



Economic Importance and Traditional Knowledge on Marine Macroalgae among Locals of Sacol Island, Zamboanga City, Philippines

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Abstract

Marine macroalgae have various uses and hold significant economic importance for locals living in coastal communities due to their diverse health-promoting activities and nutritional benefits. This study identified and explored economically important marine macroalgae and the traditional knowledge among locals residing in Pasilmanta, Sacol Island, Zamboanga City, Philippines. Data were collected through semi-structured interviews with local informants (N=30) belonging to different ethnolinguistic groups—Sama-Banguingui, Yakan, and Tausug—who were selected through snowball sampling. Seven (7) species of marine macroalgae, mainly from the classes *Chlorophyta* and *Phaeophyta*, were reported to have ethnomedicinal properties and are considered economically important. A literature review of the bioactivities and active physiological components of the documented algal species is also presented in this paper. Further research, community immersion, and field mapping of marine macroalgae covering the four main barangays of Sacol Island are recommended to provide a conclusive report and comprehensive documentation of the economic importance and traditional knowledge on seaweeds specific to the island's inhabitants. Voucher specimens for a herbarium, a database for online reference, and an educational brochure are the tangible outcomes of this study.

Keywords: *Chlorophyta*; *Ethnomedicinal*; *Phaeophyta*; *Seaweeds*; *Traditional Knowledge*

Introduction

Marine macroalgae, commonly known as seaweeds, play a pivotal role in the ecological and economic landscapes of coastal communities worldwide. In the Philippines, an archipelagic nation endowed with extensive marine biodiversity, seaweeds are integral to both subsistence and commercial activities. Beyond their ecological functions, such as oxygen production and providing habitats for marine organisms, seaweeds contribute significantly to local economies through their applications in food, medicine, and industry. Notably, the Philippines is among the top global producers of carrageenan—a hydrocolloid extracted from red seaweeds like *Kappaphycus alvarezii* and *Euचेuma denticulatum*—which is widely used in food processing and pharmaceuticals.

Marine macroalgae, commonly referred to as seaweeds, perform multiple ecological functions that enhance ocean productivity. According to Mohammed (2015) of the approximately 9,200 known species of seaweeds, only 221 have been identified as economically significant. The global economic value of seaweeds is increasingly recognised, with applications spanning organic fertilisers, biomass production, biofuel generation, bioremediation, animal feed supplements, and various industrial uses. Notably,

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seaweeds serve as raw materials to produce hydrocolloids such as agar, carrageenan, and alginate, which are widely employed in numerous industrial sectors (Ali *et al.*, 2024; Janke, 2024; Nanda, Kumar & Hussain, 2022).

In addition to their economic importance, seaweeds are also used in traditional medicine in many parts of the world. In terms of medicinal and therapeutic significance, several algal species from the divisions Chlorophyta, Phaeophyta, and Rhodophyta are known to be prolific sources of bioactive components and have been recognised as vital sources of sulphated polysaccharides. These compounds are known to possess antibacterial, antioxidant, immunomodulatory, anti-inflammatory, antitumour, anticoagulant, antiviral, antiprotozoal, and antilipemic properties (Jibril *et al.*, 2016; Mathew & Saral, 2017; Nanda, Kumar & Hussain, 2022; Sudhakar *et al.*, 2018; Sultana *et al.*, 2023; Trivedi *et al.*, 2022).

In East and South-East Asia, seaweeds form a major part of the traditional diet and are cultivated on a large scale. In the local context, the Zamboanga Peninsula region is the third major seaweed-producing region in the Philippines, contributing 12% to the total national production and 20% of Mindanao's output. Zamboanga City alone has an extensive coastline along with several representations of marine algae.

Sacol Island, situated within Zamboanga City in the Zamboanga Peninsula region, exemplifies a community where marine macroalgae are deeply embedded in daily life. The island's residents, predominantly Muslims, have historically relied on seaweeds for various purposes, including nutrition, traditional medicine, and as a source of livelihood.

However, despite the evident importance of seaweeds in Sacol Island, there is a scarcity of documented research on the economic significance and traditional knowledge associated with these marine resources in the area. This study aims to bridge this gap by exploring the economic roles of marine macroalgae and the extent of traditional knowledge among the local populace of Sacol Island. By documenting these aspects, the research seeks to contribute to the sustainable management and conservation of marine resources, ensuring that traditional practices and economic benefits are preserved for future generations. Voucher specimens for the herbarium, a database for online reference, and an educational brochure are the tangible outcomes of this study.

Materials and Methods

Study Site

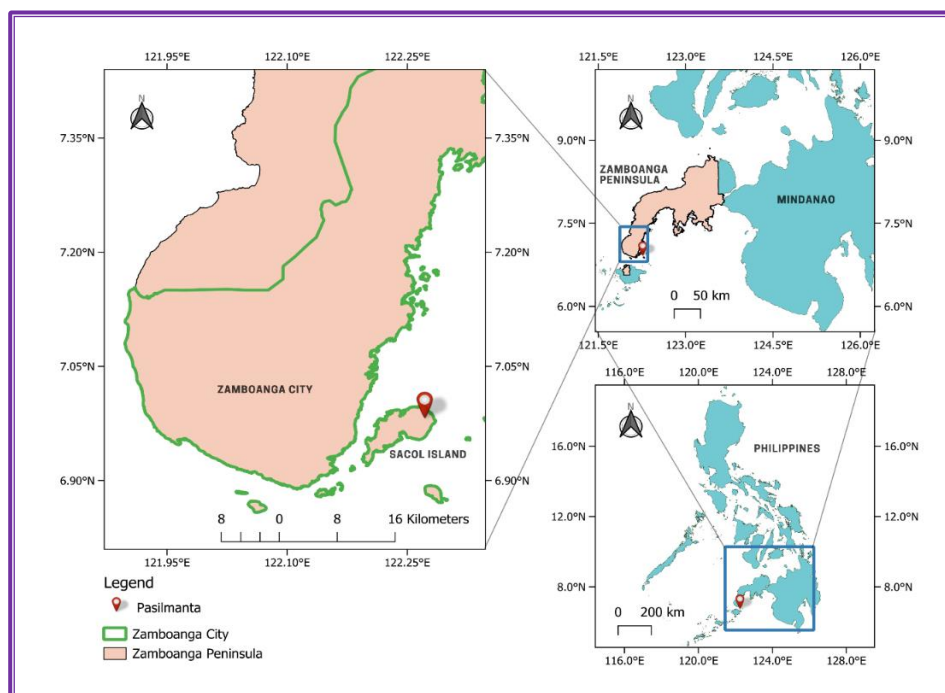


Figure 1: Map of Zamboanga City, Philippines Showing the Study Site

The study was conducted in Pasilmanta, Zamboanga City, Philippines (6.99205° N, 122.27326° E) which is one of the four main barangays of Sacol Island. Trivially, according to claims of the elders in the community, the island of Sacol originated its name from a *Kappaphycus*, a seaweed species called by locals as “*Sakol*” or popularly known as *agal-agal* which grows in abundance and cultivated in the coastal premises of the island. The map of the study site is presented in Figure 1.

Data Collection

A field visit was conducted for reconnaissance in February 2023 as part of the initial data collection and exploration of economically important macroalgae in the community. This included familiarisation with households, key officials, elders, and other individuals possessing relevant knowledge and experience regarding the use of macroalgae as traditional medicine.

Information on the economic significance and traditional knowledge of seaweed species was gathered through semi-structured interviews. Respondents were selected using purposive and snowball sampling techniques. The interview guide comprised two sections: Part I collected data on the demographic characteristics of key informants, while Part II focused on the ethnomedicinal preparation and administration of seaweeds. To ensure clarity and ease of communication, the interview questions were translated and conveyed in the local vernacular with the assistance of a local guide. Figure 2 presents snapshots taken during the interviews with island residents, who provided their consent for the publication of these photographs.



Figure 2: Snapshots During the Interviews with Locals of the Island

Ethnophycological information obtained was recorded in a tabular form adapted with modifications from ethnobotanical study of De Guzman *et al.*, (2020) which presents a review of literature of bioactivities and active physiological components. The actual collected macroalgae specimens were documented using Nikon digital camera D3000.

Ethical Consideration

A written permit was obtained from the office of the barangay chairman prior to data gathering. All local informants were oriented and briefed about the purpose of the study. An informed consent was secured from the participants prior to the interview conducted during weekends of April 2023.

Collection of Voucher Specimen

Specimen collection was conducted with the assistance of local residents during low tide, from intertidal flats to waters at depths of 2–3 metres. Whole thalli were manually collected from coastal areas in Pasilmanta during field surveys conducted between February and April 2023.

The collected specimens were placed in transparent plastic bottles, sealed, treated with 10% formaldehyde, and labelled. Exsiccatae of marine macroalgae will serve as voucher specimens and were deposited at the herbarium of Western Mindanao State University (WMSU).

Identification of Macroalgae

Identification was carried out using two methods: (a) traditional procedures following the Linnaean taxonomic scheme of classification, wherein morpho-anatomical or key phenotypic features of algae were examined under a stereo microscope; and (b) voucher specimens of the collected samples and

printed photographs of the specimens were prepared for identification and subsequently validated by experts. The same procedure described in item (b) was followed to validate the common and indigenous names of the macroalgae through the participation of local residents and key informants.

Results and Discussion

Demographic Profile

The key informants are comprised of thirty (N=30) locals belonging to different ethnolinguistic groups mainly Sama-Banguingui (50%), Yakan (40%), and Tausug (10%) where 70 % are female and 30 % male. In terms of age groups, the majority are aged 60-70 (26.67 %) and the rest of the respondents are with age range from 20-50 years old. It can be noted that most of the respondents attained some elementary level (60%), and majority of their occupation are fisherfolks and housewives. Table 1 presents a summary of the demographic profile of the respondents.

Table 1: Summary of the Demographic Profile of the Respondents of the Study

Demographic Profile (n=30)		Frequencies (%)
Gender	Male	9 (30%)
	Female	21 (70%)
Age	Young Adults (18 – 24 years old)	4 (13%)
	Adults (25 – 44 years old)	12 (40%)
	Middle Aged Adults (45 – 64 years old)	11 (37%)
	Seniors (65 years and above)	3 (10%)
Occupation	Housewife	13 (42%)
	Government Employee	2 (7%)
	Hilot (Traditional healer)	2 (7%)
	Fisherfolk	8 (27%)
	Unemployed	2 (7%)
	Student	3 (10%)
Educational Attainment	Elementary	18 (60%)
	Highschool	8 (27%)
	College Graduate	4 (13%)
Ethnicity	Sama-Banguingui	15 (50%)
	Tausug	3 (10%)
	Yakan	12 (40%)

Economic importance and Traditional Knowledge on Marine Macroalgae

The study documented seven (7) species of marine macroalgae belonging to the divisions *Chlorophyta* and *Phaeophyta* reported to have economic importance and used by locals as traditional medicine. From the results of the interview, different species of *Caulerpa* or “*gamay or lato*” are frequently claimed to have medicinal value, particularly it is used to treat or prevent emergence of goiter.

This claim is scientifically valid because various species of edible seaweed gather iodine from seawater and are therefore a good dietary source of iodine. An adequate intake of seaweed can eliminate iodine deficiency related disorders such as inflammation of thyroid or goiter. Further, the Japanese and Chinese cultures have used seaweeds to treat goiter and other glandular problems since 300 BC (Sumayya, Sreelekshmi & Murugan, 2017).

In addition, the study reported three (3) different macroalgae; *Kappaphycus*, *Euchema* and *Gracilaria* species which are consumed as food and claimed to have detoxifying and colon-cleansing properties. A 2024 study by (Čmiková *et al.*, 2024) examined the nutritional composition of three seaweed species—*Palmaria palmata* (dulse), *Ascophyllum nodosum* (knotted wrack), and *Chondrus crispus* (Irish moss). The analysis revealed that these seaweeds contain significant levels of essential minerals, including calcium, magnesium, iron, and iodine, as well as high dietary fiber content.

Additionally, a 2023 review highlighted that seaweeds possess a high total dietary fiber content, ranging from 10–75% dry weight in brown seaweeds, 10–59% in red seaweeds, and 29–67% in green seaweeds. This fiber content is comparable to, and in some cases surpasses, that of many land-based vegetables (Matos *et al.*, 2024).

In another vein, these species of seaweed have long been considered as viable source of income among fisherfolks in the community. The respondents shared that the harvested seaweeds species (mainly *Kappaphycus* and *Caulerpa*) are transported via pump boat and sold to nearby flea market located in barangays Sangali and Manicahan, approximately twelve (12) km away from the island. This scenario is indicative of the progressing cultivation and commercialisation of seaweeds in their community.

Table 1: Economic Importance and Traditiosnal Knowledge of Marine Macroalgal Species Reported by Locals of Pasmanta, Sacol Island, Zamboanga City, Philippines Including the Literature Review of Bioactivities, and its Active Physiological Components

Scientific Name	Local or Common Name	Economic Importance	Folkloric uses	Preparation and Mode of Application	Literature Review	
					Bioactivities	Active Physiological components
<i>Caulerpa lentillifera</i>	Lato	human food, source of minerals fertiliser	Use to treat goiter, use to treat wounds	Eaten raw or dip in vinegar sauce Direct application	Antibacterial Antimicrobial immunostimulatory, hypolipidemic, anti-obesity	diterpene, phytol, and fatty acids, polysaccharides (Rushdi <i>et al.</i> , 2020; Yoojam <i>et al.</i> , 2021; Zhang <i>et al.</i> , 2020)
<i>Caulerpa racemosa</i>	Gamay	human food, source of minerals	Use to treat or avoid emergence of goiter	Eaten raw or dip in vinegar sauce	Antibacterial, apoptotic, antioxidant	Phenols, flavonoid, polysaccharides (Belkacemi <i>et al.</i> , 2020; Yap <i>et al.</i> , 2019)
<i>Kappaphycus striatus</i>	Agal-agal	human food, source of minerals	Use to cleanse colon and detoxify	Blanch and mix with vinegar and spices.	Antioxidant anti-inflammatory, anticancer, antidiabetic	furfural, polyphenols, peptides, and polysaccharides (Bhuyar <i>et al.</i> , 2021; Wang <i>et al.</i> , 2018)
<i>Euचेuma denticulatum</i>	Gulaman	human food, source of minerals	Use to cleanse colon and detoxify	Blanch and mix with vinegar and spices.	anti-inflammatory, anticancer, anti-obese, antidiabetic, antiangiogenic	Fucoanthin, R-Phycoerythrin and phenols (Khatulistiani <i>et al.</i> , 2019)
<i>Gracilaria chilensis</i>	Gamugamu	human food, source of minerals	Use to cleanse colon and detoxify	Blanch and mix with vinegar and spices.	microbicidal, anti-inflammatory, antimetastatic	sulfated polysaccharides, fucans, carrageenans and ulvans Sudhakar <i>et al.</i> , 2018)
<i>Ulva spp.</i>	Lumot	Fertiliser, food	Use to treat wounds	Sun-drying and decomposed	antibacterial, antifungal, anticancer, antioxidative,	Cellulose, ulvan, phenolic acids, saponin flavonoid (Gomaa <i>et al.</i> , 2022; Pangestuti <i>et al.</i> , 2021)
<i>Sargassum spp.</i>	Kaput	fertiliser, fodder	Use as additive to steam bath "tuob"	Decoction Sun-drying	Antitumor Lipid lowering whitening, skin barrier repair, and moisturising.	Fucoanthin, fucoidan, terpenoids, flavonoids, and meroterpenoid (Arunkumar <i>et al.</i> , 2021; Lee <i>et al.</i> , 2022; Mohd Fauzief <i>et al.</i> , 2021)

In addition to edible seaweeds reported by locals, the current study documented two (2) macroalgal species; *Sargassum spp.* and *Ulva spp.* which are not consumed as food but were claimed to have

economic importance and medicinal use. Species of *Sargassum* were used as additive to “tuob” or steam bath as it is believed to have antibacterial property and relaxes the muscles. This finding agrees with the study of Moubayed *et al.* (2017) who found out that species of *Sargassum* have inhibitory activity against gram positive bacteria. Interestingly, in the study of Lee *et al.* (2022) it revealed that *Sargassum* spp., a genus of brown algae in the family *Sargassaceae*, has multiple functions in preventing and improving skin aging.

Table 1 presents the data on traditional knowledge and economic importance of macroalgal species with the literature review of bioactivities and active physiological components of each species

As shown in Table 1, seaweed is primarily consumed as food which are eaten raw or cooked and dipped in vinegar sauce and spices. *Caulerpa* and *Kappaphycus* species are the most common seaweeds consumed as food on the island which claimed to have health benefits and medicinal properties. This account finds concurrence with findings of the study Ludher and Woo (2024) highlights that seaweeds are integral to the cuisines of China, Japan, and Korea, where they are commonly used in dishes such as soups, salads, and snacks. In Southeast Asia, including the Philippines and Indonesia, seaweeds are incorporated into desserts and other culinary applications. For instance, in the Philippines, seaweed-derived products like agar and carrageenan are used to make traditional desserts such as gulaman, a jelly-like treat often served cold.

In terms of active physiological components, green and brown algae are significant sources of ulvan which attracted much attention due to their potential medicinal values and a valuable chemical compound well known for its benefits in human health (Bayu & Handayani, 2018; Pappou *et al.*, 2022).

Furthermore, the study found out that locals mistaken the identity of some marine species as macroalgae, one example is the egg string, or secretions of sea hare (*Dolabella auricularia*) called by locals as “lukot”. Also, the species of seagrasses like turtle grass (*Thalassia testudinum*) which they called “lusay” is also mistaken by locals as macroalgae. The locals associate these species to macroalgae because of their resemblance in terms of physical features to seaweed species, this observation provides substantial data to infer about their limited level of knowledge on the exact identification of seaweeds found in the island. Figure 3 shows the images of *lukot* and *lusay* mistaken as macroalgal species.

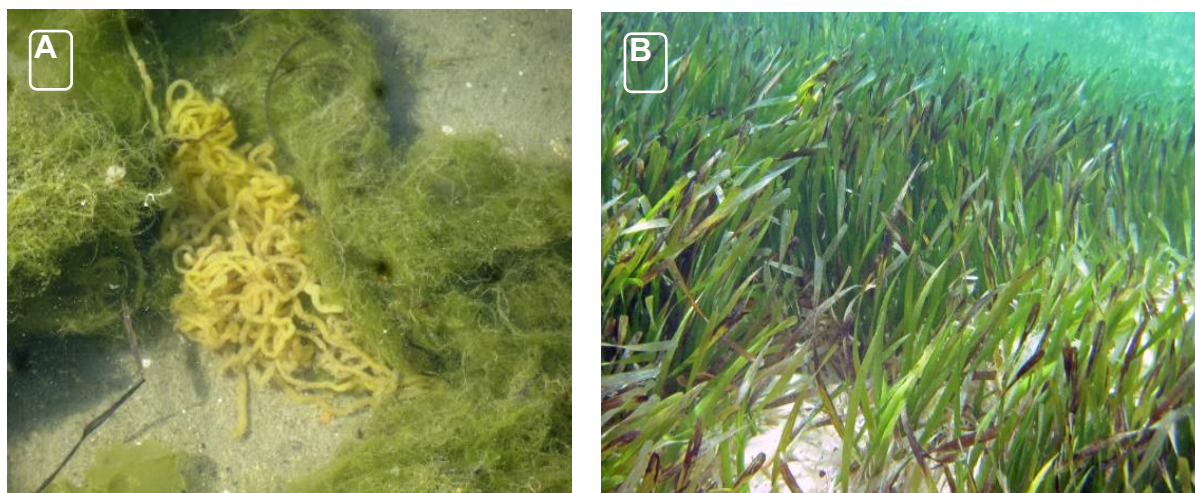


Figure 3: *In situ* habit of marine species mistaken as seaweeds by locals (A) “lukot” secretions or egg strings of sea hare (*Dolabella auricularia*) and (B) “lusay” turtle grass (*Thalassia testudinum*). Note: Photographs were lifted from Google images

Along this line, community-based training on proper identification of marine resources found in the island would be beneficial to the community in terms of passing on correct knowledge to younger populations. This could be done by conducting education and information programs on marine resources and the possibility of integrating related topics and lessons in the school’s curriculum of basic

education to also teach elementary and secondary students alike from simple identification and consequently preservation of rich marine resources of the island.

Conclusion

This study highlights the significant economic and cultural importance of marine macroalgae among the residents of Sacol Island, Philippines. Seven species from the *Chlorophyta* and *Phaeophyta* divisions were identified as integral to local livelihoods and traditional medicinal practices. Notably, species of *Caulerpa*—locally known as “gamay” or “lato”—are traditionally used to prevent or treat goiter, a practice supported by scientific evidence indicating that edible seaweeds are rich in iodine, an essential nutrient for thyroid health.

Beyond their medicinal applications, macroalgae such as *Kappaphycus*, *Euclima*, and *Gracilaria* serve as dietary staples, valued for their detoxifying and colon-cleansing properties. These seaweeds are rich in essential minerals and dietary fibre, with some species exhibiting fibre content comparable to or exceeding that of many land-based vegetables.

Economically, the cultivation and trade of seaweeds like *Kappaphycus* and *Caulerpa* provide vital income for local fisherfolk, who transport their harvests to markets in nearby barangays. Additionally, other species such as *Sargassum* and *Ulva* are utilised in traditional steam baths for their purported antibacterial and muscle-relaxing properties. Scientific studies support these uses, noting that *Sargassum* species contain bioactive compounds beneficial for skin health, including antioxidant and anti-inflammatory effects. These findings underscore the multifaceted value of marine macroalgae in Sacol Island, emphasising the need to preserve traditional knowledge and promote sustainable practices for the continued benefit of local communities.

Traditional knowledge of locals on seaweeds still exists on the island, yet the knowledge is gradually decreasing; the locals opt to take the commercially available medicine sold in the *sari-sari* (variety) stores located on the island and the use of terrestrial plants as traditional medicine.

Further research, community immersion, and field mapping of marine macroalgae to cover the four main barangays of Sacol Island are recommended to craft a conclusive report and an intensive documentation of economic importance and traditional knowledge on seaweeds particular to the people living on the island.

Author Contributions

Conceptualisation, review and editing of manuscript, G.M.; writing of draft manuscript and data gathering, G.L. The authors have agreed to the final version of the manuscript for publication.

Conflict of Interest

The authors declare that they have no competing interests.

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