillifera* J.Agardh (a); *Caulerpa racemosa* (Forsskål) J.Agardh (b); *Acanthophora spicifera* (M.Vahl) Børgesen (c; scale = 2 cm); *Gelidiella acerosa* (Forsskål) Feldmann & Hamel (d; scale = 2 cm); *Kappaphycus alvarezii* (Doty) L.M.Liao (e).

therapeutic indications. Table 3 shows the details of preparation described by the locals regarding their uses.

Knowledge Transmission

The locals from Caramoan and Garchitorena have significantly higher knowledge (Figure 3) regarding seaweed use than those from Lagonoy and Tinambac (Kruskall-Wallis test: X^2 df = 3, n = 176) = 30.5; $p < 0.001$). Caramoan and Garchitorena are geographically close to each other. The geographical proximity may have affected the knowledge transfer among these two communities. Save from where the locals reside, other demographic parameters (*i.e.* sex, age, civil status, educational attainment, and occupation) indicated no significant association with the number of known

Table 2. List of the edible and medicinal seaweed utilized by the locals from eastern Camarines Sur – including its local name, treated diseases, mode of utilization or administration, use reports (UR), use value (UV), and percent fidelity level (% FL).

No.	Species	Local name	Treated diseases	Mode of utilization or administration*	UR	UV	% FL
1	*Caulerpa lentillifera* J. Agardh	Lato	Goiter, diarrhea, indigestion, stomach aches, kidney problems, cancer	1,2,3,6	254	0.87	43.64
2	*Caulerpa racemosa* (Forsskål) J. Agardh	Lato	Goiter, diarrhea, indigestion, stomach aches	1,2,3,6	193	0.66	38.86
3	*Acanthophora spicifera* (M.Vahl) Børgesen	Gulaman		3	1	0.003	100
4	*Kappaphycus alvarezii* (Doty) L.M.Liao	Gulaman		1,2,3,4,5	12	0.04	100
5	*Gelidiella acerosa* (Forsskål) Feldmann & Hamel	Gulaman		4	2	0.007	100

*[1] raw; [2] pickled; [3] salad; [4] *dulsi*; [5] soup; [6] orally ingested

Table 3. Mode of utilization or administration and the corresponding preparation of the edible and medicinal seaweeds utilized by the locals.

Utilization or administration	Preparation
Raw	Locals harvest seaweed from the wild and wash it with seawater before consuming it directly; harvesting is usually done by hand.
Pickled	Locals prepare pickled seaweeds with vinegar or sometimes calamansi (*Citrus microcarpa*) extract. Dumilag *et al.* (2022) refer to this as seaweed salad. Seaweeds are initially washed and rinsed. Inedible parts such as the rhizoids in *Caulerpa* are removed.
Salad	Locals prepare seaweed salad in the same way as pickled preparation but with the addition of spices such as ginger, tomato, and onion, among others. Dumilag *et al.* (2022) refer to this as viand. Seaweed salads are usually prepared for visiting tourists.
Soup	Locals consume edible seaweed as soups by washing and rinsing it, then subjecting it to sun drying until almost moist-free. The dried seaweed is added to soup viand or as the main ingredient.
Candy (*dulsi*)	Locals eat seaweed as sweetened jellies. In the same preparation described by Dumilag *et al.* (2022), seaweeds are washed, boiled, and dried. Once dried bone white seaweed is achieved, sugar or milk is added immediately while the boiled seaweed powder-water mixture is set to cool.
Orally ingested	Locals administer medicinal seaweed similar to how it is eaten raw with the holdfast and other inedible parts removed.

ethnotaxa. The results of quantitative ethnobotanical indices are summarized in Table 2. *Caulerpa lentillifera* and *C. racemosa* exhibited the most uses and were identified as more ethnobotanically significant. Very few locals were familiar with the use of *Acanthophora spicifera* (0.34%) and *Gelidiella acerosa* (0.69%).

There was a continuous transmission of knowledge about seaweed use in the Partido District, with most locals (56.35%) acquiring knowledge from their female relatives (Figure 3). This may be in part due to the relatively higher frequency of female respondents. The unique position of women as knowledge holders stemming from their intrinsic connection to ethnotaxa resources (Voeks 2007) cannot be overemphasized. The gender-specific knowledge transmission highlights the important role women play in preserving local knowledge (Durbin 2011). The promotion of inclusive knowledge-sharing approaches is therefore desired. For example, inclusive and enhanced knowledge-sharing has led to better local decision-making outcomes in the southern Philippines (Hearne and Powell 2014).

Findings on the medicinal use of *Caulerpa lentillifera* and *C. racemosa* in Camarines Sur validated their previously reported pharmacological properties. The local knowledge of the medicinal properties of *Caulerpa,* believed to cure goiter, along with their palatability, may explain why they were mostly preferred. Local abundance may have also positively influenced their use. In the Indo-Pacific region, *Caulerpa* has been widely consumed as a food and traditional medicinal source (Zubia *et al.* 2020).

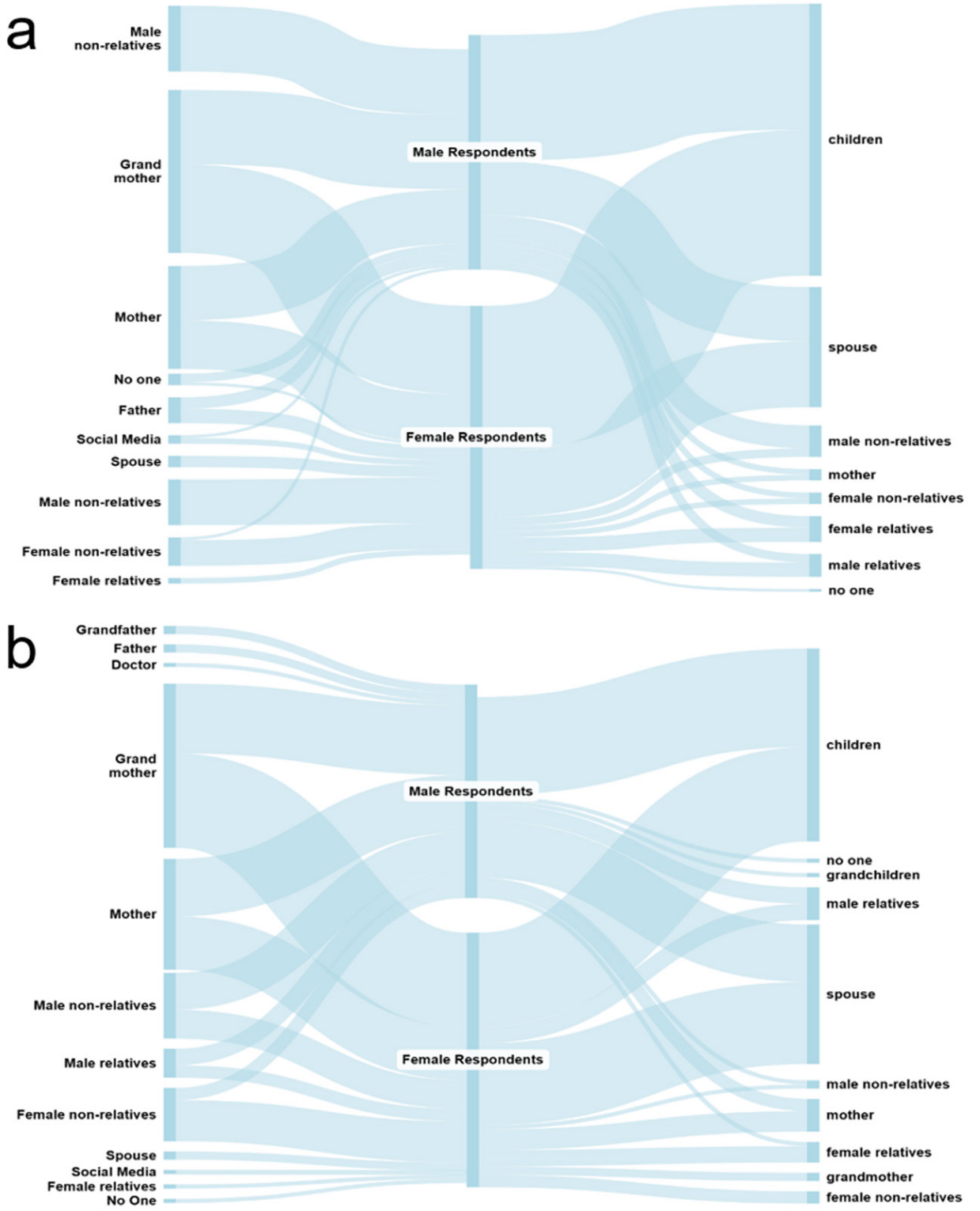

Figure 3. Knowledge transmission on edible (a) and medicinal (b) seaweeds. Data presented as weighted connections (flow). Flow thickness indicates the intensity of the weighted connections. Locals are grouped according to sex (center node), the knowledge source (left node), and the receiver of the knowledge (right node) transmitted by the locals. "No response" resulted in an imbalance in the overall weighted connections in the center node.

Table 4. Comparative frequency of seaweed ethnotaxa recorded in the Philippines and elsewhere.

Location	Number of seaweed ethnotaxa			Reference
	As food	As medicine	Total	
China	24	–	24	Xia and Abbott (1987)
Fiji	7	–	7	South (1993)
Indonesia	54	38	92	Anggadiredja (2009)
India	–	39	39	Yadav (2020)
Philippines				
Eastern Camarines Sur	5	2	7	This study
Eastern Sorsogon	10	3	13	Dumilag *et al.* (2022)
Ilocos Norte	96	34*	104	Galutira and Velasquez (1963); Velasquez (1977); Moreland (1979); Marcos-Agngarayngay (1983); Tungpalan (1983); Agngarayngay *et al.* (2005); Dumilag (2018); Dumilag and Javier (2022)
Tawi Tawi	7	–	7	Dumilag (2019)
Zamboanga City	3	–	3	Tito and Liao (2000); Ganzon-Fortes *et al.* (2006)

*Six species were exclusively used as medicine

Aside from carrageenan, *Kappaphycus alvarezii* reportedly has anti-inflammatory, antioxidant, antimicrobial, anticancer, and antidiabetic properties (Jalal *et al.* 2023). Locals used *K. alvarezii* primarily for livelihood rather than as food or medicine. This species is widely farmed in the Philippines, including in Camarines Sur. Since 1996, the annual production of *Kappaphycus* in the area has risen (Borja 2003), in part due to a growing number of recruited farmers over the years. Many coastal communities in Caramoan and Garchitorena regard seaweed farming as a primary or alternative source of livelihood. Income from farming seaweeds helped the local families meet their daily needs and supported the education of their children. These were common benefits of seaweed farming (Valderrama *et al.* 2013).

Only very few locals use *Acanthopora spicifera* and *Gelidiella acerosa*. These agar-producing red seaweeds reportedly have anticancer activity (Duraikannu *et al.* 2014). The former species has chemical constituents with reported pesticidal, antimicrobial, and anti-inflammatory properties (Rani 2013). Meanwhile, the latter taxon has bioactive compounds showing anticancer activity (Begum and Hemalatha 2022). In Ilocos Norte, *G. acerosa* is utilized for its medicinal properties as a cure for pulmonary, digestive, and glandular-related ailments (Dumilag and Javier 2022).

The locals from eastern Camarines Sur consumed seaweeds either raw, pickled, as a salad, or as a dessert (candy or *dulsi*). The locals of eastern Camarines Sur only add vinegar to pickle seaweed, similar to those from Indonesia (Anggadiredja 2009). Seaweed prepared as food varies per ethnic group (Abbott 1996). The locals in eastern Sorsogon (Dumilag *et al.* 2022) prepare seaweeds using all the known methods reported here, except as soup. Consuming seaweed as soup is already practiced, for example, in Indonesia (Anggadiredja 2009) and Korea (Rhee *et al.* 2011).

CONCLUSION

Our study contributes to the documentation of traditional knowledge of seaweed resources in Camarines Sur. The number of seaweed ethnotaxa presented in this study was relatively lower than those reported elsewhere and in the overall seaweed biodiversity of the country (see Table 4), emphasizing the need for more seaweed ethnobotany and biodiversity research. Nevertheless, even in areas with very few recorded resource ethnotaxa, understanding and cataloging species aids in conservation strategies (de Albuquerque *et al.* 2009). For instance, the high ethnobotanical indices measured for *Caulerpa* species may likely lead to increased exploitation pressure in Camarines Sur to meet the "extractivist" demands. It is known that resources with particular traditional uses are more vulnerable to harvesting due to being readily available and abundant (Wehi and Wehi 2010).

There are still major knowledge gaps despite the progress we made in documenting the seaweed ethnotaxa in the Partido District of eastern Camarines Sur. When designing future research, we recommend the following considerations: [1] investigate the spatiotemporal

variability of seaweed ethnotaxa in the entire region of Camarines Sur, [2] analyze the role of modernization in the possible decimation of knowledge transfer among the young generation in the area, and [3] determine sustainable management and the potential for biodiscovery of seaweed ethnotaxa in the region. The nature and scope of these gaps should also be examined and compared with similar efforts across other areas in the Philippines and elsewhere.

ACKNOWLEDGMENTS

This study was funded by the Commission on Higher Education under the Leading the Advancement of Knowledge in Agriculture and Science or CHED-LAKAS Project titled "Phytochemical Characterization of Macroalgae for Food and High-value Products" or PhycoPRO (LAKAS 2021-035) awarded to MAC and RVD, with additional funding from the Research and Development Office of the Partido State University and Sorsogon State University. Additional funds were given to RVD by the LinnéSys: Systematics Research Fund grant (funded by the Linnean Society of London and the Systematics Association) and the Department of Science and Technology–Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development or DOST–PCAARRD through the Socio-economics Research Division or SERD under the project titled “Enhancing the Development and Growth of Seaweed-based Enterprises in Sorsogon” (EDGES). The researchers acknowledge the valuable assistance provided by Karen Corre, Amy Esmeralda, Ian Parone, and Aldin Ongoda during the data collection process and to the local governments of Caramoan, Garchitorena, Lagonoy, and Tinambac for granting permission to conduct this study.

REFERENCES

ABBOTT IA. 1996. Ethnobotany of seaweeds: clues to uses of seaweeds. In: Lindstrom SC, Chapman DJ, editors. Fifteenth International Seaweed Symposium. Dordrecht: Springer Netherlands. p. 15–20.

AGNGARAYNGAY ZM, LLAGUNO AFC, AQUINO SG, TACLAN LB, GALACGAC ES. 2005. Edible seaweeds of Ilocos Norte: food preparations, other local uses and market potentials. Sulu-Celebes Sea Sustainable Fisheries Management Project, Quezon City, the Philippines. 27p.

ANGGADIREDJA JT. 2009. Ethnobotany study of seaweed diversity and its utilization in Warambadi, Panguhalodo areas of East Sumba District. J Teknol Lingkung 10(3): 297–310.

BEGUM SMFM, HEMALATHA S. 2022. *Gelidiella acerosa* compounds target NFκB cascade in lung adenocarcinoma. Appl Biochem Biotechnol 194(4): 1566–1579.

BLIKRA MJ, ALTINTZOGLOU T, LØVDAL T, ROGNSÅ G, SKIPNES D, SKÅRA T, SIVERTSVIK M, FERNÁNDEZ EN. 2021. Seaweed products for the future: using current tools to develop a sustainable food industry. Trends Food Sci Technol 118: 765–776.

BORJA P. 2003. Seaweed industry status in Bicol Region – Cluster VI. In: Proceedings of the National Seaweed Symposium; 03–04 Sep 2002; Cebu City. Hurtado AQ, Luhan MRJ eds. p. 17–18.

BRADECINA RG. 2016. Economic valuation of the Philippines' Caramoan beachscape. In: Marine and coastal ecosystem valuation, institutions, and policy in Southeast Asia. Olewiler N, Francisco HA, Ferrer AJG eds. Singapore: Springer Singapore. p. 17–30.

DAPAR MLG, MEVE U, LIEDE-SCHUMANN S, ALEJANDRO GJD. 2020. Ethnomedicinal plants used for the treatment of cuts and wounds by the Agusan Manobo of Sibagat, Agusan del Sur, Philippines. Ethnobot Res Appl 19: 1–18.

DE ALBUQUERQUE UP, DE SOUSA ARAÚJO TA, RAMOS MA, DO NASCIMENTO VT, DE LUCENA RFP, MONTEIRO JM, DE LIMA ARAÚJO E. 2009. How ethnobotany can aid biodiversity conservation: reflections on investigations in the semi-arid region of NE Brazil. Biodivers Conserv 18: 127–150.

DUMILAG RV. 2018. Unmasking a cryptic ethnotaxon: a case study on the identity of *Dermonema virens* (Nemaliales, Rhodophyta) in the Philippines. Webbia: J Plant Taxon Geogr 73: 89– 96.

DUMILAG RV. 2019. Edible seaweeds sold in the local public markets in Tawi-Tawi, Philippines. Philip J Sci 148: 795–803.

DUMILAG R, JAVIER R. 2022. Ethnobotany of medicinal seaweeds of Ilocos Norte, Philippines. Philip J Sci 151: 1135–1156.

DUMILAG RV, BELGICA THR, MENDOZA LC, HIBAY JM, AREVALO JR AE, MALTO MAD, ORGELA EG, LONGAVELA MR, CORRAL LEH, OLIPANY RD. 2022. Seaweed ethnobotany of eastern Sorsogon, Philippines. Algae 37(3): 227–237.

DURAIKANNU K, RANI KS, ANITHAJOTHI R, UMAGOWSALYA G, RAMAKRITINAN CM. 2014. *In-vivo* anticancer activity of red algae (*Gelidiela acerosa* and *Acanthophora spicifera*). Int J Pharm Sci Res 5(8): 3347–3352.

DURBIN S. 2011. Creating knowledge through networks: a gender perspective. Gender Work Organ 18(1): 90–112.

FRIEDMAN J, YANIV Z, DAFNI A, PALEWITCH D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. J Ethnopharmacol 16(2): 275–287.

GALUTIRA EC, VELASQUEZ GT. 1963. Taxonomy, distribution, and seasonal occurrence of edible marine algae in Ilocos Norte, Philippines. Phil J Sci 92: 483–522.

GANZON-FORTES ET, MONTAÑO MNE, MENDOZA WG. 2006. First documented report on *Solieria robusta* (Greville) Kylin (Gigartinales, Rhodophyceae) in the Philippines. Coast Mar Sci 30(1): 238–239.

HEARNE D, POWELL B. 2014. Too much of a good thing? Building social capital through knowledge transfer and collaborative networks in the southern Philippines. Int J Water Resour 30(3): 495–514.

JALAL R, JALANI K, ABDUL WAHAB I, ESHAK Z, HAMIMI A, MOHSIN H. 2023. *Kappaphycus alvarezii*: phytochemicals and ethnopharmacological significance. J Sustain Sci Manag 18: 187–208.

JEHN FU, DINGAL FJ, MILL A, HARRISON C, ILIN E, ROLEDA MY, JAMES SC, DENKENBERGER D. 2024. Seaweed as a resilient food solution after a nuclear war. Earth's Futur 12(1): e2023EF003710.

LO FBO, ALEJANDRO AF. 2022. Developing sustainability performance indicators for community-based tourism in Caramoan, Camarines Sur, and Jovellar, Albay, Philippines. Philipp J Sci 151: 18131–11828.

MAGSAYO VN, PULMONES J, CA NC, FIEL CH, KWONG KA, SANCHEZ FA, BACHARO KB. 2024. The scholarly publishing landscape of ethnobotany in the Philippines. Ethnobot Res Appl 28: 1–12.

MARCOS-AGNGARAYNGAY ZD. 1983. Species of edible seaweeds of Ilocos Norte. Ilocos Fish J 1: 118–133.

MORELAND PS. 1979. Edible seaweeds of northern Philippines: market prices, local taste preference, seaweed recipes, and other local uses. Philipp J Sci 108: 41–53.

ONG HG, KIM YD. 2014. Quantitative ethnobotanical study of the medicinal plants used by the Ati Negrito indigenous group in Guimaras island, Philippines. J Ethnopharmacol 157: 228–242.

PÉREZ-LLORÉNS JL, CRITCHLEY AT, CORNISH ML, MOURITSEN OG. 2023. Saved by seaweeds (II): traditional knowledge, home remedies, medicine, surgery, and pharmacopoeia. J Appl Phycol 35(5): 2049–2068.

PHILLIPS O, GENTRY AH. 1993. The useful plants of Tambopata, Peru: I. statistical hypotheses tests with a new quantitative technique. Econ Bot 47(1): 15–32.

RANI G. 2013. GC-MS analysis of *Acanthopora spicifera*. Int J Pharma Bio Sci 4(1): 649–653.

RHEE SS, BRAVERMAN LE, PINO S, HE X, PEARCE EN. 2011. High iodine content of Korean seaweed soup: a health risk for lactating women and their infants? Thyroid 21(8): 927–928.

SOUTH GR. 1993. Edible seaweeds of Fiji: an ethnobotanical study. Bot Mar 36(4): 335–350.

TITO OD, LIAO LM. 2000. Ethnobotany of *Solieria robusta* (Gigartinales, Rhodophyta) in Zamboanga, Philippines. Sci Diliman 12(2): 75–77.

TROTTER RT, LOGAN MH. 2019. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Plants and indigenous medicine and diet: biobehavioral approaches. Routledge. p. 91–112.

TUNGPALAN AY. 1983. Ethnobotanical study of the seaweeds of Ilocos Norte. Ilocos Fish J 1: 134–146.

VALDERRAMA D, CAI J, HISHAMUNDA N, RIDLER N. 2013. Social and economic dimensions of carrageenan seaweed farming. FAO Fish Aqua Tech Paper No. 580. Rome, Italy.

VELASQUEZ GT. 1977. History on the local uses of seaweeds. Sci Rev 18: 20–24.

VOEKS RA. 2007. Are women reservoirs of traditional plant knowledge? Gender, ethnobotany, and globalization in northeast Brazil. Singap J Trop Geogr 28(1): 7–20.

WEHI PM, WEHI WL. 2010. Traditional plant harvesting in contemporary fragmented and urban landscapes. Conserv Biol 24(2): 594–604.

XIA B, ABBOTT IA. 1987. Edible seaweeds of China and their place in the Chinese diet. Econ Bot 41(3): 341–353.

YADAV SK. 2020. Medicinal prospective of seaweed resources in India: a review. J. Pharmacogn Phytochem 9: 1384–1390.

ZUBIA M, DRAISMA SGA, MORRISSEY KL, VARELA-ÁLVAREZ E, DE O CLERCK. 2020. Concise review of the genus *Caulerpa* J.V. Lamouroux. J Appl Phycol 32: 23–39.