

SEAWEED FARMING AS ALTERNATIVE INCOME FOR SMALL-SCALE FISHERMEN:
A CASE STUDY

by

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Abstract

If access to a fully exploited fishery resources remains open, the development of alternative or supplementary income sources offers the best hope for raising incomes in fishing communities. This paper presents a case study which examines the transition of Hingotanan, Philippines from an almost exclusive dependence upon capture fishing to an extensive involvement in seaweed (Eucheuma spinosum) farming. The paper also attempts to demonstrate the likely socio-economic impact of profitable income alternatives initiated by the private sector in an essentially free enterprise setting.

It was observed that the successful introduction of seaweed farming through an essentially free enterprise method, while greatly increasing the number of middle-income level families, has also resulted in the usual development syndrome - a widened disparity in income levels. Had seaweed farming been controlled by the community rather than individuals, perhaps the consequent benefits could have been more equitably distributed. Moreover, the lack of community organization of seaweed production is leading to over-production, declining prices, the likely concentration of the industry in the hands of fewer individuals often from outside the community, and thus transitory benefits for the majority of Hingotanan's residents.

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1. INTRODUCTION

Despite their social and cultural importance and their contribution to total fish production in most countries of the Indo-Pacific region, small-scale fishermen and their communities are among the poorest sectors of most economies. As pointed out by the prospectus for this symposium, "the endeavours necessary to fight poverty and improve socio-economic conditions by developing small-scale fisheries require solutions much different in kind and magnitude from those of the traditional approach to fisheries development."

The traditional approach has sought solutions to the low income problems of small-scale fishermen primarily within the context of the fisheries they exploit. For example, efforts to increase productivity by upgrading the vessels and gear of small-scale fishermen have been successful when additional or alternative fish resources exist to support the expanded fishing effort that upgrading brings. Also, in this same context, programmes to improve marketing or to form fishermen cooperatives have been justified on the basis of the assumed increased productivity that they will stimulate.

When, however, the available resources are overfished, two other alternatives are more appropriate. The first approach, and that most often attempted in temperate fisheries, is to restrict fishing effort in order to increase the sustainable yield, and thereby the income of those fishermen who remain. Such an approach, however, is in danger of overlooking the plight of those fishermen displaced by the management scheme. The second approach requires that attention be given to areas outside capture fishing per se. If access to the resource remains open, as is the case in most, if not all small-scale fisheries in the Indo-Pacific region, the development of alternative or supplementary income sources offers the best hope for raising incomes in fishing communities.

A reduction in the dependency of a community on fishing potentially produces other benefits in addition to increased income for those who take advantage of the alternative activity. First, because it may result in reduced fishing effort, there is a potential indirect benefit for the fishery resource which might now be fished less intensively and thus recover over time from the earlier overfishing. Secondly, income for the remaining fishermen may rise either because their share of the total catch can increase, or because the reduced fish supply results in higher prices of fish.

In addition to effects on income and catch, there may be other changes in community institutions or social relationships brought about by the new activity. Not all these effects are necessarily beneficial to the community involved.

The purpose of this paper is to present a case study of changes occurring in one such community: the barrio of Hingotanan, Talibon, Bohol Province, Philippines. The case study examines the community's transition from an almost exclusive dependence upon capture fishing to an extensive involvement in seaweed (Eucheuma spinosum) farming beginning in mid-1978. The paper also attempts to demonstrate the likely socio-economic impact of profitable income alternatives initiated by the private sector in an essentially free enterprise setting.

2. THE COMMUNITY

Hingotanan Island is located approximately seven kilometers northeast of the municipality of Talibon, on the island of Bohol in the central Visayas region of the Philippines (Figure 1). Populated by approximately 340 households, this isolated community has traditionally depended almost exclusively upon fishing for its livelihood. Fishermen explored the waters of Hingotanan island in their unmotorized or motorized bancas and used such fishing gear as hook and line, various forms of gill nets, small purse seines, and stationary corrals. Also used was the illegal method of dynamite fishing.

A wide variety of reef species, squids, siganids, crabs, round scads, anchovies, sardines, and larger pelagics such as tunas, barracudas, and mackerels were caught and sold fresh in Talibon and in outlying municipalities of the neighbouring province of Leyte. Anchovies were particularly plentiful and were either sun-dried or fermented in salt before sale. Although crabs were numerous in the area, it was only recently that a more effective method was used to catch them, such as large mesh gill nets in lieu of traps. Other sources of livelihood came from copra-making with the residents of the island generally leasing coconut plantation areas from absentee landowners.

Since the early 1970's, Hingotanan fishermen have experienced declining catches and incomes. Trawlers originating in Iloilo came to the island 10 years ago and have provided stiff competition for the resident fishermen. According to residents, the trawler activity, coupled with the initial large number of small-scale fishermen in relation to the fishing area, the predominant practice of dynamite fishing and use of illegally-sized nets by trawlers and small-scale

fishermen alike have considerably reduced the catch in the area. In addition, the gathering of wild seaweed (the Eucheuma cottonii variety) from nearby Danahon Bank of Hingotanan families led to the disappearance of siganids and squids. Productivity of waters in the vicinity of Hingotanan was so low by the late 1970's that fishermen resorted to exploring the reefs towards Leyte, and families started to migrate to other islands to look for alternative means of livelihood.

The introduction of seaweed farming as an alternative source of income for Hingotanan has been considered by many residents as a phenomenon that "saved" their barrio. Seaweed farming was met by such a high degree of enthusiasm that it wasn't long after its introduction that it became an intense activity of one-third of the island's families.

3. THE INTRODUCTION OF SEAWEED FARMING AND ITS IMMEDIATE EFFECTS

In contrast to many development efforts, seaweed farming in the Philippines evolved from initiatives taken by the private rather than the government sector. The search for suitable Eucheuma farming sites has been going on for over a decade. In the early 1970's the Tawi-Tawi area of the southern Philippines became the first major producing area of Eucheuma cottonii and to a lesser extent Eucheuma spinosum (Doty 1977, Raizin and Hollenbeck, 1979). Experiments by private companies and later the Bureau of Fisheries and Aquatic Resources (BFAR) began in the mid-1970's on the reef area between the Central Visayan islands of Bohol and Cebu, but encountered serious problems with grazers, primarily siganids. In 1976, Genu Products, a subsidiary of Copenhagen Pectin of Denmark, established a company farm on the Danahon Bank five kilometers northeast of Hingotanan Island. Numerous islanders were employed at ₱25.00 per day by Genu and the few other private investors from Cebu who also established seaweed farms on the same reef.

The reef proved ideal for Eucheuma farming. Indeed wild Eucheuma had been harvested off the same reef for at least the preceding decade. The sandy bottom is not exposed at low tide and the current flow provides conditions suitable for cultivation of both E. cottonii and E. spinosum. After development of a small experimental E. spinosum farm by Marine Colloids (Phil.) Inc., expansion by former fishermen from Hingotanan was rapid. Marine Colloids deliberately encouraged the farming of E. spinosum rather than E. cottonii as the company required the iota carrageenans which are derived from the E. spinosum type. A premium price was thus paid by them for the slower growing E. spinosum (see Table 1). Initial buying prices in Hingotanan were ₱4.30/kg. for E. spinosum and ₱1.80/kg. for E. cottonii.

Rather than adopting the corporate farming approach of Genu, however, Marine Colloids decided to encourage Hingotanan fishermen to engage in their own E. spinosum farming. Through lease arrangements secured from the Bureau of Fisheries and Aquatic Resources (BFAR), individuals were granted the rights to farm a maximum of one hectare of reef area each. In some cases, corporations were formed to farm larger areas, or individuals of the same family consolidated their leases into one expanded farming unit.

To facilitate marketing, Marine Colloids retained buyers on the island to purchase Eucheuma on its behalf. The company also purchased seaweed delivered direct to its warehouse in Cebu at a slightly higher price (see Table 1). With a decidedly optimistic market and faced with little or no future regarding secure income from traditional fishing, the Hingotanan families began their transition to adopting an alternative income activity.

In mid 1978, there were only a handful of seaweed farms on the reef. One and a half years later, there were over 200 hectares in production and 89 farmhouses dotting the reef. Moreover the BFAR offices in Regions VII (Cebu) and VIII (Leyte) have over 150 additional hectares under application. By the end of 1979, fully one-third of the families in Hingotanan were engaged in seaweed farming.

Investment and annual operating costs for a one hectare E. spinosum farm are not low. As indicated in Tables IV and V, an intensively operated one hectare farm requires initial capital outlay of ₱19,580 and annual operating capital of ₱34,343. An extensively operated farm (30% of area used) requires ₱14,905 and ₱16,273 investment and operating capital respectively (see Tables II and III).

How, then, did over 100 fishing families in Hingotanan raise sums of ₱30,000-55,000 each? In actuality, each seaweed farmer began on a much smaller scale, incurring initial expenses that were not significantly higher than those incurred for fishing. Most fishing families who went into seaweed farming already owned a banca and had to pay gasoline costs for fishing. In fact, fishing activities continued initially to tide families over until their farms became productive. Respondents cited the ₱1,000 capital outlay for the BFAR lease (bond) as the major barrier to entry, not the farmhouse expense or the seed plants for the farm. The former could be built at a later date when revenue began to accumulate from harvested seaweed; the latter could be borrowed from other farmers or from the major seaweed buyers, most of whom were ready to extend credit to assure later supply.

Initial capital outlay for most families thus was approximately ₱6,000 to cover monoline, stakes, hand tools, baskets, lease, seed plants and tie-ties. All labor would be family supplied at this early stage. The first harvest would come 75-90 days later, and then average 650-700 kg. per month thereafter. When prices received were as high as ₱4.30 per kg the initial capital outlay was thus repaid within 6 months. At a price of ₱4.30 per kg. an extensively operated farm would return a total annual revenue of ₱34,400, or ₱15,661 over annual production costs. An intensively operated farm was even more profitable giving a total annual revenue of ₱86,000, or ₱47,379 over annual production costs. It is not difficult to see how families, though starting their farming operations on a small-scale, were able to pay

off previous debts, build farm houses, buy bancas and modern appliances such as television, gas stoves and refrigerators, construct new homes, and send their children away to school. And all this occurred within one year of starting seaweed farming.

The rapid transformation in Hingotanan is also apparent by the large number of concrete houses in various stages of construction and in the more optimistic attitudes of the seaweed farmers. Whereas fishing incomes had earlier averaged ₱20 per day, seaweed farming incomes ranged from ₱40-130 daily. Moreover, and perhaps more importantly, income from seaweed farming was more certain and not subject to the unpredictability of environmental factors. One respondent sees his life before he became a seaweed farmer as one of hardship, difficulty and uncertainty.

"Fishing is a very uncertain occupation and it was getting to a point that catch was very low and operating costs were high. Gasoline was becoming more and more expensive. I could not send my children to school. Life now is definitely much better. There is more certainty regarding income for the family. I am now able to send my two sons to college. If I die, I will die a respectable man."

Another seaweed farmer concurred:

"It was difficult before because there wasn't enough money to go around .. now, there is enough money to spend, and with seaweed farming the dreams I had before have become projects."

The benefits from seaweed farming have also spread beyond the farm operators. Seaweed that drifts from the farms, or 'wash-out' as it is called, can be gathered along the shoreline and dried in small quantities and sold to the island buyers. Other residents, particularly women and older children, earn ₱8 - 10 daily by making the tie-ties that are used to secure the seed plants to the monofilament. The most important source of income in 1979 for those who did not own their farm was to work as laborers on the farms of others, earning ₱8 - 10 per day plus meals.

The entrance of so many families into seaweed farming has also led to a reduction in fishing effort on the part of Hingotanan residents. Since 1978 fish prices on Hingotanan have tripled from an average ₱2 per kg. to ₱6 per kg. at the end of 1979, at least in part due to a lower supply. Although catch for those remaining in fishing continues to decline the prevailing prices have maintained fishing incomes at higher levels than probably would have been possible had no fishing effort been diverted to seaweed farming. This continuation of declining catches could be attributed to the continued presence of trawlers in the area.

However, there is another perspective to the present situation in Hingotanan. While benefits from this new economic activity have definitely accrued to the participants in seaweed farming, these benefits have not been equitably distributed in the community.

There are still full-time small-scale fishermen on the island who are exclusively dependent upon fishing for their livelihood, and primarily because of limitations of their personal finances, were left behind in the development effort. Because of lack of capital, particularly the required ₱1,000 bond for lease rights, these fishermen could not gain entry into the mainstream of seaweed farming. Their marginal position is reflected in their physical isolation from the community center, living in run-down bamboo and nipa huts and displaying the lack of basic necessities and amenities.

It was observed that the introduction of seaweed farming through an essentially free enterprise method, while increasing the number of middle-income level families has also resulted in the usual development syndrome - a widened disparity in income levels in the community as a whole. As the seaweed industry developed, there was apparently no effort made by government or the community itself to manage the seaweed activity as a community endeavour. Had seaweed farming been controlled by the community rather than individuals, perhaps the consequent benefits could have been more equitably distributed among a wider range of Hingotanan families. Moreover, the lack of community organization of production is leading to a situation where seaweed farming benefits are likely to be transitory for the majority of Hingotanan's residents.

4. EVOLVING TRENDS AND FUTURE DIRECTIONS

The approximately 200 hectares on Danahon Bank produced in excess of 350 tons of dried Eucheuma spinosum in the month of November 1979 alone, equal to the annual E. spinosum production of the entire country only two years earlier. This high level of production, while indicative of the encouraging responsiveness of fishermen to a profitable alternative activity, has unfortunately driven prices down to the point that they barely cover production costs. Hingotanan seaweed farmers are thus encountering the same boom and bust cycle experienced in 1975 by Tawi-Tawi seaweed farmers (Doty, 1977). Buying prices for E. spinosum have fallen from a high of ₱4.60 per kg. in mid-1979 to ₱2.00 per kg. beginning January 1980. E. cottonii prices have fallen from ₱2.00 per kg. to ₱1.50 per kg. in the same period (Table 1). The current prices are sufficient to cover the ₱1.93 per kg. costs of operating an intensively farmed one-hectare area, but not the ₱2.34 kg. costs of the extensively farmed areas. In part the high November production reflected the expectation of even lower prices at a later date, and in fact the major buyers in the area suspended purchase for one month beginning December 15, 1979, bearing out the farmer's fears.

The farmers have adopted numerous strategies to deal with the declining profitability of E. spinosum farming. Since a major operating expenditure is for fuel to travel between Hingotanan and the farm sites, many families are moving out to their farmhouses on a semi-permanent basis. Hired laborers are

being dismissed and replaced by family labor. Other families which operate more than one hectare by registering leases in the names of several different family members have been able to take advantage of economies of scale in farmhouse and transportation costs to maintain their farm's profitability. Despite the limited success of some of these strategies, they cannot be applied to all seaweed farms. There is a growing concern in the community that many families will not be able to survive the downturn in the seaweed business. Even prior to the recent price decline, 'outsiders' particularly businessmen and women from Cebu and Leyte were investing in seaweed farming, and there are complaints that these individuals have been given priority over Hingotanan residents in the registration of leases. Because of their more substantial assets, these absentee farmers will probably be in a better position to weather the period of lower prices, and a more concentrated seaweed farming sector is likely to evolve. Hingotanan residents may be forced to work as hired labor on seaweed farm areas that they previously leased and operated for themselves.

Although the major buyer has embarked upon a market research and development programme and is completing a processing facility in Mandaue, Cebu, the company's demand for E. spinosum has been unable to keep up with the supply at the higher prices. With the price difference between E. spinosum and E. cottonii now reduced from ₱2.60 to ₱0.50 per kg. company officials expect that many farmers will begin to cultivate the faster growing E. cottonii instead.

Feelings of frustration are now very apparent in Hingotanan as farmers observe that for the first time seaweed farming gave them a sense of control over their lives but now with the rapid decline in prices the old concerns of lack of security and difficulty in providing for one's family have returned. Already some farmers have reverted to full-time fishing. While a spirit of cooperation and mutual help prevailed in the community in 1979, these feelings are now being displaced by competitiveness.

Could the over-production problems have been avoided? The essentially 'laissez-faire' approach to development of the seaweed activity meant that no attempt was made either by the government or the community to control the number of hectares in production or the resulting supply. The freedom of entrepreneurs from outside the community to secure leases and begin farming removed the incentive for Hingotanan residents to control their own output. If, however, priority for leases had been reserved for Hingotanan residents and the community had organized itself along cooperative lines, local participation in the industry could have been preserved. Certainly given the earlier similar experience in Tawi-Tawi, the events of the last three months of 1979 in Hingotanan could have been anticipated. In fairness to Marine Colloid officials, they have been very concerned for some time about the potential over-production problem, but then they are not the ones granting seaweed farming leases. Hingotanan residents are encouraging the Talibon municipal council to consider a resolution giving local residents priority for the

granting of seaweed farm leases. The bulk of the reef area, however, lies outside the jurisdiction of the municipality and within that of the two BFAR offices in Cebu City and Tacloban City.

It is apparent from Hingotanan's experience that it is not sufficient to simply introduce a more profitable alternative to capture fishing in order to raise income levels and standards of living in fishing communities. If such communities are to benefit on a long-term basis from the new activity, it is probably necessary to preserve the activity for former fishermen through legislative means. Moreover, if the concern is for equitable distribution of benefits within such communities, some form of cooperative or community management of the activity that reduces entry barriers and distributes benefits on the basis of participation will be necessary.

5. ACKNOWLEDGEMENT

The sources of information for this case study were interviews conducted by the authors in Hingotanan and Cebu in December, 1979. The authors would like to express their appreciation to the respondents and to Mr. Ruben Barraca and Dr. Iain Neish of Marine Colloids (Phil.) Inc. for their invaluable advice and assistance.

6. REFERENCES

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TABLE 1 - Eucheuma prices in Bohol and Cebu
(Pesos per kg)^{1/}

<u>Inclusive Dates</u>	<u>E. spinosum</u>		<u>E. cottonii</u>	
	<u>Bohol</u>	<u>Cebu</u>	<u>Bohol</u>	<u>Cebu</u>
Sept. - Dec. 1978	4.30	4.70	1.80	2.20
Jan. - Sept. 1979	4.30-4.60	4.70-5.00	2.00	2.20
Oct. - Nov. 15, 1979	3.50	3.90	1.80	2.20
Nov. 15 - Dec. 15, 1979	3.00	3.40	1.60	2.00
Dec. 15 - Jan. 14, 1980 ^{2/}	-	-	-	-
Jan. 15, 1980	2.00	2.40	1.50	1.80

- Notes:
1. Quality requirements for these prices are:
 - a. Moisture content not to exceed 30%.
 - b. Sand and salt not to exceed 3 ml. in a standard calibrated liter cylinder.
 - c. No tie-ties and dirt.
 2. In mid-December, the major Cebu buyer halted purchases temporarily.

Source of Data: Marine Colloids (Phil.) Inc. (₱7.32 = US\$1.00)

TABLE 2 - Initial Investment Costs and Annual Depreciation for a One Hectare Eucheuma spinosum Farm, Bohol, Philippines (Extensively Farmed)^{1/}

<u>Investment Items</u>	<u>Cost</u>	<u>Life</u>	<u>Annual Depreciation</u>
. 1 Bamboo and Nipa Farmhouse with drying platform	₱7,500	10	750
. 1 motorized banca ^{2/}	5,000	5	1,000
. 1 dugout	200	5	40
. 15 kg. monoline at ₱35	525	10	53
. 1200 stakes at ₱0.25	300	1	300
. Hand Tools ^{3/}	230	10	23
. 6 baskets at ₱25	150	6 mos.	300
. Lease (bond) ^{4/}	1,000	-	-
TOTAL	₱14,905		₱2,466

^{1/} Approximately 30% of area is used. Cost data is based on December, 1979 prices (₱7.32 = US\$1.00).

^{2/} Equipped with 16 h.p. Briggs and Stratton gasoline engine.

^{3/} Includes one crowbar and 3 sledge hammers for driving stakes.

^{4/} The ₱1,000 bond required to secure the lease from the Bureau of Fisheries and Aquatic Resources (BFAR) must be deposited in the local Rural Bank, and can be forfeited if the farm area is not made productive.

TABLE 3 - Annual Production Costs for An Extensively Farmed One Hectare Eucheuma spinosum Farm (Hingotanan, Bohol, Philippines)

<u>Cost of Goods Sold</u>	<u>Subtotals</u>	<u>Totals</u>
30,000 seed plants (3,000 kg) at ₱0.80/kg.		₱ 2,400
 <u>Operating Costs</u>		
Tie-ties 60 kg. at ₱15	₱ 900	
Laborers (1) at ₱10 per day	3,650	
Harvesting Laborers: 56 mandays at ₱10	560	
Food for laborer at ₱5 per day	2,105	
Maintenance of banca, engine and farmhouse ^{1/}	1,250	
Gasoline ^{2/}	5,408	13,873
 <u>Depreciation (See Table II)</u>		
Farmhouse	750	
Banca/dugouts	1,040	
Monoline	53	
Stakes	300	
Tools	23	
Baskets	300	2,466
		<hr/>
Total Annual Production		₱18,739
Costs: (excluding family labor)		
Production: 8 tons dried Eucheuma		
Unit Production Cost: ₱2.34 kg.		

1/ 10% of investment cost.

2/ 2 round trips per week Hingotanan to farm. Each trip consumes 16 liters of gasoline at ₱3.25 per liter.

TABLE 4 - Initial Investment Costs and Annual Depreciation for a One Hectare Eucheuma spinosum Farm, Bohol, Philippines (Intensively Farmed)^{1/}

<u>Investment Items</u>	<u>Cost</u>	<u>Life (yrs)</u>	<u>Annual Depreciation</u>
. 1 Bamboo and Nipa Farmhouse and Drying platform	₱10,000	10	₱ 1,000
. 1 Motorized banca ^{2/}	5,000	5	1,000
. Dugouts at ₱200	400	5	80
. 50 kg. of monoline at ₱35 per kg.	1,750	10	175
. 4,000 stakes at ₱0.25	1,000	1	1,000
. Hand tools ^{3/}	230	10	23
. 20 baskets at ₱25	500	6 mos.	1,000
. Lease (bond)	1,000	-	-
TOTALS:	₱19,880		₱ 4,278

^{1/} Cost data is based on December 1979 prices (₱7.32 = US\$1.00).

^{2/} Equipped with a 16 h.p. Briggs and Stratton gasoline engine.

^{3/} Includes one crowbar and 3 sledge hammers for driving stakes.

^{4/} The ₱1,000 bond required to secure the lease from the Bureau of Fisheries and Aquatic Resources (BFAR) must be deposited in the local branch of the Rural Bank, and can be forfeited if the farm area is not made productive.

TABLE 5 - Annual Production Costs for An Intensively Farmed
One Hectare Eucheuma spinosum Farm (Hingotanan,
Bohol, Philippines)

<u>Cost of Goods Sold</u>	<u>Subtotals</u>	<u>Totals</u>
100,000 seed plants (10,000 kg) at ₱0.80 per kg.		₱ 8,000
<u>Operating Costs</u>		
Tie-ties 200 kg at ₱15	₱ 3,000	
Laborers (3) at ₱10 per day	10,950	
Food for laborers at ₱15 per day	5,475	
Maintenance of banca, engine and farmhouse ^{1/}	1,510	
Gasoline ^{2/}	5,408	26,343
<u>Depreciation</u> (see Table IV)		
Farmhouse	1,000	
Banca/dugouts	1,080	
Monoline	175	
Stakes	1,000	
Tools	23	
Baskets	1,000	4,278
		<hr/>
Total Annual Production Costs: (excluding family labor)		₱38,621
Production: 20 tons dried Eucheuma		
Unit Cost of Production: ₱1.93 per kg.		

^{1/} 10% of investment cost.

^{2/} 2 round trips per week Hingotanan to farm. Each trip consumes 16 liters of gasoline at ₱3.25 per liter.

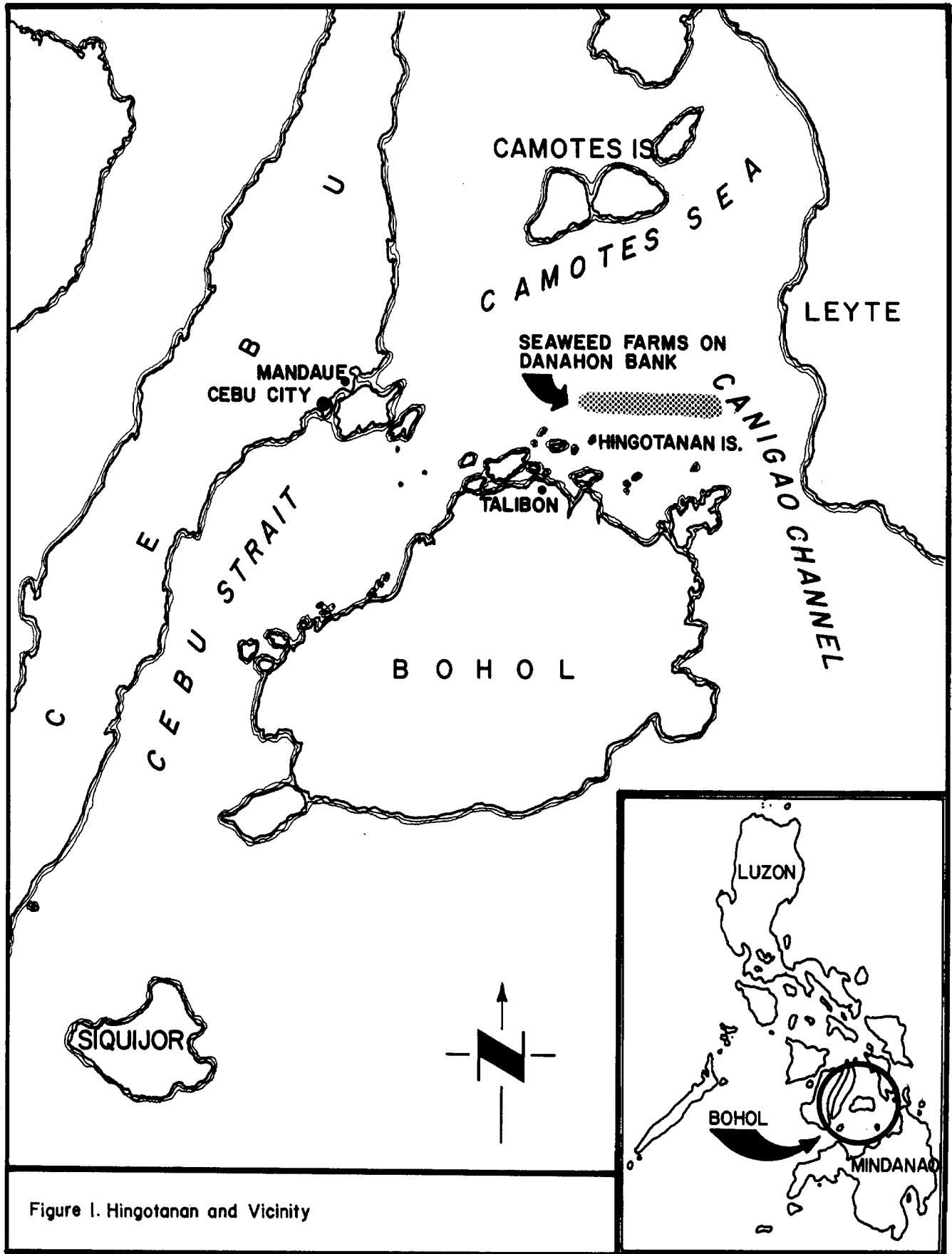


Figure 1. Hingotanan and Vicinity