1991

Aqua Farm News Volume 09(06) November - December 1991

Aquaculture Department, Southeast Asian Fisheries Development Center

AQUA FARM NEWS

ISSN 0116-6573

Produced by Audiovisual-Print Section
Training & Information Division
SEAFDEC Aquaculture Department

Vol. IX No. 6
November-December 1991

IN THIS ISSUE:

"Better life through aquaculture"

Aqua Farm News is published bimonthly by
Audiovisual-Print Section, Training and Information Division
Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

ISSN 0116-6573

Subscription rates:

Local - ₱40.00 per year
Foreign - US$26.00 per year (including air mail postage)

Please make remittances in Postal Money Order/Bank Draft/Demand Draft payable to **SEAFDEC Aquaculture Department**

What you should know about

SEAWEEDS

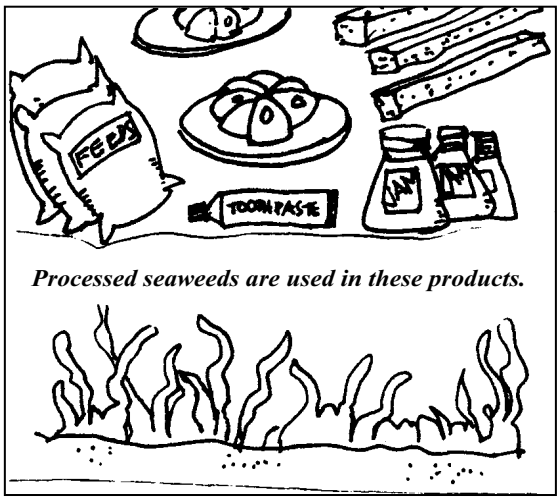
Seaweeds are marine algae which provide food for man, fish, and other aquatic animals. They are usually prepared as sated or used as component of Japanese dishes like *sushi* and *nigiri* and served as delicacies in the best hotels and restaurants. They are processed into hydrocolloid agar-agar, carrageenan, and alginate, and serve as stabilizing and gelatinizing agents in toothpaste, cosmetics, and solid fresheners; as suspending and gelling agents in breakfast dietary food, juices, jams, syrups, gravy, baby foods, pastes, and sauces; as sizing and coating agents in the manufacture of paper, textile printing and dental material; as binding and disintegrating agents in the manufacture of tablets; and as culture media in bacteriological preparations. Seaweeds are also used in the manufacture of feed and fertilizers.

Seaweeds are good sources of carbohydrates, protein, minerals, trace elements, and vitamins A, B_2, B_{12}, and C. Their food value varies for different species. Average chemical analyses of 46 species of marine algae in the Philippines show that the crude protein content (% dry weight) is 7.44, 6.40, and 9.29 for the green, brown, and red seaweeds, respectively. This is about 2 to 3 times the protein content of common green leafy vegetables which is 3.27% dry weight.

Fisherfolk living along coastal areas consume edible seaweeds in the form of salad or soup. The most commonly used species are: *Caulerpa, Codium,* and *Enteromorpha* (green algae); *Hydroclathrus* and *Sargassum* (brown algae); *Eucheuma, Gracilaria, Halymenia, Kappaphycus,* and *Porphyra* (red algae). Recipes were developed and evaluated by the former National Research Council of the Philippines which included pickled seaweeds, *okoy tagonton* seaweeds, *laksa* with seaweeds, bamboo shoots and seaweed salad, fish ball and seaweed soup, and fish and seaweed *lumpia.*

Seaweed species currently being grown commercially are *Kappaphycus* ("tambalang"), *Eucheuma* spp. ("gozo"). *Caulerpa* spp. ("lato"), *Gracilaria verrucosa* ("gulamang-dagat), *Porphyra sp.* ("gamet), and *Sargassum. Kappaphycus alvarezii* (*cottonii* type) and *Eucheuma denticulatum* (*spinosum* type) are the most widely cultured species, comprising 80-90% of the domestic seaweed produced; other species, 10-20%.

Common seaweed species processed locally are *Gracilaria verrucosa, G. eucheumoides, Gelidium* sp., *Gelidiella acerosa, Sargassum* sp., and *Eucheuma spp.* Seaweeds like *Kappaphycus, Eucheuma sp., Gelidiella,* and *Gracilaria* sp. can be processed into jams, jellies, candies, pickles, baby's food, and gulaman bars.



Processed seaweeds are used in these products.

Source: **Philippine Council for Aquatic & Marine Research and Development (PCAMRD) - Department of Science and Technology (DOST) Primer,** No. 2, October 1989.

item one

Seaweeds in the News

Having thrived for more than 20 years, the seaweed industry is one of the top foreign exchange earners for the country. Not content to merely rest on its laurels as a leader in the Southeast Asian seaweed industry, the Philippine sector is continuously striving to strengthen and improve.

The Philippines produced 268,701 tons of fresh seaweeds in 1989, valued at US$25.17 million. Only 1% of the total production was consumed locally as food (usually in salads), while the bulk was absorbed by local processors and export traders. The quantity of fresh seaweeds used for carrageenan processing was estimated at 240,700 tons, about 93% of the total seaweed production.

Exports

Seaweed exports come in the form of dried, fresh, and salted seaweeds as well as kelp meal powder. About 31,000 tons of dried seaweeds, valued at more than US$37 million, were exported in 1989 mostly to Europe (Denmark, France, and the United Kingdom which together accounted for about 57% of the total seaweed exports that year), and the USA (16%). About 26% of the total seaweed exports went to the Republic of Korea, Spain, Japan, Australia, Taiwan, West Germany, Hong Kong, Argentina, Ireland, Canada, and a few other countries.

Philippine seaweed production in 1988 was derived mainly from an estimated total area of 5,700 ha under cultivation. These production areas are concentrated in western Mindanao and the central Visayas, which account for 90.5% and 6.5%, respectively of the country's total seaweed production. Potential mariculture areas are estimated at 4,500 ha. This estimate is rather low compared to that of BFAR's approximately 13,000 ha of potential areas available for seaweed farming.

Source: *Production and utilization of seaweeds in the Philippines* by Ethel G. Liana in **INFOFISH INTERNATIONAL,** January-February 1991.

Seaweed industry eyes ASEAN market

The local seaweed industry in the light of increasing trade protectionism in the US and Europe, is developing new markets, particularly in the ASEAN region, for its carrageenan product.

Shemberg Marketing Corp., the largest exporter of seaweed products, has mapped out a ₱1-billion expansion program this year. It recently inaugurated a ₱100-million seaweed refinery in Zamboanga City and is signing today a loan agreement with the Asian Development Bank for a US $22-million loan for Shemberg Biotech Corp., a new refinery in Carmen, Cebu.

It is also expanding its existing refinery in Mactan, Cebu and is increasing its capacity for alternatively refined (AR) carrageenan from 4,000 to 6,000 tons a year and for refined carrageenan from 1,000 to 2,500 tons by January next year.

This will make Shemberg the third largest refinery in the world.

Industry officials said carrageenan exporters have been concentrating on traditional markets like US and Europe and seem to have forgotten that the ASEAN region, Asia, and the Philippines are huge markets also.

Carrageenan, which is derived from *Eucheuma,* a seaweed variety found mostly in the south

and in Visayas, has a wide variety of application in food and industry.

Benson Dakay, Shemberg executive vice-president and president of the Seaweeds Industry Association of the Philippines, said the ASEAN region alone can absorb yearly at least 3,000 tons of carrageenan worth US$30,000.

Japan net importer of the product, offers a potential market of at least 2,500 tons.

Dakay, said Thailand is interested in importing carrageenan for its canned tuna industry while producers of canned meat products in China are also engaged in talks with Shemberg.

Source: **The Philippine Star,** 3 December 1991.

Local seaweed industry sees better times

Philippine seaweed exports are expected to match last year's volume, or maybe even surpass it, despite recent developments which affected the Europe market.

Industry leaders said exports this year failed to increase significantly after the European Commission announced last May that it had set for 24 November this year the implementation of a ban on alternatively refined (Philippine natural grade) carrageenan with more than 2% acid insoluble matter (AIM) content.

PNG carrageenan exports, however, are expected to grow tremendously next year following a certification from the United States Food and Drug Administration that the product is safe. Orders from the US have started to pour in, it was learned.

Records show that from January to June this year, the country exported a total of 15,586 tons of dried seaweeds, alternatively refined (AR), and conventionally refined (CR) carrageenan valued at US$23.3 million. Exports for the year could reach 30 million tons.

Last year, about 31,961 tons worth US$51.1 million had been exported, compared to the 27,888 tons exported in 1989, valued at US$39.4 million.

Source: **The Philippine Star,** 5 December 1991.

Seaweed exports may triple to US$150 million

The Philippines is expected to triple its US$50 million worth of seaweed exports next year as the US Food and Drug Administration and the European Economic Community lift their ban on raw and processed Philippine carrageenan.

The Seaweed Industry Association of the Philippines (SIAP) said they expect to actively tap the $100-millon US market and the ₱50-million European market starting next year.

The value of seaweeds exports from January to June this year totalled $23.2 million where $4.5 million of which were for raw dried seaweeds representing 9,547.50 tons, $16.6 million for PNG carrageenan made up of 5,863.10 tons and $2.0 million for some 175.75 tons of refined carrageenan. PNG carrageenan captured 71.67% of total seaweed exports.

Zamboanga, Tawi-Tawi, and Sulu make up for 71.6% of *Eucheuma* or seaweed production while Palawan and Bohol-Leyte islands supply 4.5 and 0.8%, respectively. The industry supports some 60,000 families in these *Eucheuma* producing areas.

Source: **Manila Bulletin,** 18 December 1991.

Seaweed farmers need financing

Small seaweed farmers are in dire need of soft- and long-term loans from the government to enhance production and improve their bargaining power with big seaweed exporters.

Various sectors have expressed concern that despite the benefits being reaped by seaweed exporters due to the increasing demand of carrageenan in the world market, local seaweed farmers continue to be exploited and live on subsistence levels.

Almarin Centi Tillah, a civic leader form Sulu, and a brother of Muslim Senator Santanina Rasul, cited the continued exploitation of seaweed farmers who have remained poor, marginal, and undeveloped.

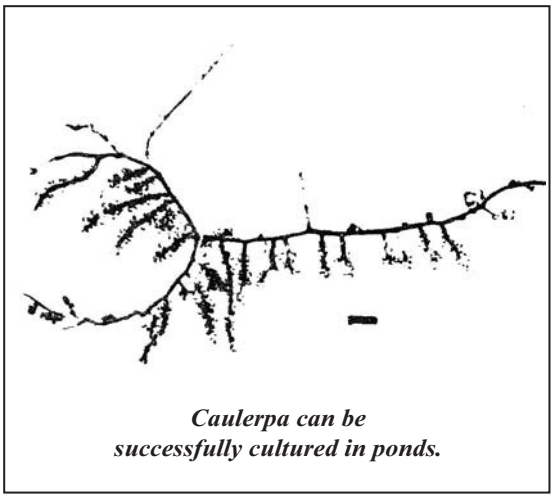
He stressed that the national government must draw up and institutionalize a credit program on a very soft- and long-term basis to improve their plight. He noted that what is unconscionable is the policy of lending to big processors who continue to exploit seaweed farmers by fixing the price of every kilogram of seaweeds among themselves.

Likewise, Tillah said the government should help organize the farmers into cooperatives to serve as a forum for discussing problems, formulating solutions, and drawing of action programs.

Source: **Manila Bulletin,** 23 December 1991.

Seaweeds pond culture studied

Caulerpa, a generic name for several species of edible seaweeds found all over the Philippines, locally known as "lato" can be possibly cultured ail year round using a flow-through system where a strict and efficient water management is applied, especially during the rainy months.



Caulerpa can be successfully cultured in ponds.

This was the gist of a study made by Gavino C. Trono, Jr. and Hector L Denila, of the Marine Science Institute, University of the Philippines, in their paper entitled "Studies on the Pond Culture of *Caulerpa."*

The research was undertaken to verify the farming method presently used for this type of species to package its culture technology for transfer to other areas, to check its economic feasibility, and to recommend management guidelines for the improvement of the present farming methods.

Source: **Manila Bulletin,** 31 December 1991.

Item Two

Seaweed Diseases

Three general categories of disease affecting *Porphyra,* the most extensively cultured seaweed in Japan, have been identified:

(i) Those caused by primary pathogens which attack *Porphyra* even when culture conditions are reasonably adequate, viz, red rot caused by *Pythium porphyrae* and chytrid blight caused by an unidentified phycomycete.

(ii) Those caused by facultative pathogens which attack weakened or stressed plants under poor culture conditions such as poor water quality, crowding, or abnormal water temperatures, viz, white rot which is of bacterial origin and green spot caused by bacteria like *Pseudomonas, Vibrio, Beneckea,* and Agar-bacterium.

(iii) Those caused by nutritional, genetic, or stress-related factors, viz, bud blight, white blight, and shot hole, which are believed to be induced by poor nutrition or water quality; poor quality product and cutting and washing blight which are thought to be caused by genetic or other plant characteristics; and tumors and diatom felt which seem to be induced by severe environmental stress.

Undaria culture, which has grown very rapidly in Japan from almost zero production in 1960 to over 100,000 tons in 1980, is also affected by diseases such as:

(i) Shot hole which is caused by bacteria of the genera *Vibrio, Alteromonas, Pseudomonas, Flavobacterium,* and *Moraxella,* and by the parasitic brown alga *Streblonema* and the copepod *Thallestris* sp.;

(ii) Chytrid blight which is caused by parasitic fungi.

Laminaria is also cultured in Japan for food but there has been no report of diseases so far, except for the occasional occurrence of parasites like *Hydrozoa* and *Polyzoa* which grow densely on the blades and cause low market prices.

Gelidium is the most important species for agar production in Japan. No diseases have been reported.

In the other countries in the region, there is limited occurrence of seaweed disease, perhaps because of the relatively recent introduction and development of seaweed culture compared to finfish and crustacean culture.

In India, the culture of seaweeds, mostly *Gracilaria,* is still at the experimental stage and no disease-related problems have been reported, except for sedimentation and grazing by fish. The expansion of the seaweed industry in India is constrained by scarcity of suitable areas as a result of pollution and limited transfer of technology for industrial use of seaweeds.

In Indonesia, a recent outbreak of "ice-ice" disease in *Eucheuma* has been reported.

In the Philippines, "ice-ice" disease has been reported in *Eucheuma* but the cause of the disease has yet to be established. A research study at the SEAFDEC Aquaculture Department identified the "rotten thallus syndrome" in *Gracilaria* cultured in tanks as caused by agar-digesting bacteria.

In Thailand, *Gracilaria* culture in ponds or net cages is done on an experimental basis and no diseases have been reported.

In China, the main species grown (i.e., *Laminaria, Porphyra, Eucheuma,* and *Gracilaria)* are affected by diseases classified either as environmentally induced (e.g., very strong illumination, sudden fluctuations of turbidity or salinity, and nutritional deficiency) or caused by pathogens (i.e., bacteria, fungi, etc.). In China, the diseases of *Laminaria* include green rot disease, white rot disease, blister disease, twisted-blade disease, malformation disease, sporeling detachment

disease, and swollen stipe-twisted frond disease. *Porphyra* is affected by the following diseases which are encountered during artificial seedling production and grow-out phases: filemot spot disease, red-rot disease, white-ring disease, shark skin-like disease, and white-rot disease. *Eucheuma* has been afflicted by "ice-ice" disease which seems to be preceded by poor nutrition and low phosphate concentration. *Gracilaria* in ponds is reported to be affected by epiphytic infestations (e.g., *Enteromorpha, Chaetomorpha, Ectocarpus,* and *Polysiphonia).*

In the Republic of Korea, the two principal cultured seaweeds - *Porphyra* and *Undaria* - are affected by fungal and bacterial infections as well as by environmental conditions like high temperature and low nutrient levels and by the overcrowding of installations.

Source: *Seaweed Health Management* by Jun-ichi Tsukidate, Chen Jia Xin, Yong Gun Gong in **Fish Health Management in Asia Pacific,** ADB/NACA, ADB Agriculture Department Report Series No. 1, June 1991.

Item Three

Environmental Impact of Seaweed Culture

Seaweed culture has expanded rapidly over the past few years. In 1987, the Food and Agriculture Organization of the United Nations estimated 3,139,473 tons (wet weight) of seaweed to have been produced throughout the world with the bulk from Eastern Asia. This expansion has brought benefits in terms of income, employment, and foreign exchange, but has also been accompanied by some conflicts with other users of the coastal zone and concerns over potential environmental impact.

Physical aspects

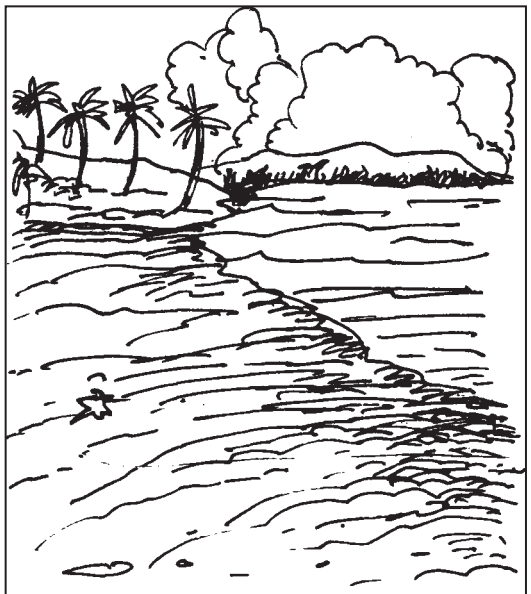
Site preparation of some species involves removal of rocks and other obstructions and potentially competitive grasses or predators. Such operations could result in some damage to coastal ecosystems, and in some instances the loss of species of conservation interest, such as seagrasses. The routine management of seaweed farms in shallow waters, such as *Gracilaria* or *Eucheuma* farms, can result in additional damage through trampling and accidental damage.

There is also some potential for large scale farms, such as the large areas covered by *Laminaria japonica* culture in China, to influence coastal water movement. There is the possibility of enhanced sedimentation, but seaweed farms can also protect coastal areas from erosion. Large seaweed farms may also help protect other more sensitive culture species and systems. For example, *Laminaria japonica* culture zones (in China) are used to shelter areas where more fragile and sensitive culture species and systems, such as mussel or scallop culture, are located. Introduction of seaweed culture rafts, ropes, anchors, and other structures can increase the surface area of substrate which particularly in open waters, may enhance production of other marine organisms in otherwise barren areas in the same way that artificial reefs have been shown to do. Seaweed culture may also be used very effectively to rehabilitate degraded coastal areas and enhance production from otherwise unproductive and barren environments.

Aesthetic aspects and multiuser conflicts

The potential aesthetic impact of aquaculture has dominated arguments over aquaculture development in some countries and aquaculture planners have to ensure that potential aesthetic

changes are considered during the development of new aquaculture ventures in order to avoid conflicts with other users. The recent conflict over the development of seaweed farming on Tubbataha Reef in the Philippines is probably one example where some of the user conflicts were derived from concern over potential aesthetic impacts. The large area required for economically viable seaweed culture in some countries has resulted in significant conflicts with users concerned with visual impact and others, such as fishermen and tourists, concerned with access.



Aesthetic considerations come into play when considering site selection for seaweed farming.

Ecological aspects

Seaweed culture is an extensive culture system which relies mostly on a natural nutrient supply. The reliance on natural nutrient supply is such that there is potential for seaweed culture to deplete coastal waters of nutrients. The effects of nutrient depletion have not been wen-studied, but nutrients diverted through the macroalgae, rather than phytoplankton food chains could affect patterns of nutrient recycling and secondary productivity. The removal of nutrients in high density culture areas also has implications for the long-term viability of seaweed farming itself.

So far, there are only a few reports of chemicals used in seaweed culture to control disease, remove fouling organisms and predators, and to assist processing. Formaldehyde has been used for controlling the growth of epiphytes on *Gracilaria* and slaked lime has been used to control other predators. It is important to ensure that practices continue to be conducive to production of a healthy project with minimal environmental impact.

The influence of seaweed culture on benthic communities has not been well studied. Shading or smothering by large scale seaweed farming could potentially reduce benthic productivity in shallow inshore areas. Increased sedimentation of organic matter from seaweeds and associated organisms could also increase benthic production in areas with low current velocity, although there may be some community changes. The area below seaweed culture areas can be used for production of other aquatic animals. For example, farms in Republic of Korea, Japan, and China find that the benthic area below seaweed farms can be used for culturing invertebrates such as abalone or sea cucumber, thus maximizing production and profit per unit area.

Seaweeds and farm structures (ropes, buoys, rafts, etc.) may also have a significant influence on coastal invertebrate and vertebrate populations. The introduction of seaweeds and structures can considerably enhance the productivity of invertebrates and fish in much the same way as artificial reefs, due to increased availability of shelter and food organisms.

Source: *Environmental Aspects of Seaweed Culture by* M.J. Phillips in **Regional Workshop on the Culture and Utilization of Seaweeds.** Vol. II, NACA. Bangkok. Thailand, August 1990.

Item Four

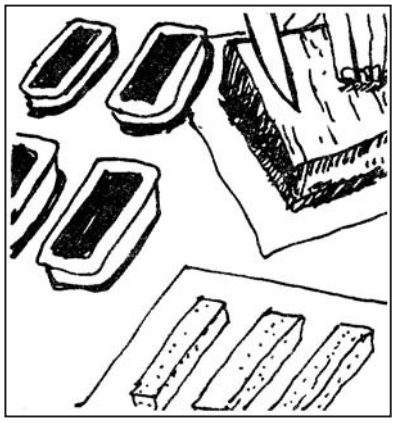
Processing Agar from Seaweeds

A seaweed extract, agar has broad commercial use. In the food industry, agar is used in making jellied desserts, as stabilizer in pie fillings, piping gels, meringues, icings, cookies, cream shells, anti-staling agent for bread and cakes, and as thickening and gelling agent in poultry, fish, and meat canning. It is also utilized as bacterial culture media and liquid media for culture of anaerobes in microbiology. In the medical-pharmaceutical industry, agar serves as laxative, suspending agent for barium sulfate in radiology, ingredient for slow-release capsules and in suppositories and surgical lubricants, and as a disintegrating agent and excipient in tablets. It is also used as impression materials to make accurate casts in prosthetic dentistry, criminology, and tool manufacturing. Very much used in tissue culture of orchids, teaks and anthuriums, agar serves in specialized laboratory applications in turbidimetric determinations involving suspensions of dense solids and in microtomy of plant tissues. In its purified form, bacteriological agar (agarose) is used in electrophoresis and immunology as in the isolation of viruses and genetic engineering for disease diagnosis.

Agar is extracted from some algae of Division Rhodophyta or the red algae. Some species of these seaweeds found locally are *Gracilaria, Gelidiella, Gelidium, Pterocladia,* and *Laurencia.*

How is agar produced out of the seaweeds?

Complete agar production involves two steps although agar produced after the first step is readily utilizable The first step involves washing of the freshly harvested seaweeds in freshwater. The seaweeds are dried to about 10% moisture, either by sun-drying or oven-drying. Bleaching and removal of salts is done on the seaweed samples with intermittent washing with freshwater and seawater. The samples are sun-dried once more to about light-brown color. These are boiled (30 min to 1 h) then strained using cheesecloth. The mixture is poured into trays and allowed to freeze while in cold storage. The crude extract is then thawed and cut into agar strips or "gulaman" bars. These agar strips are ready for use in several food recipes. The Industrial Technology Development Institute of the Department of Science and Technology has a pilot plant on agar processing.



The second step involves the refining of the crude agar into high-grade, high-quality purified form. This is achieved by subjecting samples of the crude agar to basic/alkaline solutions (3-5%); the samples are allowed to stand at room temperature tor three days. The samples are then washed with water. The residual alkali present in the solution is neutralized with dilute acids (i .e., 0.01 % HCI), washed with water and dried. Basically, the refining of agar means the reduction, if not removal, of sulfate to levels of about 0.02-0.3%. The entire process is both complex and expensive and should take place within a central processing plant which is still non-existent in the Philippines. The purified form could be used for bacteriological culture, biotechnology, genetic engineering, and specialized medical diagnosis.

Is there a bright prospect for the agar processing industry?

Yes. There is a high demand in the world market for this phycocolloid. In 1987, agar-producing seaweeds and their products accounted for roughly 9% of the total fish and fishery product exports of the Philippines. About 12 million metric tons of the seaweeds and their products, valued at around ₱-193 million, were exported. The purified form of agar known as agarose commands a price of US$1,000 per kilogram. In the event that advanced seaweed processing is successfully done locally, the country would be less dependent on expensive imports of agar products. This would in turn benefit the other local industries which depend highly on agar.

Source: **PCAMRD-DOST Technology Primer,** No. 4, March 1990.

Item Five

A Village Level Technology of Extracting Agar

Modifications in agar extraction were made to adapt the technology for use in Indian villages.

Materials

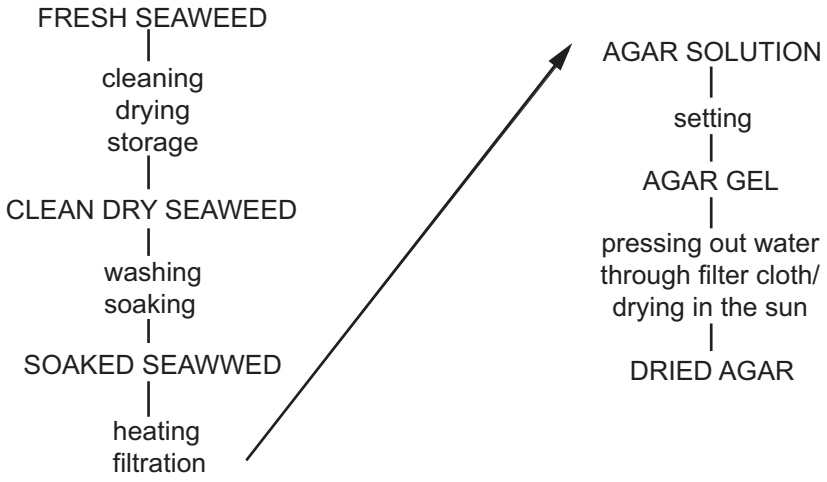
To conduct agar extraction trials, the following materials were used: clean seaweed; fresh water; tubs to soak and wash the seaweed; a pan (50 l) to boil the seaweed; wooden spoons; a kerosene or wood-fuelled stove; a screw press; two planks and some heavy stones; filter cloths; trays and a platform to dry the agar in the sun. All materials were purchased locally. The screw press was a larger version of the coconut press used in Thailand.

Agar extraction procedure

Seaweed collected from natural seaweed grounds, or from a seaweed farm, was cleaned and fully dried in the sun, so that it could be stored for (3-6 months). Before processing, the seaweed was washed and then soaked in fresh-water for several hours until soft. It was then heated in freshwater, the time depending on the amount and variety of seaweed. After heating, the sea-weed was filtered through a cloth with a screw press. The filtration had to be done quickly, and the screw press pre-heated with hot water to prevent the agar solution from setting during the process. The agar formed a gel after cooling. To remove the water from the agar, the gel was enclosed in a thick filter cloth and put under pressure either in the screw press or between two planks weighted with heavy stones for larger quantities. This process takes at least half a day, after which the agar needs drying in the sun for several days.

Village folks dry seaweeds for agar processing.

An outline of the agar extraction procedure is given below:



Extraction trials

Trials were conducted with small (100 g/l) and large (1 kg/10 l and 2 kg/20 l) samples of seaweed. The small (100 g) samples of seaweed (ground or un-ground, bleached or un-bleached) ware heated in 1 l of water for 1, 1.5, 2, or 2.5 h in a water bath, or heated directly. The larger samples were heated directly for 2, 3, or 4 h. All trials were conducted with samples from the same batch of seaweed, which was collected from a seaweed farm and fully dried. Water was added if substantial evaporation occurred during heating, and the water temperature was kept at 90-95°C. The seaweed residue was heated for a second time in 500 ml water for 20 min (100-g samples), in 4.75 l for 1 h (1-kg samples) or in 10 l of water for 1.5h (2-kg samples).

The data have not been analyzed statistically, since trials are continuing. The average agar yield obtained using this extraction method was 16% and is considered satisfactory. There were no big differences in agar yield between heating the seaweed in a water bath or heating it directly.

Source: *Extraction of Agar from Gracilaria edulis as a Village Level Technology - Preliminary Results by* B.A. Lalkman in ***Gracilaria* Production and Utilization in the Bay of Bengal**, Bay of Bengal Programme for Fisheries Development, Madras, India, November 1990.

Item six

Make Your Own Gulaman from Seaweeds

Seaweeds are locally produced into gulaman, a favorite dessert among children and adults. Gulaman is sold at the local markets in bars and is relatively easy to prepare.

Materials needed:

raw seaweeds *(Gracilaria, Gracilariopsis, Pterocladia, Gelidium, Getidiella)*
vinegar or 0.1 N sulfuric acid (H_2SO_4) available at the drugstore

commercial sodium thiosulfate ($Na_2S_2O_3$), also available at the drugstore
trays, basins, or any aluminum container; big kettle or vat; strainer or cheesecloth
bamboo matting or wire screen; ice; salt

Procedure

1. Select freshly harvested seaweeds gathered early in the morning or during low tide.
2. Wash the seaweeds with freshwater and drain thoroughly.
3. Spread the seaweeds into thin layers over wooden trays or in any clean container and dry under the sun for one week.
4. Resoak seaweeds in freshwater for 5-10 min. Dry again under the sun until the color of the seaweeds turns dirty yellow.
5. Once the seaweeds are dried, bleach them with weak acids like vinegar until the color turns olive green. One hundred g of dried seaweeds is either soaked in a solution of 3.5 l of water and 90 mi of 0.1 N sulfuric acid or soaked in a solution of half a liter water and 2.5 g of commercial sodium thiosulfate.
6. Drain the bleached seaweeds and sun-dry until sufficiently dried (light brown in color).
7. To the dried seaweeds, add 3.5 l of water and a diluted solution of vinegar until slightly acidic to taste. Allow this to boil for 30 min to 1 h while constantly stirring the solution. Boiling can be repeated until the solidification of the extracted agar is difficult to achieve.
8. Alter boiling, strain the seaweeds using ordinary cheesecloth. Separate the liquid portion from the plant residue.
9. After extraction, allow the filtered extract to cool and solidify. Once it is hard enough, cut into strips or bars or to any desired form.
10. Pack the gulaman strips or bars into an ice box with dry ice or wrap them in cheesecloth with ice and salt; keep the bars intact for 2-3 days.
11. Thaw the gulaman bars by placing them on bamboo mattings or wire screen and allow them to dry at room temperature.
12. Finally, allow the extracted thawed agar to dry under the sun until the desired texture is obtained.
13. Cool the gulaman bars before packing and storing.

Source: ***Make Your Own Gulaman from Seaweeds*** by Dalisay de Guzman and Ginna Guiang, Fisheries Research Department and Applied Communication Department, PCARRD, February 1987.

item seven

Regulations on Seaweed Gathering/Farming

Salient provisions from Fisheries Administrative Order No. 108 (1973-09-13, Series of 1973) are as follows:

Section 2. Gathering and/or culture of seaweeds

No person, partnership, association, corporation, or cooperative shall gather seaweeds in areas designated by the Director as seaweed restricted areas and seaweed farm lots or culture seaweeds in any public water area in the Philippines without any of the following permits or license

issued by the Director (of Fisheries):

a) Permit to Gather;

b) License to Culture;

c) Gratuitous Permit (for scientific, research, and/or educational purposes).

Section 3. Who are entitled to gather and/or culture seaweeds

a) Citizens of the Philippines;

b) Partnerships, associations, or corporations duly registered in accordance with law and sixty (60) percentum of the authorized capital stock of which belongs to citizens of the Philippines;

c) Cooperatives duty registered in accordance with law.

Section 4. Restrictions on seaweed fanning or culture

1. Size of seaweed farm lot -

a) For individual - Not more than an aggregate maximum area of 1 ha. provided that only one license shall be issued to a family, either to the husband or the wife unless they are living separately and independently from each other, and provided further that any member of the family and living independently, may also apply for a license.

b) For partnerships, associations, corporations, or cooperatives - Not more than an aggregate maximum area of 30 ha.

c) The provisions of the preceding paragraphs (a) and (b) notwithstanding, the (DA) Secretary may, upon the recommendation of the (DA) Director, increase or decrease the area that may be granted for reasons of public interest, taking into consideration (1) the financial capacity and/or qualification of the applicant; (2) the socioeconomic importance of the project or industry for which the area is applied; and (3) the existence of numerous applications for permits and/or license in the place where the area applied for is located.

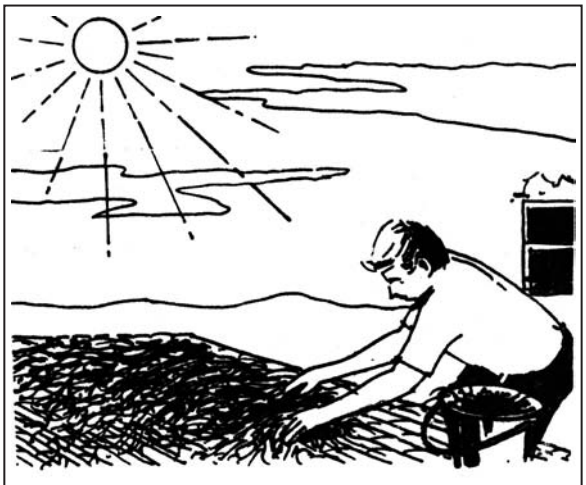
2. Establishment of seaweed farm lot - No seaweed farm lots shall be established within a distance of sixty (60) meters from each other nor shall they be so established as to obstruct free navigation.

Section 5. Obligations of seaweed fanner-licensee

The seaweed farmer-licensee shall comply with all pertinent existing laws, rules and regulations, and those which may hereinafter be promulgated.

Section 9. Duration of the license

A license to culture seaweeds in any public water area of the Philippines issued by the Director shall be for a period not exceeding ten (10) years subject to renewal; a permit to gather shall be for a period of one (1) year subject to renewal; and a gratuitous permit shall be for a period of six (6) months subject to renewal.



"Gotta make hay with this latest sunshine industry."

Item Eight

Seaweed Success Story

After he received his TOYM (for The Outstanding Young Men) award for aquaculture recently, seaweed king BENSON DAKAY was quoted as saying: "Let's go back to work "His friends were stunned; they were expecting a champagne toast at least.

But Dakay, 36, was just being true to the secrets of his success. 12-hour workdays and a consuming love-affair with seaweeds.

"I was playing with the sea," Dakay recalled of his "fishy" romance which began when he was nine. "Snorkeling led me to discover seaweeds," he recounted. At 11, the precocious Dakay asked his father to help him ship his first five tons of seaweeds to the United States. At 19, he made his first million.

Today, Dakay owns one of the biggest carrageenan refinery in the world - the Shemberg Marketing Corporation located on a 17-ha land in Paknaan, Mandaue, Cebu. His firm has cornered 35% of the world's market for carrageenan.

"Seaweed farming is a better alternative than cyanide fishing," Dakay said, explaining how the environmentally friendly carrageenan might help Pinatubo's victims recover from the crisis.

Shemberg buys ₱9.50 per kilogram of seaweeds from contract-growers, Dakay disclosed.

Carrageenan is a food additive used as stabilizer, binder, and extender. Noted for its suspending, thickening, and gelling properties, and as an emulsifying agent, it is used in ice cream, peanut butter, yogurt, meat products like hamburgers, hotdogs, turkey meats, and toiletries Ike shampoos and toothpaste.

Dakay's firm has so far earned some ₱300 million this year, mostly from exports to some 50 countries. But he expects to earn more because the United States' Food and Drug Administration recently declared Philippine seaweeds as safe for human consumption.

Dakay recalled receiving the FDA ruling a day before he was given the TOYM award.

It's a double-jackpot." Dakay said, vowing to spread his luck by bringing in even more dollars for the country.

Source: *A Fishy Romance* by Rita Villadiego in the **Philippine Daily Inquirer,** 23 July 1991.

Third Asian Fisheries Forum on 26-30 October 1992

The Asian Fisheries Society will hold the **Third Asian Fisheries Forum** and the **First Asian Fisheries Exposition (*Fish Asia '92*)** on 26-30 October 1992 in Singapore with the theme *"Fisheries Towards 2000."*

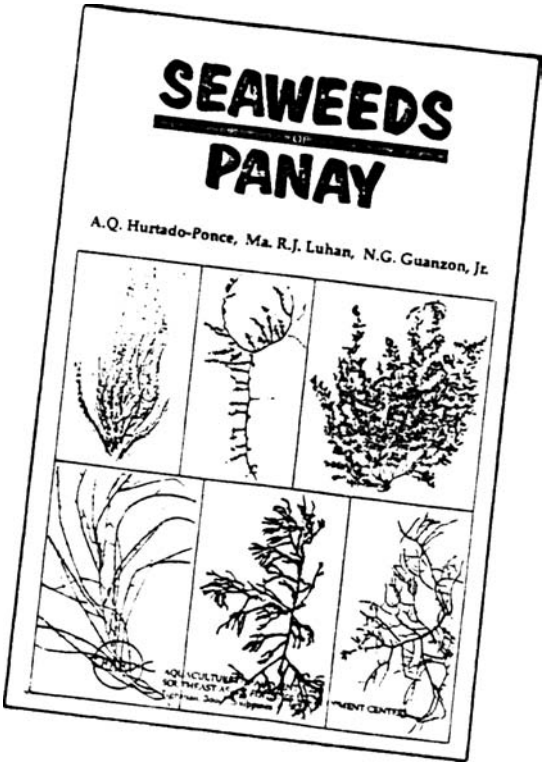
The forum offers a venue for fisheries and aquaculture specialists to share knowledge and discuss common problems, virtually the only event of its type on a large scale in Asia.

Fish Asia '92, a natural extension to the already well-established Asian Fisheries Forum, aims to bring together all the key players in the fisheries industry. Exposition participants and visitors wilt include the industry's buyers, sellers, multiple retailers, caterers, processors, importers, exporters, government representatives, and merchants from the local and international scene.

For further information, write: ITP Services Re Ltd, 2 Jurong East St. 21 # 05-19/22, IMM Bldg., Singapore 2260; Telex: RS 55223 PROMPT; Tel.: 2913238;FAX 2965384.

SEAFDEC/AQD NEWS

New Publication



Available in the first quarter of 1992 is ***Seaweeds of Panay*** by A.Q. Hurtado-Ponce, Ma. R.J. Luhan, and N.G. Guanzon, Jr. of SEAFDEC/AQD's Seaweed Project.

The book consists of four parts: (1) Introduction - reviews the literature, habitat, distribution, morphological structure, and reproduction; (2) Classification - describes the classes to which seaweeds generally belong; (3) Collection and Preservation - explains the procedure used in treatment of specimens; and (4) Taxonomic List - details the seaweeds found in Panay, Philippines. A glossary of technical terms and a list of references are included.

A highly informative and practical book, it acquaints and provides information to members of the academe and research institutions, policy makers, fishermen, and businessmen on the taxonomy, distribution, ecology, and economic importance of the seaweeds in Panay and Guimaras Islands.

AQUA FARM NEWS is produced bimonthly by the Audiovisual-Print Section, Training & Information Division of the **Aquaculture Department, Southeast Asian Fisheries Development Center,** P.O. Box 256, Iloilo City, Philippines.

Entered as second class mail matter at the Iloilo City Post Office on August 3, 1984.