Seaweed Farming in the Sulu Archipelago

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After the successful culture of *Eucheuma* in Siasi, Sulu by the group of the late Dr. Maxwell Doty, Sulu and Tawi-Tawi became the first provinces to adopt and innovate on the technology. Seaweed farming in the Sulu archipelago became a major livelihood second to fishing especially among the coastal dwellers. Seaweed farming improved not only the living conditions of the populace but also in part helped solve the insurgency problem. However, until today some farmers still remain poor despite the economic benefits they obtain from the industry. This may be due to the different problems that beset the industry, which affect them economically. This paper deals on seaweed farming in the Sulu Archipelago especially Tawi-Tawi, its problems and its impact on the environment.

Seaweed farming

The fixed off-bottom and floating methods are the most common methods used in seaweed farming in the Sulu Archipelago. An innovation of the floating method, the "palabad", is used in Sitangkai, where only one end of the line is tied to a stake leaving the other end free. The free end goes with the current. This is usually employed in deeper areas or in channels (river, harbor, or strait).

Farm size vary from 0.25 ha to over a hectare. The frequency of planting also varies. Some farmers plant 4 to 6 times a year while others plant 3 to 4 times a year. Most of the time, farming is done depending on the availability of funds (capital), seedling materials or people who could tend the farm. Planting is usually suspended whenever there is an occurrence of "ice-ice" disease. Since farmers already know the probable time when the disease occurs, they stop planting one month before the onset of the disease and resume planting a month after the disease disappears. This is done to make sure that the area is "clean".

Plants are usually harvested 20 to 45 days after planting. Farmers revealed that harvesting of plants depends on the demand of seaweed raw materials and sometimes dictated by buyers. Sometimes buyers prod them to harvest their plants even if their plants are newly planted because of the demand in the market. Farmers, however, say that it is not advisable to let the plants stay in the farm for more than 60 days because the plants become heavy that the thalli can no longer hold its weight. The thalli are brittle and easily break even with the slightest movement of the water. They also claim that even if they prolong their culture, their weight would no longer increase sizably. Furthermore, they stress that as soon as the plants reach optimum size, they harvest them immediately to avoid the occurence of "ice-ice" disease any time.

Farmers intimated that the "giant" variety are usually harvested 20 days after planting because this "giant" variety grows very fast, allowing it to acquire a large biomass immediately.

Seaweed farming is a family enterprise where almost all members of the family, including the children, are involved.

Seaweed Production

The introduction of seaweed fanning in the early seventies provided much economic benefits that it became the third ranking fishery export of the country. From the south, seaweed farming rapidly spread all over the country. At present the Seaweed Industry Association of the Philippines (SIAP) grouped the seaweed-producing areas into clusters, with Sulu and Tawi-Tawi belonging to cluster 5.

Among the different regions, the Autonomous Region for Muslim Mindanao (ARMM), where Sulu and Tawi-Tawi belong, accounts for 52% of the total seaweed production in the year 2000 (Figure 1). Practically, the whole province of Sulu and Tawi-Tawi is involved in seaweed farming. Areas in Sulu which are engaged in the industry are: Maimbong, Panglima Tahil, Indanan, Siasi, Pandami, Patikul, Pata, Tongkil and Tapul. In Tawi-Tawi, 8 municipalities are involved in farming wherein Sitangkai produced the most amount of seaweeds (Table 1). Data from the Provincial Agricultural Office of Tawi-Tawi indicated an increasing seaweed production from 50,034 t in 1992 and 240,420 t in 2000. An increasing number of farmers from 9,375 in 1992 to 21,000 in 2000 were involved in the activity. There were 5,054 ha planted with seaweeds in 1992 and this increased to 26,718 ha in 2000. The Provincial Agriculture Office of Tawi-Tawi reported an increasing trend in seaweed production for Tawi-Tawi from 1992 to 1999, however, production remained almost constant for 1999 and 2000. One reason is that the area planted with seaweeds did not increase compared with the previous years, and that there was almost the same number of farmers who were engaged in farming (Table 2).

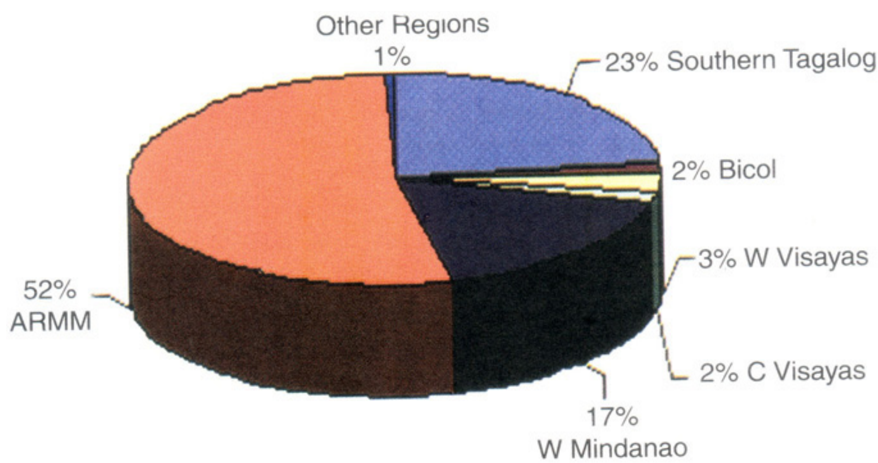

Figure 1. Percentage seaweed production by Region (Year 2000).
Source: Bureau of Agricultural Statistics.

Table 1. Area of seaweed farms and production by municipality, Tawi-Tawi (2000)

Municipality	Area Planted (ha)	Production (t)*	Potential Area (ha)	Number of Farmers
Sitangkai	6,739	59,216	375	4000
Panglima Sugala	4,279	38,798		3,556
Tandubas	3,964	35,963		3,203
South Ubian	3,140	28,547		2,203
Languyan	2,956	26,891	4,520	2,491
Simunul	2,564	23,363		2,049
Sapa-Sapa	2,090	18,810	1,118	2,491
Bongao	1,068	18,810		1,507
Total	**26,800**	**241,200**	**6,013**	**21,500**

*Average Production per hectare is 9 t
Source: Tawi-Tawi Provincial Agriculture Office (PAO), 2000

Table 2. Trend of seaweeds production (t wet-weight equivalent) in some provinces (1993-2000)

Province	1993	1994	1995	1996	1997	1998	1999	2000
Tawi-Tawi	103,867	123,047	164,763	166,200	181,336	186,293	189,192	168,398
Sulu	168,528	167,283	178,996	168,860	173,729	173,223	168,265	157,392
Palawan	56,439	102,150	102,649	178,910	163,495	141,301	103,386	139,950
Zamboanga City	15,063	45,140	79,128	85,139	82,151	95,260	98,131	81,947
Antique	1,714	1,653	1,255	1,282	1,843	12,027	17,222	18,831
Zamboanga del Sur	8,762	8,269	7,925	8,165	7,921	8,346	9,569	12,131
Zamboanga del Norte	0	0	0	0	0	5,850	8,010	11,907
Sorsogon *(Gracilaria)*	1,144	2,678	10,813	8,845	2,062	3,069	3,415	2,570
Camarines Norte	0	0	0	0	715	3,558	5,018	5,012
Mindoro Occidental	1,541	1,818	1,052	1,346	1,324	1,402	1,333	1,345
Surigao del Sur	624	493	391	440	556	565	739	1,178

Source: Bureau of Agricultural Statistics

life through seaweed farming. However, the fishing industry was severely affected because many fishermen shifted to seaweed farming.

In terms of ecological impacts, Trono (1993) claimed that in the construction of the support system for the farm, the associated ecosystems like the mangroves, coral reefs and seagrasses are affected. Cutting of tall seagrasses, removal of seaweed thalli and rocks are necessary. Initially, the stakes used are mangrove posts because they are stronger and lasts longer than other wooden stakes when submerged in seawater. In the process of planting and harvesting, trampling on the farm bottom, which can include transplanting on corals may also occur. However, the ecological benefits derived from farming far outweighs these detrimental effects (Trono 1993).

In fact Doty (1973) indicated that seaweeds culture is an effective conservation measure since this stops the practice of wild stock harvesting which do not mean pruning but tearing away the basal discs of the *Eucheuma* thereby disturbing the substrate. Harvesting from natural stocks is destructive, because this does not leave any material for regeneration, eventually extirpating the species from the area. This practice leads to ecological repercussions on some species, which are totally or partly dependent on the seaweeds and on the overall ecological function they perform.

The introduction of seaweed farming in resource depleted areas like reef flats results in the enhancement of their environmental conditions (Trono 1993, Phillips 1990). Seaweeds, as primary producers, enhance the organic production and serve as food to various herbivores like siganids and sea urchins, which are likewise food of some animals in the higher level of the food chain. Hence, productivity of the reef flat improves (Trono 1993). The presence of a large biomass of seaweeds results in habitat enhancement by providing shade, cover and attachment surfaces to associated marine plants and animals. Large seaweed farms may also help protect other more sensitive culture species and systems such as mussel or scallop culture (Phillips 1990). No study has yet been made on the amount of contribution of large seaweed farms to carbon sequestration in the atmosphere.

Seaweed farms also provide residence and food to some micrograzers like sea urchins, *Tripneustes gratilla,* which arrive in planktonic form and settle on the seaweed (Doty 1987). The second type of grazers is the synaptid holothurian, *Ophiodesma spectabilis,* that come as net plankters. In the process, they graze off the thalli of the seaweed thereby affecting their growth or severing them. To seaweed farmers, they are treated as pests, but they perform a role in enhancing the biodiversity of the area. Doty (1987) likewise noted that macrograzers like the long spined sea urchin, *Diadema sitosum,* rabbit fishes, puffer fishes are co-existing with the seaweed farms since they are the major grazers. But the largest grazer of all is the green turtle, *Chelonia mydas.* The effects of feeding especially in numbers is definitely devastating to the farmer but the farms serve as bountiful grazing ground of this threatened species. We have heard some accounts that green turtles forage in the seaweed farms of Tawi-Tawi and this was confirmed by one of the satellite tracking experiments wherein one turtle was recorded to have gone from Turtle Islands to Tandubas, Tawi-Tawi.

Seaweeds have also the special property to sequester some pollutants in the water medium as shown by Troell et al. (1999) when they used seaweed for removing nutrients from intensive mariculture. They are also known to absorb low levels of lead, mercury, arsenic, magnesium as shown in the analysis of the composition of carrageenan and seaweed flour.

In terms of its deleterious effects, Trono (1993) stated that since farms are now located in far away reef flats, settlements have now sprouted in these areas. This would then contribute problem of domestic wastes. However, he noted that due to strong currents prevailing in these areas, these wastes especially organic ones do not accumulate in the reefs as in the Danajon Barrier Reef in Bohol. In the municipality of Sitangkai, the farms are already located on the reef flats almost at the boundary between Semporna, Sabah, Malaysia and Tawi-Tawi because of the very good growth rates of seaweeds in these areas. Seaweed farmers from Sulu and even from Basilan have settled in what the natives call "pondohan" (personal observation). Initially, these were just temporary shelters to watch over their farms during the culture period. However, it has now evolved into clusters of five or more houses for every "pondohan". Each "pondohan", usually led by the head of the clan or large family, has its own system of governance and means of securing their farms and their property. In these areas, where they are left to fend for themselves, illegal fishing activities like dynamite and cyanide fishing are common practices. This is likewise true to the outlying reefs of Balabac Municipality in Mangsi Islands (personal observation). However, it was also observed that in some of the "pondohans" in Sitangkai, the farmers also grow out *Tridacna* species within their farms. *Tridacna* species are listed in CITES as threatened and if they can grow this out to maturity to a point that it has spawned at least once before eating the meat or selling the shell to Sitangkai traders, they shall have contributed to its conservation. It has also been observed that because of the prosperity that seaweed farming has generated, communities can now afford to build concrete houses and "pantans" or drying areas for the seaweeds. Unfortunately, they quarry coral stones and rubbles as filling or reclamation materials for the construction of their houses and drying areas. This is widely practiced in Sitangkai and in Tandubas areas (personal observation).

Phillips (1990) claims that since seaweeds culture system relies mostly on natural nutrient supply, its eventual depletion may occur. Though this has not yet been well studied, the use of nutrients through the macroalgae rather than phytoplankton food chains could disturb the natural nutrient recycling process and secondary productivity. Phillips (1990) further says that since high density culture areas require large amounts of nutrients, this will affect the long term viability of seaweed farming itself. Use of synthetic fertilizers to supplement natural sources of nutrients may not be a practical option.

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