# Establishing a Conservation-Friendly Livelihood: The Case of Lato Farming in Rizal, Magsaysay, Palawan, Philippines

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**Abstract**
This study describes certain aspects of the *lato* (*Caulerpa lentillefera*) production by Barangay Rizal in Magsaysay, Palawan, as a livelihood with conservation goals. Most *lato* growers have elementary and secondary education, and this livelihood had a good income. The *lato* farmers aspired to have a stable market and stable market price throughout the year for their produce and find ways to mitigate the adverse effects of excessive rain draining into their *lato* farms. The existing associations of *lato* farmers were functional, served their members' needs, and were instrumental in achieving common goals. Through sustained support of this community initiative, the Local Government Unit can sustain these associations through various support programs and linkages to various organizations and groups to improve their livelihood. Furthermore, the associations' vigilant protection of their environment is recommended to sustain their livelihood and provide a possible replication model in other suitable *lato* farming areas.

**Keywords**
*lato*, conservation, livelihood, sustainability, farmers, Palawan

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## 1. Introduction

Since ancient times, humans have consumed marine algae (Young et al. (2006), as cited in Banu, 2011). People worldwide, especially those in Asia, consider seaweed to be an excellent delicacy and have been using it in their diets for centuries. One of the most favored species of edible seaweed is *Caulerpa lentillifera* due to its green-grass color and soft and succulent texture (Ratana-Arpon & Chirapart, 2006). Tabangar lato is a variety of the *Caulerpa lentillifera*. There are other varieties like *lomo-lomo* or *keseg-keseg*. But *Tabangar* is preferred for its commercial value – longer shelf life, rich taste, and attractive overall appearance. Known locally as *lato*, *ar-arosep*, or *arosep* (Figure 1), it is usually eaten as a salad with a mixture of fresh tomatoes and onions, combined with a blend of vinegar, fish sauce, fish paste (locally called bagoong), as dressing.



Figure 1. *Caulerpa lentillifera* (Source: R. del Rosario/PSU)

C. *lentillifera*, which is known to be rich in iodine, has a high content of minerals like phosphorous, calcium, magnesium, potassium, and copper (Jimenez-Escrig, 2000; Ratana-Arporn & Chirapart, 2006; Wild Singapore, 2016). Cabial et al. (2015) found a similarity in the composition of seaweed lipid extracts to commercially available fish oil. Although further studies still need to be conducted, initial results implied omega-3 fatty acids in *Caulerpa lentillifera*. Yap et al. (2019) reported further on the antioxidant and antibacterial properties of *lato*, while Sharma and Rhyu (2014) reported anti-diabetic effects.

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Of Caulerpa varieties, commercial production exists only for C. *lentillifera* (Paul, Symon, & de Nys, 2009). Commercial cultivation is gaining recognition due to domestic and international demand (Rabia, 2016). In the Philippines, much of the production centers around Cebu. However, because of its attractiveness as a source of livelihood for coastal households, production has spread throughout coastal areas in the country. Hence, production generally comes from family farms on small islands (Salayao et al., 1991). Despite its popularity and relative ease in its production, commercial-scale production is still insufficient, and its productivity does not meet local demand (Gerundio et al., 2020). This study is conducted to fill the dearth of research on *lato* production in the Philippines, especially outside Cebu's production center. It is also to share the experience of *lato* farming as a livelihood.

This paper describes *lato* farming experience as a livelihood source with Barangay Rizal residents' conservation goal in Magsaysay, Palawan. Specifically, it describes the community's efforts concerning the support they received from the United Nations Development Programme- Small Grants Program Cycle 5 (UNDP-SGP5) project "Empowering Women and Men for Biodiversity Conservation in Magsaysay, Palawan". In this case, the researchers described the *lato* farmers' profiles, their aspirations, especially towards their *lato* farming livelihood, their conservation goal, and their experience in helping one another through their associations/organizations and producing and marketing their produce. This study aims to share knowledge with other communities, inspire people of other communities with similar livelihoods, and be a model for possible replication in other suitable areas for *lato* farming.

## 2. Methodology

This research is qualitative. The researchers used the following methods of gathering data: (1) Baseline Survey, (2) Focus Group Discussion or FGD, (3) Key Informant Interview or KII, and (4) Observation. Data analysis was discussed in each of the methodologies used.

### 2.1. Baseline Survey or Household Interview

For the interview, 51 *lato* farmers of Rizal, Magsaysay, out of 103, were selected using normal random sampling. A prepared questionnaire was used for a paper and pen interview in April 2016, focusing on the demographic profile and *lato*-farming baseline information. Informed consent was obtained from the participants to address the ethical concerns of the study. Data gathered were cleaned, interview notes were transcribed and encoded using Excel, organized according to categories, and presented in tables and figures.

### 2.2. Focus Group Discussion (FGD)

During a seminar-workshop on biodiversity (April 2016) and introduction to biodiversity-friendly livelihoods (August 2016), focus group discussions were held. In the said FGD, the participants were grouped according to their livelihoods – cashew production, *lato* production or farming, salt-making, and cashew product processing. In the FGD for *lato* farming (with eight participants), using guide questions, they discussed the positive side of their livelihood, the problems encountered, and their proposed solutions to the problems mentioned. In the April workshop, the participants were guided in the discussion by Threats, Opportunities, Weaknesses, and Strengths (TOWS) Analysis. The August discussion validated the April focused group discussion on the threats to the livelihood and the proposed solutions. The data gathered from the first and second FGDs were sifted, organized, and reduced into themes. Only the data with the group's consensus (presented by the group as an output in their TOWS Analysis) and confirmed during the second FGD were used in the study.

### 2.3. Key Informant Interview (KII)

This was done in December 2016 during a Participatory Learning and Action where resource and livelihood activity mapping were conducted. Seven officers of four different lato growing or farming associations were interviewed. It focused on the role of their associations in their livelihood. Another KII was conducted on February 22, 2018, to validate the previous KII findings with the same set of interviewees, except for one who was not present during the first KII and another who was present in the first KII but absent during the second. The validated data were organized and presented in narrative form in this study. This method ensured the study of multiple and rich data sources in addition to validation.

### 2.4. Observation

The visits (three times with 25 participants) to the *lato* demonstration areas provided an excellent way to observe the families working in the *lato* farms, including how *lato* was planted, cared for, and harvested. It also allowed the researchers to witness why *lato* farming was considered a family-based livelihood, i.e., couples help each other manage their area.

## 3. Discussion of Findings

As part of the UNDP-SGP5 project "Empowering Women and Men for Biodiversity Conservation in Magsaysay, Palawan", residents of Barangay Rizal in Magsaysay, Palawan worked to establish biodiversity-friendly livelihoods, of which *lato* farming was one. To this end, the barangay local government identified a demonstration site for *Caulerpa lentillifera* production and formally declared this recognition through Barangay Rizal Resolution No. 20, Series of 2016 (October 2016).

### 3.1. Profile of the *Lato* Farmers

The average household of the *late farmer has three to four members, the household head of which is aged* from 41 to 50 years and is either elementary (37.25%) or high school (33.33%) educated (Figure 2).

In these households, *lato* farming is the primary source of income of the participants, who, on average, earn anywhere from less than P3000 to P5000 per month, mostly from *lato* production (Figure 3). About 30% of the farmers earned Php 5,000+ to Php 9,000, and about 10% earned Php 9,000+ to Php 11,000 and less than 10% earned Php 31,000+ monthly.

During the study, income from *lato* production had become variable because of lower production brought about by the unstable environment resulting from the weather's unpredictability. For instance, when water becomes more brackish during heavy rainfall, the *lato* dies. However,

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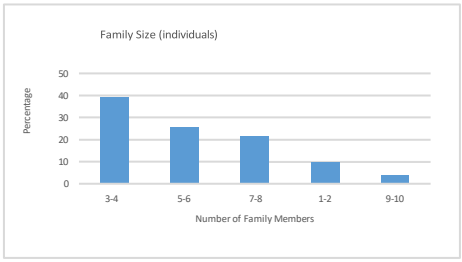
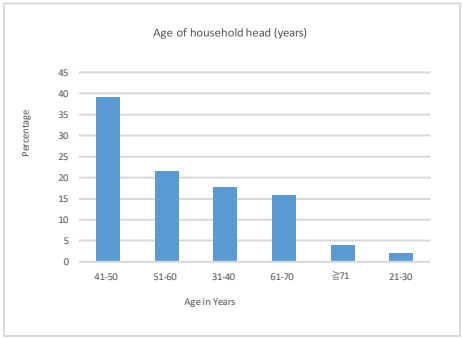
compared to other livelihood activities in Magsaysay, *lato* farming was still a favored enterprise and considered an excellent livelihood source.



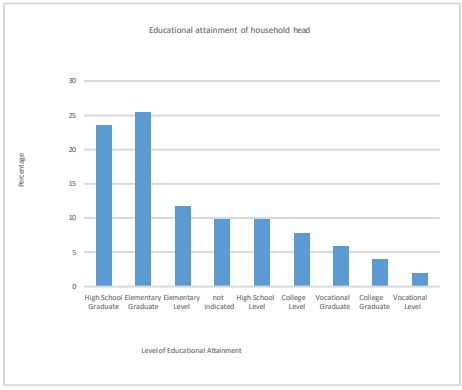
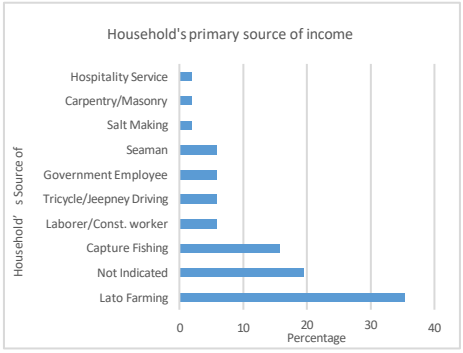
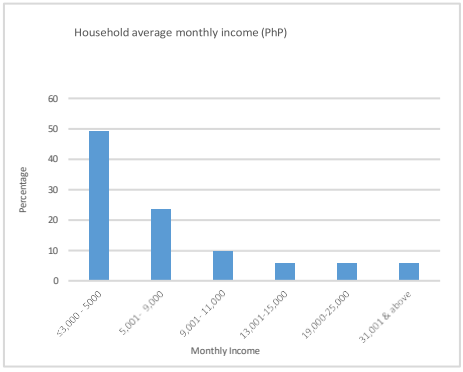




*Figure 2*. Some socio-demographic characteristics of the households of *lato* farmers



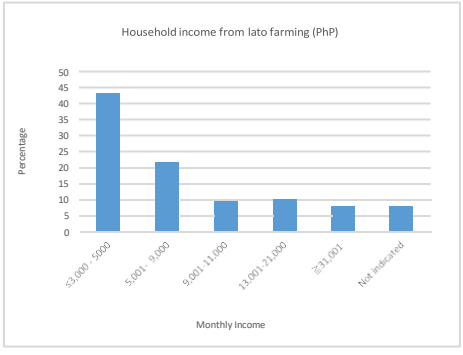




*Figure 3*. Income characteristics of *lato* farmers' households

### 3.2. Associations Related to *Lato* Growing

Four *lato* growers associations were noted in the area, namely: (1) One Town One Product (OTOP) *Lato* Growers Association; (2) *Lato* Growers Malampaya; (3) Barangay Rizal *Lato* Farmers Association and (4) Barangay Rizal *Lato* Farmers Association (Table 1).

Table 1

*The existing farmers' associations in Barangay Rizal, Magsaysay, Palawan*

| Bases | OTOP - *Lato* Growers Association | *Lato* Growers Malampaya | Brgy Rizal *Lato* Farmers Association | Brgy Rizal Growers Association |
|---|---|---|---|---|
| Year organized | 1980s | 2007 | 2013 | 2014 |
| Organizer | MAO Cuyo | MPDO | MPDO | MPDO |
| DOLE Status | Not registered | Not registered | Registered | Assisted |
| Members (number and type) | 20 *lato* growers, buyers, and sellers in the area | 26 members | 25 now (35 when it started) | 30 members |
| Initial capitalization (PhP) | 20,000/member from former Gov. Mitra | 2,000 + 100,000 from Malampaya | P20 membership fee + P10 monthly dues | Membership fees |
| Current President | Data not available | Data not available | Edwin Badenas | Clarina Gacasa |
| Benefits to Members | Training, seminar, loans | Loans | Technical assistance from DOLE | Seminars training |

*Note: MAO - Municipal Agricultural Officer; MPDO -Municipal Project Development Officer; OTOP - One Town–One Product*

The *Lato* Growers Association was the pioneering farmer's association in the area and was established as part of the One Town–One Product (OTOP) initiative in the 1980s. It was organized by the Municipal Agricultural Officer of Cuyo, which may be why the *lato* is also known locally as *latong Cuyo*.

It was discovered that *lato* farmers were members of more than one association. Mr. Edwin Badenas, the president of the DOLE-registered Barangay Rizal Lato Farmers Association, decided to be part of this organization only to focus on his association's development. There were other like-minded *lato* growers.

The OTOP-*Lato* Growers Association and the *Lato* Growers Malampaya could generate income from the funds they received from the Malampaya Gas Field Project and the Department of Labor and Employment (DOLE). The fund was used to provide loans to members at a reasonable interest. These loans were for repairing the *lato* farm fences (nylon net) and buying *lato* seedlings and rafts. The loan earnings were returned to the members at the end of each year, usually in December. According to the members, the associations provided much-needed mutual support and financial assistance for farming livelihood.

In December 2016, a federation of the four associations was organized, with an election of officers. Each of these associations has provided its members with social and financial support. Some lato growers became members of more than one association. Members sought dual membership to be able to access more support that was available.

### 3.3. Aspirations of *Lato* Growers

In 2016, when this study was done, the farm gate price for Tabangar *lato* averaged seventy pesos (Php 70). However, farmers had hoped the price of a kilo could be eighty pesos for more significant earnings. The Local Government Unit (LGU) cautioned the farmers not to make *lato* farm gate prices higher than Php 70 to protect local consumers, according to MPDO Edna Saban during a KII on December 20, 2016.

Understandably, the growers aspired for the following: (1) a stable market and price for their *lato* harvest during peak and lean seasons, (2) a way for their *lato* to survive strong rainy seasons, and (3) a sustainable livelihood based on the *Tabangar* variety.

Early in 2018, during January and February, *lato* was bought at eighty pesos a kilogram, making their aspiration a reality during the lean season of 2018. By constructing a shared nursery, *lato* farming of *Tabangar* has been sustained so far because farmers can avail of seedlings for production.

### 3.4. Growing *Lato*

The *Tabangar* variety of *Lato* (*Caulerpa lentillifera*) is the primary type planted by the Barangay Rizal lato growers in Magsaysay, Palawan, because it commands a higher price and is the favored variety in Puerto Princesa City, the primary importer of *lato* from Magsaysay. It also has a shelf life of seven days using the present harvesting method and packing in banana leaves. Other varieties like *lomo lomo*, *uban uban*, and *keseg keseg* are also in the municipality. *Lomo-lomo* and *keseg-keseg* are planted in small and controlled quantities for local consumption as these are also favorites among many townfolks of Magsaysay.

*Lato*, mostly *Tabangar* variety, is cultured in muddy substrate in the small villages of Naga, Tenga-tenga, Igeneb, Masagana, and Malapad-lapad in Brgy. Rizal in Palawan. They are planted in 1.2 to 1.4 m deep water in 20m x 20m farm lots at least one meter away from the lowest tide. Farmers may have more than one lot, fenced using bamboo and net to avoid predators such as fish *(danggit, sapsap),* turtles, and crabs *(alimasag, dawat).* Farmers pay Php 150 to Barangay Rizal to exercise their rights to grow *lato* on their claimed farm lots.

Generally, the seedlings are planted in November and December. However, for production, farmers plant the seedlings in January and February when seedlings are scarce or are destroyed by unfavorable climatic conditions. Some variations from farm to farm depend on the growth of the seedlings and the effect of climatic and other environmental conditions on each farm lot, such as incessant and strong rains, typhoons, and floods. As mentioned earlier, *lato* is vulnerable to natural predators, as well.

Harvest is lean in January and February and peaks in March and April. It tends to decline toward June, especially with continuous rain. The seaweed is harvested every day or every other day with an average of 10-20 kg per harvest. Under favorable conditions, the average harvest per farm lot is 40-50 kg per week.

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### 3.5. Marketing *Lato*

During the lean season, the *lato* growers market most of their produce in Magsaysay and Cuyo's local markets. There is a relatively strong and stable domestic demand for *lato* as it is a local favorite among Cuyo Island residents. According to the officers of the four associations during a KII in December 2016, Mrs. Merla Herrera, Mrs. Emelda Gadiano, Mrs. Marilou Eleazar, Mr. Edwin Badenas, and Mrs. Clarina Gacasa, an estimated 75% of produce is consumed in Cuyo Island while 25% is sold in Puerto Princesa and Iloilo. However, during the peak season, this proportion is reversed, with 25-50% being sold in Cuyo Island while the rest is sold in the markets of Puerto Princesa and to mainland municipalities. The local market cannot absorb all the production at this peak time.

The growers also expressed that marketing of the products at present still poses a problem. Thus, some *lato* organization leaders suggested integrating all associations and establishing one drop area for marketing, as well as setting one price. Likewise, it was expressed that LGU and NGO support is very much welcome. In connection with marketing, improvement of packaging is aimed for, and the members hoped there would be training for this.

Another proposal was to establish an additional outlet for *lato* in Puerto Princesa through the Palawan State University (PSU) main campus community, sold directly to consumers so it could be bought and sold at a reasonable price. As of this writing, there were no takers yet of this proposal from enterprising individual members or groups of PSU Community. At least two groups have seriously considered it.

### 3.6. Initiatives Under the Biodiversity Conservation Project

The participants mentioned that the project allowed them to participate in seminar-workshops on biodiversity and conservation and be introduced to biodiversity-friendly livelihoods. They were also assisted in getting organized and formally registered as a PO at DOLE on September 6, 2017.

Through Barangay Resolution No 20, Series of 2016, the Rizal *lato* area covering the coastal areas of Naga, Tenga-tenga, Igeneb, Masagana, and Malapad-lapad had been declared as a demonstration site for *lato* farming with attendant barangay support and protection for conservation. The last part of the resolution reads: "Whereas, the residents of the coastal areas of Naga, Tenga-tenga, Igeneb, Masagana, and Malapad-lapad derive their livelihoods from the production of *lato (Tabangar).* While making a living out of planting, harvesting, and selling *lato*, they also protect the environment and conserve biodiversity as this means sustaining their livelihoods".

They also received PhP 100,000 grant (in two tranches of PhP 50,000 each) based on their submitted proposals. After having received the grant, the PO was asked to submit accomplishment reports on how they made use of the fund granted.

The first tranche was used to buy materials for making *balsa* or *gaket*. The second tranche was used to build a common nursery and additional *gaket*. Creating a common nursery was very important and served the needs of the *lato* farmers. When seedlings were scarce due to unfavorable climatic conditions, some *lato* farmers with seedlings refused to share them with others. The farmers whose seedlings/plantings were destroyed were not able to plant. The association bought seedlings with the common nursery project and planted them for propagation. Each farmer now had the chance to buy from the nursery to propagate or replant in his/her farm lot.

### 3.7. Profile of *Lato* Farmers

The average age of the household head (presumably the seaweed farmer) corresponded to the report of Espaldon et al. (2010) for seaweed growers in Batangas. They ranged in age from 27 to 68 years. However, they had a slightly bigger household size (five). In education, both groups had a similar proportion (about 25%) of high school graduates, but more Batangas growers reached the elementary level or graduated (50%) than in Magsaysay (~35%). They were similar in the proportion of growers who reached or graduated college.

As for the main occupation, both groups claimed seaweed farming as the main livelihood. However, the Batangas seaweed growers comprised 76% of the participants, while the Magsaysay growers comprised only 35%. Conversely, only 8% of Batangas participants said they fished, while this proportion almost doubled (>15%) among our participants. For both groups, other sources of livelihood included construction/labor, driving (tricycle or public utility jeepneys), and employment in government or private agencies.

Notably, only 28% of those who grew seaweeds in Batangas relied solely on their seaweed income. In contrast, all the Magsaysay seaweed growers relied solely on seaweed income regardless of their monthly income. A significant difference is the level of income derived from seaweed farming. The average household monthly income among Batangas seaweed growers is PhP 57,544. Magsaysay *lato* growers range from less than 3000 per month to more than PhP 31,000 per month, with the majority in the lower ranges up to PhP 11,000 per month.

As a family-based livelihood, *lato* growing remains attractive to coastal families primarily because it provides a better income, requires less initial investment, and entails less taxing labor than growing cashews, rice, or vegetables. FAO (2018) supported these observations and further stated that what makes seaweed farming attractive to coastal communities is that the technology is relatively simple, and the crop can be harvested in about six weeks. Also, seaweed farming enables women and children to safely access seaweed plots, furthering the entire family's involvement in the enterprise. Thus women gain a significant opportunity to earn income for themselves and their families while the men work as fishermen and in other sectors.

### 3.8. Associations Related to *Lato* Farming

According to IFAD (n.d.), small family farms comprise 85% of all farms worldwide. Many of these farms are in isolated areas such as islands. The people on these farms constitute the majority of the rural poor. Smallholders form organizations to help overcome the challenges associated with this isolation and increase profitability and productivity.

Farmers organizations (FOs) are essential institutions for empowering poverty alleviation, farmers' advancement, and assisting the rural poor (Penunia, 2011). Growing evidence from Africa (Sinyolo, 2018) showed that farmers' organizations (FOs), mainly involving smallholder farmers,

enable their members to overcome challenges such as lack of finances, knowledge, and networks.

Penunia (2011) further explained that, on one side, FOs increase the likelihood that policymakers and the public hear farmers' voices. On the other side, FOs can help farmers gain skills, access inputs, form enterprises, and process and market their products more effectively to generate higher incomes. Through FOs, farmers can access information needed to produce, add value, market their commodities, and develop effective linkages with input agencies such as financial service providers and output markets.

The FOs found in the study site are successful because they could arrange major investments (Chamala & Shingi, 1998) in the organization, especially by private institutions like the Malampaya Gas Field. It can be inferred that to accomplish this, the leadership is truly representative and enlightened enough to build and nurture these FOs.

Chamala and Shingi (1998) further noted that several low-resource farmer groups working with other stakeholders like banks, agribusiness, NGOs, private consultants, and religious and philanthropic agencies would bring more resources to the development process. IFAD (n.d.) agreed that when smallholders and other resource-poor agricultural producers work together, it becomes easier to access farming inputs such as seeds, plant material, water, fertilizers, and pesticides and to aggregate produce to reach larger markets. Farmers are then able to reduce costs and improve their bargaining power. Moreover, farmers are better positioned to improve their food security and move out of poverty when they thrive.

Nguyet (2002) similarly noted that when farmers work together in groups, important new skills are developed like technical skills, group management, problem-solving, economic cooperation, bookkeeping, verbal expression, and grassroots democracy, which all help the rural society to develop more quickly economically, socially, and politically. Moreover, members obtain the benefits of scale working together. The organization helps farmers " formulate their needs for assistance, propose appropriate solutions, and request support from relevant institutions (administrations, technical services, mass organizations, other groups of farmers, etc.)."

### 3.9. Aspiration of *Lato* Growers

Mausch et al. (2018) argued that a better understanding of households' aspirations is key to designing successful technologies that will be widely adopted. Mojo et al. (2015) added that aspirations motivate behaviors, serve to mobilize and direct energy into actions, and are regarded as important determinants of success.

As expected, participants aspire for a stable market and price for their produce. It was not immediately apparent what they meant by stable market and price, although we can deduce that the desire is to make money/gain from their efforts. They may agree with Issing (2002) that price stability is equated with financial stability.

Finally, there is an aspiration for sustainable livelihoods. A livelihood is deemed sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities, assets, and activities now and in the future while not undermining the natural resource base (Serrat, 2008). The participants viewed sustainability as perpetuating into the future but did not indicate the concept of not undermining the present resource base. However, the training on biodiversity-friendly livelihood has highlighted this concept with them. Moreover, the participants' thinking of sustainability calls for a move away from prescriptive to location/situation-specific approaches and activities, which stress the participants' "ownership" of their actions.

The discussion of sustainable livelihoods may include the human aspect, covering skills, knowledge, and the health and safety of the next generation of farmers and workers (BAT, 2014). Accusations of child labor can be made, mainly as the enterprise is often described as a "family affair". Along with working conditions and the farmers' discouragement of their children from entering the same enterprise, these are common challenges concerning the growers' aspirations that must be addressed.

### 3.10. Growing *Lato*

FAO (2018) states that *Caulerpa* is the second most commercially significant species after Eucheuma spp. Farming seaweeds in the Philippines generates income for more than 500,000 people from over 100,000 families living along coastlines and on the many islands. Chen et al. (2019) reported on previous studies, which suggest that the optimal salinity concentration for the growth of C. *lentillifera* was between 30‰–40‰ while the optimal temperature for growth was about 20–28 °C. In Palawan, Del Mundo et al. (2002) validated the selection of Magsaysay and Cuyo as an ideal site for *lato* production, designating it as a Class A site due to its favorable climatic conditions for year-round cultivation. This class includes Agutaya, Cagayancillo Balabac, and Calamianes Group of Islands.

The participants mentioned *lato* production is still a desirable livelihood because it does not entail complicated or expensive processes and inputs. Espaldon et al. (2010) explained that setting up is an easy process for the farmers. Materials needed are few and, for the most part, inexpensive, like bamboo, sticks, strings, and seedlings. Some farmers buy only the seedlings. Maintenance requires minimal time only. It includes replacing each stick and string every two to three times of use and the bamboo every year. There is no need for other daily inputs. Planting and harvesting are the most time-consuming activities for seaweed farming.

The reported decline in the production of *lato* in the study site is confirmed by Hill et al. (2011). They said that this decline resulted from the highly intensive nature of the farming system and subsequent disease-related issues. Therefore, the situation was not unique to the study site. They noted that from 2011, production of 5,145 metric tons, production dropped to only 1,219 mt in 2015.

Although the *lato* is widely cultivated in the Philippines, commercial-scale production is still insufficient (Chen et al., 2019), and productivity does not meet demand. It might be due to the lack of optimum cultivation conditions.

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The reported growth characteristics of *lato* in Magsaysay corresponded to seasonality, growth rates during the peak seasons, and reduction in growth due to freshwater intrusion (heavy rains in the wet season) (Trono & Denila, 1987). Trono and Denila (1987) reported that low light intensity and nutrient levels were suspected of complicating factors affecting its growth. However, these factors were not covered in this study.

The rapid growth of the *lato* in the site is also not unique to the site but is inherent in the species. Rabia (2016) reported the same for *lato* grown using tray and sowing methods, which increased in weight from 476 to 888% over the initial weight recorded. She further noted that while these weight increases are quite significant, they are relatively lower than the increase in biomass reported by other researchers.

Still, the production of seaweed, especially in large volumes, could represent a "transformational change" in the global food security equation, according to the World Bank (n.d.). Because seaweeds (including *lato*) serve many uses beyond human food - animal feed and biofuels most especially could generate revenues and improve environmental quality - all responsive to the aims of environmentally friendly livelihoods.

### 3.11. Marketing of *Lato*

The selling price of *lato* reported by the participants in 2015 shows that prices have remained relatively unchanged for several years. Del Mundo et al. reported in 2002 that *lato* is sold fresh at PhP 70 to PhP 80 per kilogram. Regardless, the World Bank (n.d.) said prices here are significantly higher than in Africa's similar markets because of proximity to markets. On the other hand, production costs were also higher.

As described by the participants, the process of harvesting and then delivering to the market reflected the process across Indonesia's production sites (Simos, 2011). Harvesters (usually women and children) collect the "grape" clusters and return to shore to clean the harvest. It entails removing plant runners, stems, and damaged berries. The cleaned produce is then sold directly to buyers in the local markets or is sold as seedlings to other farmers/growers.

### 3.12. Initiatives Under the Biodiversity Conservation Project

Seaweed farming has become one of the most important livelihood sources for at least 100,000 coastal families in Southeast Asia, contributing to reducing blast and cyanide fishing and improving peace and order in seaweed farming areas (Simbahon & Ricohermoso, 2001).

Despite its importance, the Philippines' seaweed industry is still constrained by key issues from input provision to processing. The PRDP (n.d.) noted that among these issues are lack of access to good quality seedlings, lack of know-how in technical aspects of seaweed farming, including postharvest practices, lack of access to financial resources to grow a business and to facilitate upgrading, lack of postharvest facilities and logistics, the prevalence of unregistered buyers directly purchasing from the farm, absence of policy relating to water use and permits.

However, in support of the enterprise, Mendiola (2019) stressed that seaweeds are much more sustainable than other aquaculture species because they do not need feeds and do not create waste in aquaculture. The plant only requires seawater, light, and an attachment point. Another plus is that they are nutritionally rich - promising many health benefits.

They positively affect the environment because they absorb carbon dioxide and release oxygen while cleaning water by removing unnecessary nutrients. Water, where seaweeds are cultivated, becomes a nursing ground for fish and crustaceans. Hehre and Meeuwig (2016) reported that comparisons of reef fish landings across the central Philippines reveal that the catch of siganids was positively correlated to farmed seaweed production.

The common nursery set up by the project participants reportedly had positive effects mainly related to the members/growers' access to planting material. BFAR (2008) described that the impact of even a 1/4 ha nursery is quite significant. A ¼ hectare seaweed nursery can serve one and a half (1.5) new hectares of seaweed grow-out every cropping. There will be an estimated three croppings per nursery in 12 months. Not only will this shared nursery help its members, but they can eventually help farmers in other areas or expand their plantings in Magsaysay.

The growers collaborated with LGUs, NGOs, and academe to establish a biodiversity-friendly livelihood. Farrington (1998) suggested that agricultural and rural development strategies would benefit from increased collaboration between government research, extension organizations, and nongovernmental development organizations. This collaboration can mutually reinforce the NGO's group organizing and human resource development skills, complementing the government's technical skills and facilities.

## 4. Conclusions

The study points to the need for sustained support for seaweed production, specifically *lato* production in Magsaysay, Palawan, as a biodiversity-friendly livelihood that addresses the call for poverty alleviation, food security, and inclusiveness. The interventions of technology providers are highly relevant and will highlight the contributions of academic and relevant government agencies like the Bureau of Fisheries and Aquatic Resources (BFAR). Specific interventions include quality seedlings/planting materials, providing credit, and establishing appropriate water use and water quality policy.

To make the enterprise more viable, the participants call for initiatives on sustaining reasonable farm gate prices and relevant interventions across the various stages of the value chain. Identifying the priority interventions can be the subject of more research. Government and development agencies can create more appropriate and sustainable policies to benefit the small-holding growers by supporting and involving legitimate farmers' organizations at all decision-making levels.

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from where they derive their livelihoods. They also manifested a commitment to conserve the said natural resources.

**Declaration of Conflict of Interest**

The authors declare that no conflict of interest is involved in this study.

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**References**

Banu, A.T. (2011). *Nutrient composition, antioxidant activity and therapeutic use of selected seaweeds* (PhD Thesis). Avinashilingam Deemed University For Women). Retrieved from http://hdl.handle.net/10603/5570.

BAT. (2014). Supporting farmers' livelihood: The opportunity. sustainability focus report 2014. British American Tobacco (BAT). London. Retrieved from https://www.bat.com/ar/2014/assets/downloads/ Supporting_farmers_ livelihoods_-_The_opportunity_2014.pdf.

BFAR. (2008). *Fisheries commodity roadmap: Seaweeds.* Bureau of Fisheries and Aquatic Resources (BFAR). Diliman, Quezon City.

Cabial, R.F.L., Keh, H.T., Jalijali E.F.B, Nazal, M.E.B.H., & Llanos, N.L. (2015). The chemical analysis of omega-3 fatty acid and cadmium in Caulerpa lentillifera and Euchemia dentriculatum using high performance liquid chromatography and atomic absorption spectroscopy. *Proceedings of the DLSU Research Congress, 3, 2015.* Research Congress 2015: Research for Sustainable Future Dela Salle University, Manila, Philippines.

Chamala, S. & Shingi, P.M. (1998). Establishing and strengthening farmer organizations. In FAO (1997), *Improving agricultural extension: A reference manual* (Chapter 21.). Food and Agriculture Organization of the United Nations. Rome, Italy.

Chen, X., Sun, Y., Liu, H., Liu, S., Qin, Y., & Li, P. (2019). Advances in cultivation, wastewater treatment application, bioactive components of Caulerpa lentillifera and their biotechnological applications. *Peer Journal,* 7, e6118. doi: 10.7717/peerj.6118.

Del Mundo, R. D., Cabungcal, R. M., & Fontanilla, Z. T. (2002). *Status of Kappaphycus and Caulerpa farming in Palawan.* BFAR Region 4, Diliman, Quezon, City.

Espaldon, M.V.O., Sumalde, Z.M., Rebancos, C.M., Villanueva, J.D., & Mercene-Mutia, M.T. (2010). *Sustainable livelihood and seaweed farming in Calatagan, Batangas, Philippines.* IIFET 2010 Montpellier Proceedings.

FAO. (2018). The global status of seaweed production, trade and utilization. *Food and Agriculture Organization of the United Nations Globefish Research Programme (124),* 124.

Farrington, J. (1998). The role of nongovernmental organizations in extension. In FAO. 1997, *Improving agricultural extension: A reference manual,* (Chapter 23). Food and Agriculture Organization of the United Nations. Rome, Italy.

Gerundio, R.L.J., .Orbita, R. R., & Orbita, M. L. S. (2020). Growth, biomass and productivity of green seaweed *Caulerpa lentiliifera* (J. Agardh) at different stocking densities. *International Journal of Biosciences, 16(4),* 290-298.

Hehre, E. J. & Meeuwig, J. J. (2016). A global analysis of the relationship between farmed seaweed production and herbivorous fish catch. *PLoS One 11(2),* e)148250.doi: 10.1371/journal.pone.0148250.

Hill, N A.O., Rowcliffe, J. M., Koldewey, H.J., & Milner-Gulland, E.J. (2011). The interaction between seaweed farming as an alternative occupation and fisher numbers in the Central Philippines. *Conservation Biolog,y 26(2),* 324-334.

IFAD. (n.d.). *Farmer organizations: Resources and bargaining power for rural producers.* International Fund for Agricultural Development. Retrieved from https://www.ifad.org/en/farmer-organizations.

Issing, O. (2002). *Why stable prices and stable markets are important and how they fit together.* Paper presented at the First Conference of the Monetary Stability Foundation on December 5 2002 in Frankfurt, Germany. Retrieved from https://www.ecb.europa.eu/press/key/date/2002/html/sp021205.en.html.

Jiménez-Escrig, A. & Sánchez-Muniz, F.J. (2000). *Dietary fibre from edible seaweeds: Chemical structure, physiochemical properties and effects on cholesterol metabolism.* Retrieved from http://www.pacificharvest.co. nz/wp-content/uploads/2016/07/Jimenez-2000-Nutrition-Research-20.pdf.

Mausch, K., Harris, D., Heather, E., Jones, E., Yim, J., & Hauser, M. (2018). Households' aspirations for rural development through agriculture. *Outlook on Agriculture, 47(2),* 108-115.

Mendiola, I. (2019). *Seaweed: The sustainable option that can improve food security.* F&B Report. Retrieved from http://fnbreport.ph/features/seaweed-the-sustainable-option-that-can-improve-food-security-idgem- 20190 719/.

Mojo, D., Fischer, C., & Degefa, T. (2015). Collective action and aspirations: The impact of cooperatives on Ethiopian coffee farmers' aspirations. *Annals of Public and Cooperative Economics, 87(2),* 217-238.

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Nguyet, N. T. K. (2002). Establishment and maintenance of farmers' groups (FGs). *Agricultural Extension Network Updates (AENU), 5(1),* 1-7.

Paul, N.A., Symon, A.D. & de Nys, R. (2009). *Green caviar and sea grapes: Targetted cultivation of high value seaweeds from the genus Caulerpa.* School of Marine and Tropical Biology, James Cook University, Townsville 4811.

Penunia, E. A. (2011). *The role of farmers' organization in empowering and promoting the leadership of rural women.* Paper presented to the UN expert group meeting on "Enabling rural women's economic empowerment: institutions, opportunities and participation?" organized by UN Women in cooperation with FAO, IFAD and WFP on Sep 20-23, 2011 in Accra, Ghana.

PRDP. (n.d.). *Seaweeds value chain analysis Palawan*. Department of Agriculture Philippine Rural Development Project. Philippines: Author.

Rabia, M.D.S. (2016). Cultivation of *Caulerpa lentillifera* using tray and sowing methods in brackish water pond. *Environmental Sciences, 4(1),* 23-29. http://dx.doi.org/10.12988/es.2016.51012.

Ratana-Arporn, P. & Chirapart, A. (2006). *Nutritional evaluation of tropical green seaweeds Caulerpa Lentillifera and Ulva reticulate.* Retrieved from https://www.researchgate.net/publication/267256016_ Nutritional _ Evaluation_of_Tropical_ Green_Seaweeds_Caulerpa_lentillifera_and_Ulva_ret iculata.

Salayao, N. D., Tagarino, R. N., & Kick, C. G. (1991). *Seaweed farming in the Philippines: Its prospects in Northeast Sorsogon.* Study report retrieved from https://www.doc-developpement-durable. org/file/culture-algues/algoculture/SEAWEED %20FARMING%20IN%20THE%20PHILIPPINES.p df.

Serrat, O. (2008). *The sustainable livelihoods approach. Knowledge solutions from the Asian Development Bank.* Retrieved from https://www.adb.org/sites/default/files/publication/27 638/sustainable- livelihoods-approach.pdf.

Sharma, B. R. & Rhyu, D. Y. (2014). Anti-diabetic effects of Caulerpa lentillifera: Stimulation of insulin secretion in pancreatic β-cells and enhancement of glucose uptake in adipocytes. *Asian Pacific Journal of Tropical Biomedicin,e 4(7),* 575-580.

Simbahon, R. S., & Ricohermoso, M. A. (2001). Developments in seaweed farming in Southeast Asia. In L. M. B. Garcia (Ed.), *Responsible aquaculture development in Southeast Asia. Proceedings of the seminar-workshop on aquaculture development in Southeast Asia organized by the Aquaculture Department, Southeast Asian Fisheries Development Center, 12-14 October 1999, Iloilo City, Philippines* (pp. 99-102). Tigbauan, Iloilo, Philippines: Aquaculture Department, Southeast Asian Fisheries Development Center.

Simos, T. (2011). *Caulerpa value chain review 2011: Fiji and Samoa.* Australian Centre for International Agricultural Research.

Sinyolo, S. (2018). *Why it's beneficial to organise smallholder farmers into groups. The Conversation Media Group Ltd.* Retrieved from https://theconversation.com/why-its-beneficial-to-organise -smallholder-farmers-into-groups-98028.

Trono, G. C. & Denila, H. L. (1987). Studies on the pond culture of *Caulerpa*. *Philippine Journal of Science,* 17, 83-98.

Wild Singapore. (2016). *Round sea grapes on Singapore shores: Caulerpa lentillifera. Wild Fact Sheets.* Retrieved from http://www.wildsingapore.com/wildfacts/plants/seawe ed/chlorophyta/lentillifera.htm.

World Bank. (n.d.) *Seaweed aquaculture for food security, income generation and environmental health in tropical developing countries.* 16 p. Retrieved from http://documents1.worldbank.org/curated/en/ 9478314690 90666344/pdf/107147-WP-REVISED-Seaweed-Aquaculture-Web.pdf.

Yap, W.F., Tay, V., Tan, S.H., Yow, Y.Y., & Chew, J. (2019). Decoding antioxidant and antibacterial potentials of Malaysian green seaweeds: *Caulerpa racemosa and Caulerpa lentillifera. Antibiotics,* 8(3), 152.

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